Imperial College London

Transitional Space in Active Learning: Perspectives from an Undergraduate STEM Education Context

---

Luke McCrone

2021

Centre for Higher Education Research and Scholarship

Imperial College London

Submitted in part fulfilment of the requirements for the degree of

Doctor of Typesetting of Imperial College London

and the Diploma of Imperial College London

Declaration of Originality

I declare that this thesis is my own work and where the work of others has been used, it has been appropriately acknowledged and cited within the text.

Luke Daniel McCrone

Copyright Statement

The copyright of this thesis rests with the author. Unless otherwise indicated, its contents are licensed under a Creative Commons Attribution-Non Commercial 4.0 International Licence (CC BY-NC).

Under this licence, you may copy and redistribute the material in any medium or format. You may also create and distribute modified versions of the work. This is on the condition that: you credit the author and do not use it, or any derivative works, for a commercial purpose.

When reusing or sharing this work, ensure you make the licence terms clear to others by naming the licence and linking to the licence text. Where a work has been adapted, you should indicate that the work has been changed and describe those changes.

Please seek permission from the copyright holder for uses of this work that are not included in this licence or permitted under UK Copyright Law.

Abstract

There is increasing evidence, particularly in STEMM higher education, that traditional didactic transmission lecturing is less effective than more active, student-centred learning. This has resulted in ongoing curriculum review and pedagogic transformation at the research-intensive institution studied and elsewhere across a changing sector. However, the examination of active learning was generally confined to instructional contexts and has assumed that undergraduate students successfully transition between timetabled and non-timetabled learning. The expectation for greater self-directed learning associated with the sector-wide shift to blended learning presents an argument for better understanding student engagement with and perception of transition. This study took a phenomenological approach to using naturalistic ethnographic observation (60 observations) and field interviews (50 interviews), in combination with automated occupancy monitoring data, to capture student transitions in two different departmental settings: Chemical Engineering and Physics. Studying physical, temporal, cognitive and social transitions in to and out of timetabled face-to-face lectures led to the definition of on-ramp, medial and off-ramp transitional spaces. These findings informed an institutional redesign of a raked lecture theatre and adjacent foyer space, which provided an opportunity to implement and test the operational impact of these research ideas with educators, architects and other practitioners. A subsequent phase of data collection included in-depth interviews with 4 students and 3 lecturers which reported transitions in behaviour, perception and expectation to actively learn in the refurbished and other learning spaces. Bioecological theory formed a framework for better understanding student transition in relation to strategy and physical/conceptual infrastructure as nested systems of influence. Transitional learning spaces within and at the fringe of classrooms are of increasing importance and might be imagined as ecotones to better understand and support blended learning in an increasingly complex post-COVID HE ecosystem.

Acknowledgements

It would be undignified to claim that this thesis is the sole result of my own doing. It is the product of immense conversation and relationship with others, to whom I owe gratitude.

I would first like to thank my main supervisor, Professor Martyn Kingsbury, who has been instrumental in guiding and inspiring me throughout this process; our conversations have been truly one of the highlights.

I would then like to thank Professor Simone Buitendijk for supporting and setting me on this PhD journey by helping to establish the Centre for Higher Education Research and Scholarship (CHERS).

I would also like to thank Dr Dave Riley who imparted invaluable experience to me throughout the PhD. I would also like to thank Dr Jo Horsburgh for her ongoing support and my academic colleagues inside and outside of CHERS for their rich perspectives on my work.

To the staff and students who participated in this research, thank you for your time, openness and honesty.

Finally, I would to thank my family and friends for whom none of this work would have been possible without. My parents, Jane and Sam, and my brothers, Mark and James, have supported me up until the end, picking me up whenever the PhD knocked me down.

Contents

1 Introduction **16**

1.1 Research rationale 16

1.2 Research context 18

1.2.1 Institutional context 18

1.2.2 Researcher background 25

1.3 Research questions 26

1.4 Thesis contributions 27

1.4.1 Potential audiences 28

1.5 Thesis structure 28

2 Reviewing the literature **30**

2.1 Introduction 30

2.2 Space 30

2.2.1 Space as social 32

2.2.2 Space and power 34

2.2.3 Socio-spatial research 37

2.3 Active learning 40

2.3.1 The case for active learning 43

2.4 Socio-spatial practice 48

2.4.1 Innovative Learning Environments (ILEs) . . . 51
2.4.2 Is changing space enough? . . . 54
2.4.3 Teacher transitions into ILEs . . . 56
2.4.4 The formal and informal divide . . . 59
2.4.5 In-between, hidden and liminal space . . . 62
2.5 Transition . . . 66
2.5.1 Models of transition . . . 67
2.5.2 Transition as process . . . 69
2.5.3 Transition as space . . . 71
2.5.4 Ecotones and boundary spaces . . . 74
2.5.5 Thinking ecologically . . . 76
2.6 Chapter synopsis . . . 78

3 Constructing a theoretical framework 79

3.1 Introduction . . . 79
3.2 Bioecological theory . . . 80
3.2.1 Ecological systems model . . . 82
3.2.2 Person-Process-Context-Time (PPCT) model . . . 87
3.2.3 Bioecological shortcomings . . . 92
3.3 Understanding transition . . . 94
3.4 Drivers for transition . . . 94
3.4.1 Liminality . . . 94
3.5 Mechanisms for transition . . . 96
3.5.1 Referencing . . . 96
3.6 Influences on transition . . . 100
3.6.1 Cultural-Historical Activity Theory (CHAT) . . . 100

3.6.2 Power-geometry . . . 106
3.7 Products of transition . . . 109
3.7.1 Spatial triad . . . 109
3.8 Integration of theories . . . 111

4 Methods and collecting data **113**

4.1 Introduction . . . 113
4.2 Settings . . . 113
4.2.1 Formal spaces . . . 115
4.2.2 Informal spaces . . . 119
4.3 Methodology . . . 122
4.3.1 Phenomenology . . . 123
4.4 Methods . . . 127
4.4.1 Preparing for the field . . . 127
4.4.2 Naturalistic ethnographic observation . . . 129
4.4.3 Ethnographic field interviews . . . 132
4.4.4 Occupancy monitoring insights . . . 133
4.4.5 In-depth interviews . . . 134
4.5 Data collection . . . 135
4.5.1 Participants and recruitment . . . 137
4.5.2 Fieldwork timing . . . 139
4.5.3 Ethical considerations . . . 140
4.6 Data analysis . . . 148
4.6.1 Reflexive thematic analysis . . . 148
4.6.2 Phased process . . . 150
4.6.3 Challenges . . . 153

5 Space for in-situ transition? 154

5.1 Introduction . . . 154

5.2 ACEX breakout: a free space . . . 155

5.2.1 A student-owned space . . . 155

5.2.2 Elastic power-geometry . . . 158

5.2.3 In-situ timetable transitions . . . 160

5.2.4 Incidental active learning . . . 163

5.3 ACEX Lecture Theatre 1: a suppressed space . . . 164

5.3.1 Comparison with Blackett Lecture Theatre 2 . . . 166

5.3.2 Fixed power-geometry . . . 166

5.3.3 Didactic suppression of referencing . . . 167

5.4 Transitional spaces . . . 178

5.4.1 On-ramp and off-ramp transitions . . . 178

5.4.2 Transitional space behaviours . . . 185

5.4.3 Transitional space properties . . . 194

5.5 Chapter synopsis . . . 204

6 Redesigning for in-situ transition 205

6.1 Introduction . . . 205

6.2 Blackett Lecture Theatre 2: medial transitions . . . 206

6.2.1 Seminar activity transitions . . . 207

6.2.2 Post-renovation medial behaviours . . . 212

6.2.3 Transitions in perception . . . 225

6.2.4 Transitions in referencing . . . 231

6.2.5 Influences on referencing . . . 238

6.3 Chapter synopsis . . . 246

7 Exploring ex-situ transition **247**

7.1 Introduction . . . 247

7.2 Harnessing transitional space . . . 248

7.2.1 Blackett foyer: fringe transitions . . . 249

7.3 Ex-situ transitions . . . 266

7.3.1 Role transitions . . . 267

7.3.2 Transitions in expectation . . . 269

7.3.3 Transitions in agency . . . 275

7.3.4 Transitions in behaviour . . . 281

7.3.5 Regressive and progressive transition . . . 286

7.4 Chapter synopsis . . . 287

8 Discussion and conclusions **288**

8.1 Introduction . . . 288

8.2 Transitions: connecting microsystems . . . 289

8.2.1 Transitions: nicety or necessity? . . . 291

8.2.2 Revisiting ecotones . . . 293

8.3 Designing transitional zones . . . 295

8.3.1 Broadening the 'learning container' . . . 297

8.3.2 'Stepping stone' spaces . . . 301

8.3.3 Transition to what? . . . 305

8.4 Conclusion . . . 308

8.4.1 Summary of research findings . . . 308

8.4.2 Limitations . . . 312

8.4.3 Future work . . . 315

8.4.4 Implications of study . . . 317

Bibliography **320**

Appendices **358**

Appendix 1: Research information sheet 358

Appendix 2: Participant information sheet 359

Appendix 3: Informed consent form 360

Appendix 4: ACEX student field interview script 361

Appendix 5: Blackett student field interview script 362

Appendix 6: Blackett lecturer field interview script 363

Appendix 7: Blackett student in-depth interview script 364

Appendix 8: Blackett lecturer in-depth interview script 366

Appendix 9: Observation field notes example 367

Appendix 10: Raw sociogram example 369

Appendix 11: Timetable transition occupancy raw data 370

Appendix 12: In-depth interview transcript excerpt 371

Appendix 13: South Kensington campus map 374

List of Tables

Table 3.1: Key theoretical concepts and their purpose for understanding transition . 94

Table 3.2: Lefebvre's spatial triad adapted from Elden (2007) (p. 110) 109

Table 4.1: ACEX and Blackett setting information and demography 114

Table 4.2: ACEX LT1 and refurbished Blackett LT2 space information 115

Table 4.3: ACEX breakout and pre-renovation Blackett foyer space information . . 119

Table 4.4: Data collected in ACEX and Blackett settings (N = not used) 136

Table 4.5: In-depth interview participant pseudonyms and status 138

Table 4.6: Thematic analysis stages adapted from Braun and Clarke (2006) (p. 87) 152

Table 5.1: ACEX breakout space categories and percentages of reported activities . 157

Table 5.2: Definition of on-ramp, medial and off-ramp transitional spaces 183

Table 5.3: Average values calculated for the percentage of students engaged in meaningful on-ramp and off-ramp transitions for type 1 and type 2 timetables (raw data in appendix 11) 199

Table 8.1: Summary of transition types defined in this study 289

List of Figures

Figure 2.1: Spectrum of learning places adapted from Radcliffe et al. (2008) (p. 13) 44

Figure 3.1: Ecological systems model adapted from O'Toole et al. (2019) (p. 22) . . 87

Figure 3.2: Original CHAT triangle based on Engeström (1987) with focus on formal classroom learning as an example of an activity system 103

Figure 3.3: Adapted ecological systems model developed from figure 3.1 112

Figure 4.1: Floor plan diagram of ACEX breakout space and Lecture Theatre 1 . . 114

Figure 4.2: Floor plan of Blackett refurbished LT2 and the pre-renovation foyer space 115

Figure 4.3: Photograph of ACEX Lecture Theatre 1 showing traditional raked seating 116

Figure 4.4: Photograph of Blackett pre-renovation Lecture Theatre 2 117

Figure 4.5: Photograph of refurbished Blackett Lecture Theatre 2 118

Figure 4.6: Photograph of the ACEX breakout space showing door entrance to ACEX LT1 to right of photo (source: Imperial image library) 120

Figure 4.7: Photograph of the pre-renovation Blackett foyer space showing entrance door to Lecture Theatre 2 to right of photo 121

Figure 4.8: Photograph of the refurbished Blackett foyer space 122

Figure 4.9: Data collection and analysis process 151

Figure 5.1: Traditional (blue) ACEX LT1 and breakout spaces plotted as microsystems on ecological systems model with in-situ transition within and between 155

Figure 5.2: ACEX LT1 and breakout space occupancy plotted against time with LT1 timetable superimposed on a weekday during term time 162

Figure 5.3: Digitised sociogram of breakout space showing typical learning behaviour immediately after a timetabled lecture session in LT1 165

Figure 5.4: (a) Definition of on-ramp (red) and off-ramp (blue) transitional space in relation to timetabled space; (b) LT1 and breakout occupancy plotted against timetable indicating the relative changes in occupancy as students enter (on-ramp) and exit (off-ramp) LT1 179

Figure 5.5: Definition of type 1 and type 2 timetable configurations for ACEX LT1 with time along the base, year cohorts attending and on-ramp, medial and off-ramp transitions labelled 198

Figure 5.6: Adapted CHAT prism showing the transitions in expected rules, tools and power-geometry between the formal and informal space 203

Figure 6.1: Refurbished Blackett LT2 and pre-renovation foyer space plotted as microsystems on the ecological systems model showing broader transitional space resulting from strategic-driven redesign 206

Figure 6.2: Characteristic pairs of activities and associated transitions observed throughout seminar sessions in LT2 with enabling design feature italicised. Transition numbers correspond to numbered transitions in figure 6.3. 209

Figure 6.3: Floor plan of the front section of the refurbished LT2 space showing characteristic transitions between seminar activities and/or actors. Numbers correspond to numbered transitions in figure 6.2. 210

Figure 6.4: Adapted CHAT triangles showing the characteristic order of transitions between students and material/social references in ACEX LT1 (left) and Blackett LT2 (right) 235

Figure 6.5: Top LT2 seating booth shows all potential reference interactions/transitions between a group of 5 students and a coordinator with bottom booth showing those connections available to an individual student 240

Figure 7.1: Refurbished Blackett LT2 and foyer spaces plotted as microsystems on the ecological systems model with broadened transitional space resulting from redesign 248

Figure 7.2: Diagram adapted from Martens et al. (2019) to show transitions between the potential learner roles of students 254

Figure 7.3: 3D render showing the key features of the redesigned Blackett foyer space including high stools/tables and variable writing surfaces 255

Figure 7.4: Photograph of the refurbished foyer space showing independent and active learning activity (source: Imperial image library) 256

Figure 8.1: Ecological systems model showing broadened transitional space between refurbished Blackett LT2 and foyer spaces (coloured red) with ex-situ transitions connecting to other learning spaces (coloured blue) . 298

Chapter 1

Introduction

1.1 Research rationale

There is increasing evidence, particularly in science, technology, engineering, mathematics and medicine (STEMM) education, that traditional didactic transmission lecturing is less effective than more active, student-centred learning (Freeman et al., 2014). This mounting evidence has resulted in ongoing institution-wide curriculum review, pedagogic transformation and space refurbishments at Imperial College London, the research-intensive institution that provides the context for this study. The institution's Learning and Teaching strategy has supported much of this change and this PhD study (Imperial College London, 2017).

The prevailing emphasis on formal instructional contexts is evident from the relative capital that institutions continue to invest in their classroom infrastructure. It could be argued, however, that the time and money invested into these physical formal spaces no longer reflects the growing 'self-directed' informal workload that students now contend with. This disproportionate investment is alarming as the average cost of UK education space is nearly £200 per m^2 (Temple, 2007) and the ongoing maintenance of this physical capital

approaches £3 billion annually, only exceeded by staff budgets (Temple, 2018). Some of the more substantial investments into UK university space include redevelopments by The University of Birmingham (£365 million), The University of Leeds (£520 million) and a £1-billion redevelopment of the University of Manchester campus. Furthermore, Universities UK (UUK) estimates that UK universities could lose £6.2 billion in revenues from the recent coronavirus disease 2019 (COVID-19) pandemic if they fail to attract international students (Ahlburg, 2020). University space plays a key role in the marketing of the university to home and international students (Siems et al., 2006), the recruitment and retention of staff and students (Price et al., 2003), the quality of learning and teaching (Monahan, 2000; Oblinger, 2006), and the modification of practices and identities (Whitton, 2018). Therefore, even the most venerable institutions are having to adopt evidence-informed evaluations which help to justify significant capital investments into education space and infrastructure.

University infrastructure should arguably be (re)designed to support increased active learning, which should not only better prepare students for ground-breaking research and societal impact, but for a rapidly changing labour market. The World Economic Forum (WEF) recently reported the top skills demanded by the job market between 2020 and 2025 as:

> '...critical thinking and analysis as well as problem-solving, and skills in self-management such as active learning, resilience, stress tolerance and flexibility' (World Economic Forum, 2020, p. 5).

Finding ways to support transition toward self-directed, active learning is now an undeniable responsibility of higher education institutions. Nonetheless, the challenge to develop active learners with 'traditional' university infrastructure has been heightened by the COVID-19 pandemic, which has facilitated a transition to remote learning. This challenge has been exacerbated by our limited understanding of transitional space and the continued assumption

that students absorb information in the formal 'learning container' (Imms and Kvan, 2021, p. 9), and later revise it independently. The shift to remote learning and more open-ended curricula is making it increasingly difficult for students to properly schedule out-of-class learning time, which can potentially decrease self-regulation (Akçayır and Akçayır, 2018). There are therefore risks associated with transitioning learning from campus-based spaces to fully remote spaces in family homes, halls of residence and other informal spaces. Given adolescent students are more susceptible to isolation than people of other age groups (Alghraibeh and Juieed, 2018), the main risk is that we isolate undergraduate students who now 'attend' virtual lectures from personal spaces in which there is variable internet connectivity and home 'comfort'. Removing the physical transitions and sense of place, which provide structural separation between work and personal life, may negatively impact student well being (Muhammad et al., 2014). This thesis seeks to understand these physical, cognitive and social transitions linked to in-person timetabled learning - as potential sites of student interaction and cohort community - which is arguably of historic importance as we transition out of COVID-19 and manage the associated opportunity, uncertainty and challenge.

1.2 Research context

1.2.1 Institutional context

Imperial College London is a STEMM, research-intensive institution consisting of physical campuses across London. As of 2019-20, the university had close to 10,500 undergraduate, 4000 taught postgraduate and 3800 research postgraduate students. The institution is an international member of the Russell Group with 60% of students from outside of the UK.

Learning and Teaching strategy

Recruitment of a new Vice Provost (Education) in 2016 and the creation of a financially supported learning and teaching strategy demonstrates the institution's ongoing commitment to educational transformation. Such strategies have emerged in British universities since the 1990's Dearing Report, and have proliferated due to increased state-mandated quality assurance and competition for resources (Goodyear and Ellis, 2019). Whilst this strategy, five years later, is part of the College strategy (Imperial College London, 2020), the research unit under which this PhD has been undertaken - the Centre for Higher Education Research and Scholarship (CHERS) - is testament to fulfilling key facets of the strategy to achieve a globally leading educational experience (Imperial College London, 2017, p. 11-17):

- Research-based
- Student-centred
- Evidence-based
- Inclusive and diverse
- Outward-looking
- Technology enhanced

Research-based education firstly involves a more evidenced and scholarly approach to curriculum development and pedagogic strategy (Asmar, 2002). Additionally, it incorporates enquiry-based activities into these curricula which promote active learning, rather than activities based on the acquisition of subject content (Griffiths, 2004). These changes seek not only to educate lifelong learners who gain deep conceptual understanding of their discipline, but individuals who can transition across disciplinary boundaries with curiosity,

critical thinking and creativity to tackle real-world problems in the 21st century (Mahat et al., 2018).

However, the inscription of a strategy will never guarantee academic departments cooperate and participate in the renewal processes. Strategies work indirectly and do not remain static given they are often reinterpreted, contested and subverted by those engaged with change processes (Newton, 2003). Furthermore, for change processes in practice to occur at the individual level, transitions in the overall context and ethos of an institution must be instituted by its higher echelons using reward and recognition (Walker and Entwistle, 1999; Kegan et al., 2009). Research-intensive universities in particular comprise fragmented communities which renders institutional transformation more challenging (Brew, 2010). Curriculum reform is a global trend in which adoption of credit systems and modular provision are commonplace (Mason et al., 2001). A structural reform of the institution's curriculum represents one core change process which has been pivotal in the realisation of the Learning and Teaching strategy. However, this reform relies not only on external strategic mandate, but on the meanings negotiated at all levels of the university as new practices evolve in academic communities. Annala and Mäkinen (2017) note that '...curriculum change is a highly complex social process, which is related to the individual, disciplinary and institutional identities and reflects the power relations within the academy' (p. 1954). Blackmore and Kandiko (2012) elaborate on this complexity by specifying '...the unstructured and spontaneous learning that takes place within and outside the formal academic environment' (p. 3) as supplementary to the formal set of intended learning experiences. This chimes with work into the explicit and hidden curriculum (Eisner, 1985) and rationalises the focus of this study on the transitional spaces in-between the formal, timetabled curricular activities. Rather than viewing curriculum as what counts as valid knowledge (Bernstein, 1990), this study treats curriculum more as a process, as a transition,

where the student's perspective and agency is also considered (Annala and Mäkinen, 2017). I have used transition as a foundational concept to understand how the ideologies written into institutional strategy came to be negotiated and reified by students and educators in two different departments. I was able to achieve this understanding by studying learning behaviour before and after the strategic refurbishment of the Blackett formal and informal learning spaces, later embraced by both 'traditional' and interactive educators. Whilst the findings from this study are restricted to two departmental contexts, my previous involvement in the conception of the Learning and Teaching strategy (see section 1.2.2) has given me a better 'handle' on the bigger picture and the institution's macrosystem (Bronfenbrenner, 1979).

Institutional space

Imperial College London is a historic institution with its main South Kensington campus situated in a dense and expensive urban area in Central London. The institution is comprised of four faculties: Engineering, Medicine, Natural Sciences and Business School. This study has explored learning spaces in the ACEX and Blackett buildings of the main campus associated with the Departments of Chemical Engineering and Physics respectively. Growing student numbers across the sector (Ahlburg, 2020), in combination with the cost and density of the main campus within the surrounding area, has led to institutional space shortages and difficulty of expansion. The financial need to support student number growth, without causing detriment to the quality of the student experience, is a key challenge linked directly to the management and use of the institution's education infrastructure like its physical spaces. In addition to the establishment of the White City Campus in 2009, the institution has been required to be resourceful with its existing spaces in South Kensington as the main site of undergraduate teaching. Changes to modes of delivery, motivated by the

Learning and Teaching strategy and COVID-19, have catalysed the need for reallocation, re-purposing and refurbishment of existing spaces.

To optimise this management of physical infrastructure for world-class education and research, '...a nuanced approach and joined-up dialogue is particularly needed between university staff focusing on enhancing the physical environment and colleagues devoting their time to improving education' (Carnell, 2017, p. 1). The constitution of research-intensive universities as fragmented communities makes this joined-up dialogue difficult (Brew, 2010). This fragmentation is evident from the challenges faced in the institution's implementation of a 'Space Sharing Programme'. This programme has established a pool of core College spaces which are made more widely available to all departments for teaching, meetings or events. It is underpinned by the principle that all space is College space for supporting the academic mission, and coheres with the 'Academic Timetabling Policy' which seeks to deliver timetables which enable the best learning and teaching. However, space sharing has been met with resistance from members of departments, which may have been exacerbated by an under-representation of staff and student views in the (re)design of spaces and buildings (Neary and Saunders, 2011). Creative solutions which amplify user voice through participatory design (Casanova et al., 2018) mitigate this tension and have informed the redesign of the Blackett informal space in this study. This aligns with the 'student-centred' facet of the institution's strategy and broader trends in the sector (Martens et al., 2019).

The institution compiled a space analytics toolkit to better inform decision making and future planning regarding space and timetables. Occupancy data insights is a particularly novel tool in this toolkit, generated from the institution's recent implementation of anonymised occupancy monitoring technology across the South Kensington campus. Other than using this automated, real time occupancy data to analyse behavioural patterns within and between timetabled spaces in the ACEX setting, I attended the 'Space Data Insights

Group' which was convened to discuss ways of embedding space-related data. My attendance at this and other committees, like the Blackett space design board, allowed me to better understand ongoing change processes, and to anecdotally test my research findings with a different group of practitioners.

Regulatory context

National level discussions about curriculum intent and graduate attributes often remain idealised and removed from the reality of institutions (Blackmore and Kandiko, 2012). Nonetheless, regulatory bodies like the Office for Students (OfS) appear to be exerting increasing influence on English higher education providers in their bid to hold universities to account on value for money, widened participation and high teaching standards. The Teaching Excellence and Student Outcomes Framework (TEF) has linked the fulfillment of these criteria to the financial freedom of universities. TEF ratings (bronze, silver or gold) are determined by a provider's fulfillment of educational gains, student satisfaction, continuation and employment metrics, and determine the ability of that provider to raise their tuition fees. Since it is likely that TEF will continue to assess at both the provider- and subject-level according to an independent review (Pearce, 2019), UK universities and colleges must ensure they establish and evidence institution-wide teaching practice in their TEF submissions. This further warrants the formation of institution-wide strategies, curriculum reforms and the sharing of best practice between departments. The need for UK universities to cater for international students via campus-based and digital-based programmes frames an important global context. Scholarly, strategic and regulatory forces are placing increasing pressure on institutions to develop graduates with certain skills and competences, which is forcing all universities to evaluate their learning spaces, with a view to design environments which are more auspicious and inclusive for active learning (Brooks, 2011).

COVID-19

The advent of the coronavirus disease 2019 (COVID-19) pandemic, which coincided with the end of data collection in this study, required education institutions globally to transition their in-person teaching to remote teaching. Online lectures resulting from pandemic restrictions are likely to prevail, expanding the potential learning 'space' available to the institution beyond the confines of the physical classroom and campus. This shifting of mode of delivery has arguably advanced a pre-existing sector-wide progression to blended and flipped classroom approaches (Edwards and Clinton, 2019). Flipped approaches have been proven effective (Akçayır and Akçayır, 2018), yet overlook the transitions into informal self-directed learning, including where this learning physically takes place. These assumptions, in conjunction with a systemic shift to blended learning, now warrant a closer look at how best to leverage in-person timetabled learning and the associated informal experience as students reside on campus.

The very idea of the university is changing and having to respond to '...new images, new technologies, new texts, new discourses and new forms of professional life' (Barnett, 2000, p. 417). New conceptualisations of the 'university' have therefore emerged, including for example virtual universities that do not require physical space (Ryan et al., 2000) and multiversities spread over a network of institutions internationally (Kerr, 2001). COVID-19 has furthered a pre-existing international HE identity crisis (Whitton, 2018) by forcibly transitioning much of the traditional formal learning into the realm of informal space in which students have greater agency over when and where to learn. With cognisance of this unfolding context, I have explored the interplay between the physical and conceptual structure of the learning ecosystem and its power to exert influence over student transition, as well as the role of student agency in shaping these learning ecologies for themselves (Barnett and Jackson, 2019).

1.2.2 Researcher background

Phenomenology assumes that the social phenomena being studied always exist in the researcher's life world such that a subjective understanding of both the researched and the researcher need to be acknowledged (Flood, 2010). Whilst I have remained reflexive throughout this study by adapting my positionality and ontology (Somekh and Lewin, 2005), it is important to be transparent about my background and previous involvement with the institution I have researched. This permits impartial judgement about how these experiences may have shaped my positionality and research intentions.

My successful completion of a BSc and MSc degree in the Department of Earth Science and Engineering afforded me a technical proficiency in conducting fieldwork and operating across complex temporal and spatial scales. My learner perspective was further honed following my election into a sabbatical officer role as Deputy President (Education) at Imperial College Union in which I presented the student voice in committees at all levels of the College. This gave me insight into the governance of the institution, and the role of academic and professional staff in shaping the resources, student experience and institutional ecosystem. I also in this sabbatical role partnered with members of the College to shape the Learning and Teaching strategy, and thereby the context in which the research has been carried out. My involvement as a student with the TEF outside of the institution provided me with external insight into sector-level best practice in learning and teaching across further and higher education providers.

My continued involvement in the institution's hall of residence system, including most recently as Hall Warden, has exposed me to 1st year undergraduate students residing in halls. Although I have not formally collected data regarding student experience of remote study amid the COVID-19 pandemic, I have gained anecdotal insight into how students have managed this transition. My unique ontology from studying, living among and representing

students predisposed me uniquely to interpret student perception of and engagement with transitional spaces and has given me ready access to participants and relevant research sites when organising my data collection (Creswell, 2002).

1.3 Research questions

Research questions have narrowed the aims and purpose of the study into specific questions that I would like to answer and address (Creswell, 2002). This thesis overall seeks to explore and answer the following research questions:

1. What are the nature of transitions in learning spaces?

2. How does the redesign of learning spaces influence transitions?

These research questions are broad and purposefully vague, given they attempt to capture the spirit of a larger number of more detailed questions which emerge in chapters 5, 6, 7 and 8. The first research question is descriptive and involved me 'looking' at the transitions within and between 'traditional' formal and informal learning spaces. This is underpinned by the research topic which pertains to how undergraduate students perceive and engage with transitional space. Understanding transition from the student perspective also helps with defining what is meant by the 'nature' of transition in the first research question. The second research question then builds from and confirms these earlier findings, and is opportunistic given it relates to an exploration of transitions within 'refurbished' formal and informal learning spaces which the researcher fed into the redesign of.
These research questions were ultimately chosen to better understand the layers of transition (physical, cognitive, social and temporal) necessary for effective active learning.

1.4 Thesis contributions

The findings of this study are the first known academic investigation into active learning behaviour in transitional spaces. Studying transitions in formal learning spaces allowed me to describe ethnographically the nature and properties of transitional spaces as sites of important interaction and incidental active learning. This led to my coining of 'on-ramp', 'medial' and 'off-ramp' transitions inherent to physical timetabled learning which I define later in the thesis. These terms, among others, have made linguistic and conceptual contribution to an under-researched area.

To practically achieve this understanding, I looked at learning activity within and between traditional formal and informal spaces across two departments: the Department of Chemical Engineering (ACEX setting) and Physics (Blackett setting). Understanding the 'status quo' of learning in and between traditional spaces positioned me opportunistically to feed into the parallel redesign of both traditional Blackett Lecture Theatre 2 (LT2) and the adjacent informal foyer space which I had studied prior to redesign. Conducting post-occupancy evaluation of these refurbished spaces, together costing over £1 million, enabled me to confirm my earlier findings and ideas about transitional spaces. I was also able to evaluate the impact of these refurbished learning spaces on effective transitions to active learning, as desired by the institution's Learning and Teaching strategy (Imperial College London, 2017) and the wider sector (Freeman et al., 2014).

My ongoing involvement in the 'StudentShapers' scheme, partnering with students and academic staff to remodel informal transitional spaces in various departmental buildings, is testament to the tangible impact and translational potential of this research. Whilst the refurbishment of these learning spaces pre-dated COVID-19, the findings of this study recognise them as potentially instrumental in the College and sector's response to the COVID-19 pandemic and socially distanced blended learning.

1.4.1 Potential audiences

This thesis has sought to explore how the institution, among others, can create environments that better support transition to active learning. The potential audiences interested in this area of work might be:

- STEM educators and students
- Educational researchers
- Space designers and architects
- Curriculum and timetable designers
- Estates
- Senior management

The interest of these audiences in my research was first confirmed in my formal interviews with students and lecturers. My involvement in the redesign of Blackett LT2 and the adjacent foyer space resulted in productive conversations in which I could test the validity of my findings with building managers, members of estates, architects and other practitioners. Finally, my attendance at academic conferences allowed me to confirm the interest of other audiences in my work, including fellow educational researchers, curriculum and timetable designers, and those dealing with strategy.

1.5 Thesis structure

To answer the research questions, the thesis is structured as eight chapters:
Chapter 1 has introduced and rationalised the research aims, framed the research problem(s) and highlighted some of the key contributions.

Chapter 2 reviews the literature around learning space, active learning and transition as key themes in this study. It draws links between each of these areas to foreground the thesis and address the paucity of literature on transitional space.

Chapter 3 focuses on the construction of a theoretical framework by presenting the key theories employed, including their relative strengths and weaknesses for answering the research questions.

Chapter 4 introduces the research settings, methodological approach, methods used to collect data, participants studied, ethical implications of the research and the approach to data analysis.

Chapter 5 introduces findings pertaining to 'in-situ transitions' in the traditional formal and informal spaces of the ACEX setting. These findings allowed me to address the first research question.

Chapter 6 builds on chapter 5 by exploring in-situ transitions relating to refurbished Blackett LT2, including within medial spaces within timetabled sessions. This chapter addresses the second research question.

Chapter 7 introduces the partnership-driven redesign of the Blackett foyer space and further findings regarding the refurbished learning spaces. It further addresses the second research question by investigating how capital investment into refurbished spaces supported 'ex-situ transitions' to active learning.

Chapter 8 assimilates findings from chapters 5, 6 and 7 into a discussion contextualised within the broader literature and evolving sector context. It concludes the thesis with a summary of key findings in relation to the research questions, discusses limitations of the study, potential future work and the implications of the research.

Chapter 2

Reviewing the literature

2.1 Introduction

This study adopted a narrative approach to reviewing the existing literature by combining conceptual, empirical and systematic review approaches (Hammond and Wellington, 2019). By organising literature into themes, it has been possible to convey a story of the academic literature sourced from peer-reviewed journals, books and other material.

2.2 Space

In this section I introduce theories and empirical works regarding 'space' to discuss how socio-spatial thinking has and can support a better understanding of learning and transition. Renès Descartes (1596-1650) posited a mind-body dualism, whereby the mind was believed to be a non-physical phenomena confined to the biological brain and distinct from the outer material world (Lakoff and Johnson, 1999). Dualism maintained the separation between mind and body, subject and object, and our internal and external world which at the time, informed our understanding of social phenomena like learning.

By the 19th century, a number of influential individuals had presented work that insisted on

a non-dualistic view of reality. On the one hand, Georg Hegel (1770-1831) founded *idealism* (Pippin and Pippin, 1989) to postulate that the finite world is a reflection of the mind and is inseparable from human perception. On the other, Karl Marx (1818-1883) posited *materialism* (Marx and Engels, 1970) as the claim that history is the result of material conditions, not of ideals.

This non-dualistic thinking paved the way for a re-conceptualisation of space and learning. *Space* is a construct composed of both physical and social components, such that it has a physical context determined by geometry, and a social context derived from socially constructed meanings (Soja, 1989; Cleveland, 2011). This progressive re-definition resulted from the *spatial turn* of the 20$^{\text{th}}$ century and contended with the Cartesian understanding of space as a neutral, apolitical container defined by its physical mathematical properties (Soja, 1989). For many of us, however, physical notions of space are axiomatic because of our personal experience of particular locations that have recognisable material properties. As a result, Temple (2007) remarks that the term 'learning space' is problematic, given it has long been perceived as the physical location of the university campus; ICT has changed this perception by advancing the possibilities of where, how and when learning takes place (Deed and Alterator, 2017). Space has therefore been used as a polysemic metaphor in this study, first connoting the physical entities we imagine, whilst also encapsulating the non-physical entities in which social interaction and learning are situated (Lave and Wenger, 1991).

Since the spatial turn, the physical dimension of space features in many of the theories that deal with interactions between people and physical space. Sennett (2018) refers to the sixteenth-century definition of *ville* as the physical location, form and infrastructure, including buildings. Henri Lefebvre (1901-1991) introduces *conceived space* as the abstract designs like campus plans used to determine and construct space (Lefebvre and Nicholson-Smith, 1991). Whitton (2018) in his doctoral thesis suggests that these physical

forms of space reinforce particular cultural values, behaviours and ways of being. Hence, the physicality of space cannot be ignored when considering the link between human activity and space. The physical properties of space after all '...predispose current practices to emulate past practices' (Jacklin, 2000, p. 4).

2.2.1 Space as social

This study, like other empirical studies such as Leighton (2017) and Nelson and Johnson (2017), is premised upon the idea that space shapes social relations and practices (Lefebvre and Nicholson-Smith, 1991; Massey, 2013). The realisation that space is not just a physical object, but a socio-spatial dialectic, supplants the Cartesian idea of space as an asocial and apolitical vacuum of activity (Tuan, 1977). Thrift and Valentine (2009) state that instead of being '...viewed as a container within which the world proceeds, space is seen as a co-product of those proceedings' (p. 86). However, as Doreen Massey (1944-2016) has duly noted, *space* and *spatial* are terms used as if their meaning is clear, yet they have ambiguity and several interpretations (Massey, 2009). Mulcahy et al. (2015) rightfully note that space should be treated as a verb more so than a noun, since it is more something we do than something we have. Therefore, whilst significant intellectual effort has been invested into understanding space and its relationship with social activity (Soja, 1989; Lefebvre and Nicholson-Smith, 1991; Massey, 2005; Sennett, 2018), it is important to note before delving into socio-spatial theories that they present a range of ontological perspectives that are moot and understood in different ways.

Henri Lefebvre's sociological theory suggests that all space is socially and politically produced, implicit in the very title of his magnum opus: *The Production of Space* (Lefebvre and Nicholson-Smith, 1991). This coupling of space and social activity posits that space is produced as a result of social interaction or as a mental construction, and that there exists

'...a politics of space because space is political' (Lefebvre and Nicholson-Smith, 1991, p. 33). Lefebvre also notes, however, that a '...social space is not a *socialised* space' (p. 220), in that it does not become social, but was rather produced by social forces. This emphasis on space challenges the hegemony of time that has dominated since the wake of Hegel, Marx and William James (Casey, 2013). Lefebvre's prodigious writings were thereby concerned with the reconciliation of Hegel's idealism (the finite world as a reflection of mind) and Marx's materialism (history as a result of material conditions not of ideals), such that a consideration of the material and mental together seemed key if a true understanding of the lived experience of humans was to be reached.

Given the temporocentrism of philosophical history, Lefebvre's first task as a socio-spatial theorist was to valorise space as equally important in sociological theory and to correct the Kantian view of space as a mere experiential container (Elden, 2007). Secondly, he wished to critically understand the modern world, positing that space is produced in two ways: as a social formation (mode of production) and as a mental construction (conception). This foundation of thinking led him to present a conceptual triad of *lived space* and *perceived space* which he adds to his aforementioned *conceived space* (Lefebvre and Nicholson-Smith, 1991). This conceptual triad set out to understand how space was produced, with perceived space alluding to the outcome of an inhabitant's use of space (spatial practice), lived space relating to the meaning and symbolism assigned to space (representational space) and conceived space linked to the ideologies of space based on those that conceptualise it (representations of space), deemed to be the dominant space in society (Temple, 2019). These three arms of the triad are interlocking and inseparable. Although Lefebvre's theory was produced to better understand the spatiality of politics and the transition between industrialised and urban society, his core concepts have been employed with effectiveness at finer scales of space use in a number of contemporary studies (Leighton, 2017; Nelson and

Johnson, 2017; Whitton, 2018). Lefebvre's spatial triad is revisited as an important theory in section 3.7.1.

Sennett (2018) attempts to bridge a similar socio-spatial gap by defining the *cité* as the social life that permeates the physical *ville*. Thinking about the interplay between social life (cité) and the urban configuration of space (ville) is a central thrust of space syntax theory (Hillier and Hanson, 1989), which denies space-as-form reduction, instead advocating that social structure is inherently spatial and that the configuration of space has a social logic (Bafna, 2003). According to this theory, one cannot be simply mapped on to the other, but rather that the relationship has a dynamic aspect in that space can modify social structures and vice versa. Augé (1995) provides a nuanced definition of *non-places* as those with specific ends (e.g. airport terminals and train stations) that have such insignificance that humans remain anonymous as passengers or customers. Augé further defines *anthropological places* to contrast with non-places, which are places that empower an individual's identity and allow them to meet other people that share social references. Temple (2019) usefully integrates these socio-spatial theories to note that between non-places and anthropological places exist transitional areas, including on university campus settings. These intermediate areas are the focus of this thesis.

2.2.2 Space and power

Power is posited to operate in all human social relationships and able to create harmony, collective strength and individual well being (Chinn and Falk-Rafael, 2015). Transitions in power between students and educators are important to understand in relation to this study's research questions. The socio-spatial conception of space not only as physical, but inherently social implies it is a method of control in which power can be enacted (Elden, 2007). Space has therefore been used historically by groups to exert dominance over others,

including by teachers over students. Nonetheless, whilst the use of power by those at the top of a hierarchy has negative connotations of domination, power can be a necessary and productive force in society and has been treated accordingly in this study (Gaventa, 2003). Power is structured and reproduced by architecture, such that space sends functional and symbolic messages about values and priorities to its users (Temple, 2019). The relations between space and power also have important temporal dimensions, given they are remade via materially-embedded practices and never static or complete, but in a process of becoming (Massey et al., 1999).

Doreen Massey conceptualised space as a geographical concept that is a product of interrelations constituted through all levels of interaction, from the '...global to the intimately tiny' (Massey, 2005, p. 9). In addition to space being a product of relations, her theory resembles Lefebvre's widely accepted belief that space is always under construction and that space and time are implicated in each other. Building on the notion that space is relational, not only is it imbued with power, but power itself is believed to have a geography. Massey (2007) uses the term *power-geometry* to unpack this two sided definition of space, stating that it is not only important to consider entities and spaces, but to consider the wider relations of power within which they are set, shaped by economic, political and cultural influences and resources. Massey (2009) argues that the functioning of a power-geometry will depend on that within the '...economic, that within the distribution of educational resources, that within the cultural sphere, and so on' (p. 23). All of these interdependent factors could be said to shape any learning space, including the physical affordances (Gibson, 1977) and social processes that maintain or change the power-geometry of that space. The concept of power-geometry has been used as a flexible lens through which understanding can be gained about spaces as products of negotiation, competition, agreement and conflict between different positions and conditions; it is a key theory further discussed in section 3.6.2.

A sociologist who dealt with the sociopolitical is Pierre Bourdieu (1930-2002). His concept of *capital* (Bourdieu, 1989) does not deal directly with space, but perceives capital as the foundation of social life and the currency that buys an individual a higher position in society. 'Cultural capital' is described as what an individual has and what they know, and when shared with others leads to a collective identity. 'Social capital' is more about who an individual knows, and is gained when that person either forms relationships with a lot of people, or is connected with a few people that possess a lot of capital. Bourdieu equates possession of capital to having power, and ties this to the *habitus* of individuals, which is the socially ingrained habits and dispositions shared by people with similar backgrounds (education, social class, religion, ethnicity etc.) (Bourdieu, 1977). In the context of space, those who have ownership and/or power in a space might therefore be externally recognised as having capital. Temple (2019) argued for the cultivation of university spaces and places which empower connection and furthering of social capital. Concepts like habitus and social capital are useful to at least consider in this study as they provide one lens for understanding the relationship between space, behaviour and power.

Whilst I reviewed other theories regarding space and power, I do not extensively report them here. This includes the work of Michel Foucault (1926-1984) who wrote about the techniques of power exercised in enclosures, prisons, hospitals and asylums (Foucault, 1992) and the conceptualisation of these 'other spaces' as *heterotopia* (following utopia and dystopia) (Foucault, 2018). Freire (2018) is another theorist who argued that learning is political and does not stop at the classroom, such that the teacher must strive to be empowering in forming a transformative relationship between them and their students, students and their learning, and students and society. Jack Mezirow (1923-2014) introduced *transformative learning* (Mezirow, 1978) to argue that the locus of control must sit with the learner to empower them to transform and change their frame of reference.

2.2.3 Socio-spatial research

Following the emergence of socio-spatial thinking, the interaction between the built environment and human behaviour has been studied by psychologists and behavioural scientists since the 1950s. However, higher education has not concerned itself extensively with learning space design until recently (Temple, 2008). Architectural psychology, environmental psychology and ecological psychology arose as new fields from this area of study. Weinstein (1981), for example, used an environmental psychological approach to suggest that the environment communicates direct and symbolic effects to students. Altinbasak (2016) more recently adopted an ecological psychological approach to understand the correlation between behavioural settings and a space's affordances. A suite of socio-spatial theories that assume the intersection between social and spatial practices, and our individual beliefs and perceptions (Boys et al., 2014) present useful antecedents for understanding our interaction with the physical world.

The premise of these socio-spatial theories is that the intangible appropriates the tangible, and they are interdependent of one another. In spite of this theoretical premise, Mulcahy et al. (2015) note that the actual discourse into learning spaces is dominated by a *realist* perspective - focusing on entities (e.g. built environment, design features, learning outcomes) - rather than relations (e.g. socio-spatiality). A *relationalist* perspective is about the encounters between space and its occupation, where the ville (infrastructural elements) and the cité (social life permeating these) are understood to be produced together (Sennett, 2018). This relationalist perspective provides a new way of thinking about learning space because it focuses not only on decipherable physical and social elements, but on the relations between them and the potential in-between space (Oblinger, 2006; Brooks, 2011). Blackmore et al. (2011) confirm that learning space research has been preoccupied with the design phase, paying less attention to the occupation of space. The sector's perception that 'All that

is really needed for education is a great teacher and a ready student' (Keohane, 2006, p. 54) may have caused socio-spatial research to remain in its infancy (Hunley and Schaller, 2009). Whilst this age-old relationship between teacher and student remains fundamental, the 21st century has introduced instruments of knowledge that are changing the nature of this relationship, including the design and management of space. Socio-spatial theories negate this traditional perception and have led to a corpus of empirical literature exploring the link between space design, research, learning and teaching activity (Boys et al., 2014; Mulcahy et al., 2015; Carnell, 2017; Temple, 2019).

McNeil and Borg (2018) argue that because learning space research sits at the confluence of a number of disciplines, it lacks a shared language and has different sites of practice; this provides an alternative explanation for why a realist perspective dominates. In response, they developed a descriptive framework containing common language and conventions for the community to better understand the context of a learning space case study. Paul Temple is another academic who, in his plea for the importance of space and place in learning and academic institutions, has drawn upon several socio-spatial theories to develop a learning space lexicon (Temple, 2009, 2018, 2019). His relationalist perspective integrates the work of Lefebvre, Sennett and Augé, to better understand place and the way space is best managed in educational institutions. More recently, Temple (2019) integrated socio-spatial thinking, social capital theory (Bourdieu, 1989) and *common-pool resource* theory (Ostrom, 1990) to evidence practical ways to convert institutional *non-places* into user-determined *special places* (Augé, 1995). This recent work used these theories to support campus users to cultivate cité and place by sharing ownership over space as a common resource.

Pierce et al. (2001) define psychological *ownership* as '...that state in which individuals feel as though the target of ownership (material or immaterial in nature) or a piece of it is "theirs"' (p. 299). Ownership of space can therefore be linked to possessiveness in a

shared place which has meaning for the user personally, linked to the perceived or actual power and agency of others in that space (Duncan, 1981). This goal to develop social capital and ownership in institutional spaces is shared by other researchers within the academic community, including by Browndorf (2014) who set out to present ways to enable institutions, without sufficient financial resource for physical renovation, to create library environments that nurture 'citizenship behaviour' and 'feelings of responsibility' (p. 89). Drawing on theories of governance, ownership and *communicative commons* (Birdsall, 2010), the study concludes that by training students to take greater ownership of library resources, there are increases in active and experiential learning and better participation in the wider cultural commons following their graduation. Other thinkers perceive space as intimately connected to usage and sense of ownership, including Trowler (2001) whose work posits that knowledge can be thought of in terms of geographical landscapes consisting of academic *tribes* and disciplinary *territories*. The geography of landscapes is determined by the interactions and transitions between different practitioners and communities, with their boundaries changing as a result of globalisation and new forms of communication technology (Wenger-Trayner et al., 2014). Using socio-spatial thinking to understand the transitions which increase social capital and ownership within existing institutional spaces (Bourdieu, 1989), as opposed to investing in new builds, seems beneficial for educational and economic reasons, and is an understanding that has sought to be elucidated in this PhD study.

A handful of other empirical works have used socio-spatial theory to frame their study. Pantidi (2013) used ethnography to evidence fluid transitions between technology, architecture and people which are catalysed by the differences between anticipated and actual use of innovative learning space. Whitton (2018) and Zhang (2014) both used Lefebvre's conceptual triad to illustrate the tensions between each triad space type, concluding that spaces are predominantly user-determined as opposed to organisationally

designated. Cleveland (2011) interviewed middle years school leaders, teachers and students to reach the conclusion that learning environments need to support a variety of learning behaviours and pedagogical encounters. Kokko and Hirsto (2020) used a sociomaterial approach to better understand the change processes that enabled transition from physical spaces to learning environments in two Finnish schools, recognising that:

> '...learning spaces are not understood as given or fixed, but rather as temporal processes, which provide the opportunity to see spaces as an ongoing series of redesigns always under construction' (p. 2).

This thinking is reflected in the model of Brand (1995) who categorised core building elements as movable *stuff* (3 year life cycle), the *space plan* (7 year life cycle), the *services* (10-20 year life cycle) and the architectural *structure* (over 100 year life cycle) which continuously change according to the changing needs of users since initial occupation.
This section has introduced the most relevant socio-spatial theories and empirical works for understanding the link between space and social activity. Active learning is one important example of social activity which is unique for each individual learner based on their personal learning ecologies (Barnett and Jackson, 2019), given they link their own ways of thinking, being and doing to the learning environment. This orients us toward the interaction between the active learner and the socio-spatial environments that they are now a contiguous part of (Pendleton-Jullian, 2019).

2.3 Active learning

Following my introduction of socio-spatial theories and resulting empirical studies, a separate suite of theories are introduced in this section which further bridge the gap between the social and material, and between subject and object, helping to benefit research

into any learning phenomena (Niemimaa, 2017). One of the more influential theorists in developmental psychology, Lev Vygotsky (1896-1934), founded *social constructivism* where knowledge is believed to be constructed through social interaction with others (Vygotsky, 1980). This follows the earlier work of Jean Piaget (1896–1980) and his theory of cognitive development and *constructivism* which, unlike social constructivism, posited that learning could be separated from its sociocultural context (Piaget and Cook, 1952). This lay an important foundation for subsequent work, including for one of Vygotsky's students Leont'ev (1978) who added a social dimension to cultural-historical psychological theory. Engeström (1987) then formulated his cultural-historical activity theory (CHAT) triangle from these key theories, to form a framework that represents the cultural mediation of action and which is explored as a useful theory in section 3.6.1.

Active learning in this study aligns with this social constructivist perspective where knowledge is actively constructed by the learner and integrated with his or her existing knowledge and experiences (Cleland and Durning, 2015). It is defined here as:

> '...instructional activities involving students in doing things and thinking about what they are doing' (Eison and Bonwell, 1991, p. 5).

'Collaborative learning' is one form of active learning in which learners collaborate in groups to reach a shared understanding through discussion in person or online (Akçayır and Akçayır, 2018). *Passive learning*, on the other hand, aligns with behaviourist theories that view the student as an empty vessel waiting to be filled with knowledge, aligning more so with didactic transmission instruction methods where information is transmitted to students who sit, listen and absorb information (Michel et al., 2009); this is the case in 'traditional' lectures. These conceptions mirror the metaphorical distinction made by Sfard (1998) between *acquisition* and *participation*, which frame how learners and educators perceive and engage with education (Wegner and Nückles, 2013). The growing ideal is to develop students

that engage in what Lippman (2010) defines as peripheral, guided or full participation in learning.

A number of learning theories take social constructivism as their base and are briefly summarised here. Lave and Wenger (1991) present their theory of situated learning as legitimate peripheral participation in a *community of practice*; these are linked to landscapes of practice where the real body of knowledge exists (Wenger-Trayner et al., 2014). Kolb (2014) and his experiential model of learning posits that learning can occur without a teacher and instead relies on the learner's active engagement with direct experience to make meaning. Montessori (1917) and her Montessori method of education advocated for children as independent agents that learn best when able to choose activity from a prescribed range of options within a thoughtfully prepared environment.

Social constructivist theories collectively argue that active learning involves something more than passively listening to information or reading PowerPoint slides, it involves discovery, processing and applying information, all of which require higher order thinking skills (Bloom, 1964; Prince and Felder, 2006). In addition to this clear theoretical impetus for active learning approaches, the marketisation and internationalisation of the UK higher education sector, the widening participation agenda and the development of ubiquitous mobile smart devices has led to innovation in teaching approaches (Keppell et al., 2011; Freeman et al., 2014), leadership and management approaches (Bates and Sangra, 2011) and learning spaces (Riddle and Souter, 2012). In response, many universities like the institution researched develop Learning and Teaching strategies (Imperial College London, 2017) which aim to take a more evidenced and scholarly approach to development of curriculum and pedagogy (Asmar, 2002). These strategies seek to develop the best physical and virtual learning environments, which maximise the number of formal contact hours to appeal to consumer-oriented students (McNeil and Borg, 2018) and to minimise the financial impact

of attrition (Perry and Allard, 2003). This warrants closer examination of the resources, technology and palette of environmental affordances which enable effective physical, cognitive and social learning spaces (Dewey, 1966). The transitions and interactions between educators and students which shape these spaces is explored in this study, and are of increasing importance following the recent COVID-19 pandemic (Remuzzi and Remuzzi, 2020) and the forced closure of physical campuses.

2.3.1 The case for active learning

University structure and traditional didactic transmission originate in a time when a few academic institutions were the guardians of a relatively discrete body of scholarly knowledge. In our modern information-rich society, learning is now ubiquitous as higher education institutions arguably no longer hold the monopoly on information. This has arguably devalued passive learning in traditional, in-person didactic contexts, which could be argued as a remnant of a time when scholarly knowledge was restricted to a controlled elite. Notwithstanding, Wilson and Jennings (2000) argue: 'A website will not replace talented faculty. Instead the faculty reach will be extended by technology and their effectiveness enhanced by the interactivity' (p. 79). How best to use the increasingly limited physical classroom contact to promote effective active learning (Beichner, 2014) frames a very important debate as we transition out of and learn from COVID-19. Sandrone and Schneider (2020) argue for a flexible learning experience beyond the pandemic, presenting ten practical steps to develop adaptive curricula for active and distance learning in STEMM education. It is therefore time to rethink learning space design to better engage students in active learning. The World Economic Forum (WEF) define active learning as: 'Understanding the implications of new information for both current and future problem-solving and decision-making' (World Economic Forum, 2020, p. 153) and rank 'innovation' and 'active

learning' as the top two skills respectively for 2025. However, in spite of the acceptance of the relative effectiveness of active learning both inside and outside of higher education, Michel et al. (2009) assert that a clear definition is lacking, given the range of teaching activities that could be deemed 'active'. To address this, Carmean and Haefner (2002) present deep learning principles which include social (Chickering and Ehrmann, 1996), active (Brown, 2000), contextual (Merrill, 2002), engaging and student-oriented (Donovan et al., 1999). Radcliffe et al. (2008) and their 'places for learning' framework in figure 2.1 map didactic, reflective and active learning modalities on to a spectrum of unstructured (e.g. home spaces) to structured (e.g. lecture theatres) spaces (p. 13). This figure and taxonomy, however, fails to capture underlying complexity, including the role of student agency and the *tactics* they adopt to '...use, manipulate, and divert these spaces' (De Certeau, 1984, p. 30), which are imposed as *strategies* by the subject of power (the institution).

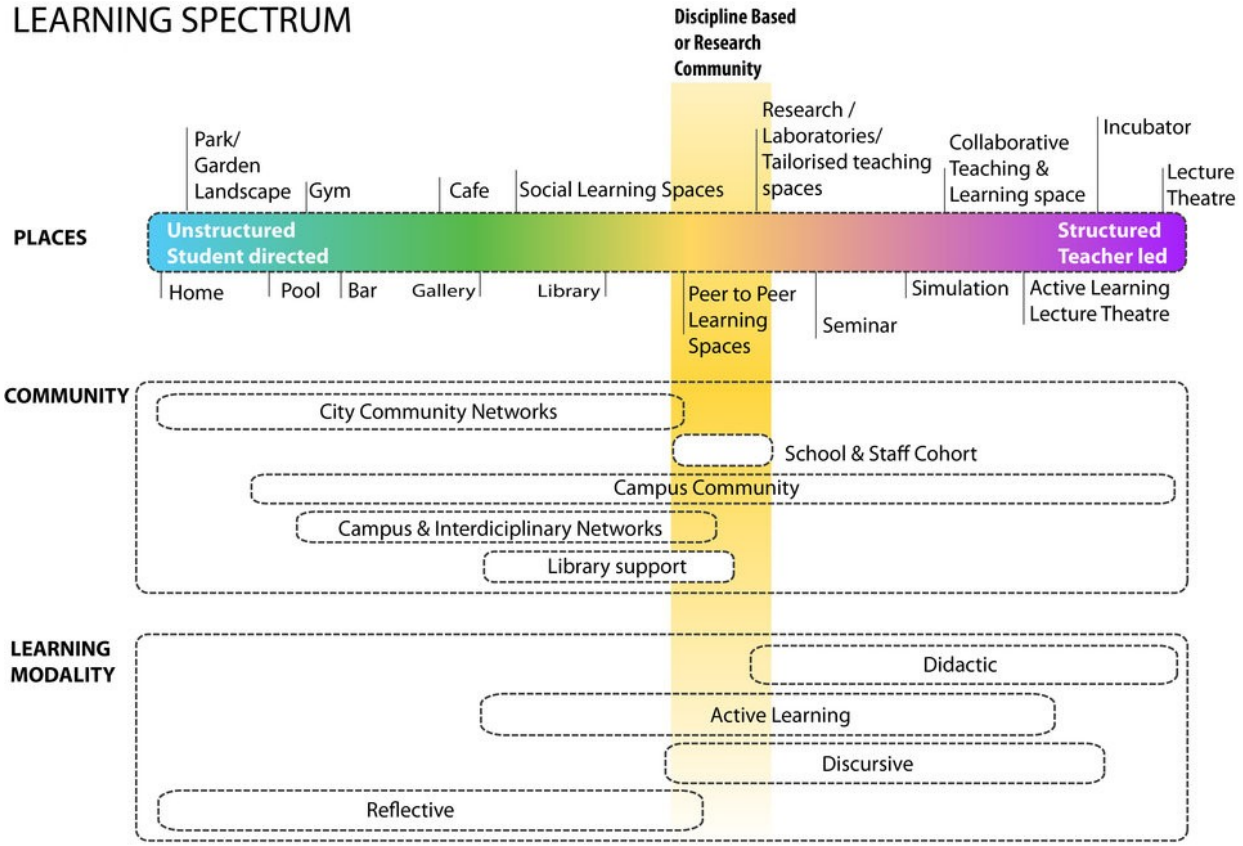


Figure 2.1: Spectrum of learning places adapted from Radcliffe et al. (2008) (p. 13)

Given active learning is about '...seeking new information, organizing it in a way that is meaningful, and having the chance to explain it to others' (Allen and Tanner, 2005, p. 262), it requires students to understand information before they are able to socialise it usefully with others. Bloom (1964) and their credited taxonomy suggest that the process of effective active learning should guide a student through transitions between knowledge and comprehension at the base, up through application, analysis, synthesis and evaluation as higher order cognitive skills. This taxonomy further defines three domains of educational activity: cognitive, affective and psychomotor, stating that each are strengthened through active learning strategies such as visual learning, cooperative learning, discussions and peer learning/teaching (Eison and Bonwell, 1991). The need for STEM students to self-direct transition through these active learning domains is also important because of the inquiring nature of the disciplinary area (Prince and Felder, 2006).

There exists compelling empirical evidence for the effectiveness of active learning. Hake (1998) contrasted interactive engagement approaches with traditional didactic methods for introductory physics courses by presenting surveys of all 6000 student pre-/post-test results known to the author, including those studies that used tests like the Force Concept Inventory (FCI) (Hestenes et al., 1992). The results of this landmark study concluded that interactive engagement methods enhanced the problem-solving ability and mechanics course effectiveness of students well beyond traditional courses. Studies like this set the stage for over two decades worth of empirical research into the relative effectiveness of active learning in STEM education. According to one study, students who learn in small groups demonstrate greater academic achievement, express more favourable attitudes to learning and persist through their course more so than traditionally taught students (Springer et al., 1999). Freeman et al. (2014) published a more recent landmark study which conducted the largest meta-analysis of 225 STEM education studies to conclude that active learning increases

examination performance by 6% and that students were 1.5 times more likely to fail when traditionally lectured. The active learning approaches in the Freeman et al. (2014) study included '...occasional group problem-solving, worksheets or tutorials completed during class, use of personal response systems with or without peer instruction, and studio or workshop course designs' (p. 1). A more recent meta-analysis study of literature in STEM fields found that active learning benefits all students, but has disproportionate benefits for individuals from underrepresented minorities and low-income backgrounds, reducing awarding gaps in passing rates by 33% (Theobald et al., 2020). This has crucial implications given awarding gaps decrease workplace diversity and increase income inequality (Piketty, 2015).

Michel et al. (2009), on the other hand, used a quantitative approach to postulate that active learning is not superior to passive learning with regards to cognitive outcomes. Martin et al. (2007) argue that the traditional didactic transmission lecture has numerous benefits, including that both students and lecturers have a clear awareness of what needs to be learned based on the organised presentation of information, and that students learn this information in rote fashion to later recall it in assessment tests. Active forms of learning like problem-based, inquiry based and discovery learning (Prince and Felder, 2006) also possess an open-endedness where students can miss important concepts and fundamental principles that are required to solve open-ended problems, rendering these approaches far from a perfect alternative to didactic lecturing (Martin et al., 2007). They also share the shortcoming with passive lectures that material is learned in a context removed from where it is later applied, for example in a workplace environment. Therefore, if active approaches are not structured well, overall knowledge gains can be less than with traditional approaches, even if the quality of knowledge retention is increased in for example problem-based learning (Dochy et al., 2003).

Research has provided evidence for the positive impact of active learning not only on subject

mastery, but mastery of higher-level cognitive skills required for adaptation and discovery (Martin et al., 2007). This evidence for better learning outcomes resulting from active engagement in learning has led to the adoption of the flipped classroom model, defined as:

> '...what has been traditionally done during class time i.e. class presentations is shifted to home activities and what has been traditionally done at home i.e. homework and projects are transferred to as class activities' (Sohrabi and Iraj, 2016, p. 1).

By re-purposing the formal space to cover independent 'homework' style aspects within class, peers are able to more actively engage with each other, the teacher and material, and the transitions between the formal and informal spaces. This inverted approach has documented advantages and challenges, including the improvement of student learning performance on the one hand and inadequate student preparation for class on the other (Akçayır and Akçayır, 2018). Other studies show that flipped classroom can also reduce the cognitive load imposed by purely traditional or active models of instruction (Turan and Goktas, 2016), given there is increased frequency of transitional space between learning activities. With the widespread adoption of online learning in response to COVID-19, Khan et al. (2017) note that active learning in online courses poses challenges; they discuss strategies to mitigate this challenge such as building an online community, outlining learning expectations and ensuring all students have equal access to course materials and technology.

The objective of active learning is for students, through exploration and interaction, to understand concepts of a domain and develop habits of mind that support generative use of those concepts, as opposed to receiving prescribed knowledge (Bligh and Flood, 2017). This helps students develop what Giyoo and Inagaki (1986) refer to as both technical expertise and *adaptive expertise*. Epstein (2019) defines these unfamiliar, novel domains as *wicked environments*, demanding of an individual what his book title refers to as 'Range'; an

ability to transition between different disciplines and problem-solving approaches. However, Finkelstein et al. (2016) argue that traditional teaching approaches have been crystallised by the physical spaces in which they are situated, inhibiting the transitions in student and educator mindset necessary for active learning. These transitions have been focused on in this study and link to the first research question of the thesis:

> What are the nature of transitions in learning spaces?

The spaces in which social constructivist forms of learning take place are now being understood as a vital element for supporting better interaction and transition between students and teachers (Campbell, 2020). Perceiving these spaces not as fixed, but as socially constructed and contested sites in which both student and teacher identity is in constant flux assists a better understanding of active learning space (Bradbeer, 2016).

2.4 Socio-spatial practice

The literature into learning space has developed to a point where space is now treated as a pedagogic tool (Imms and Kvan, 2021) for achieving innovative and active forms of learning. This modern conception is supporting what Prensky (2008) refers to as the transition from 'Sage on the Stage' didactic transmission pedagogy where teachers are telling students, toward 'Guide on the Side' active approaches where students are telling themselves with teacher guidance (p. 1). The remnant design of traditional formal teaching spaces is based on their clear purpose according to Markus (1993): 'The face, and especially the eyes, signified character and willingness to learn. The sloping floor, the raised master's platform, the raked gallery and the tiered desks were direct instruments for visual surveillance.' (p. 92). However, given the accumulation of empirical studies which have explored the link between learning and physical space, it is surprising that the architectural design of university lecture

theatres has remained immutable since the Industrial Revolution (Fisher, 2004). Authors like Boys et al. (2014) make an important call for action to leverage the body of literature that has drawn from learning theory, place making and architecture to understand what makes a successful learning space in practice. This increasing empirical attention in learning spaces research has been reflected in other areas, including by charitable organisations like JISC which published on 21st century learning space design (JISC, 2006), and the Higher Education Design Quality Forum (HEDQF).

It is also surprising that a number of sub-committees exist in the UK which uphold the impact of educational buildings in society, such as the Royal Institute of British Architects (RIBA) and the Association of University Directors of Estates (AUDE), but which do not engage significantly with pedagogic practice, curriculum or actors within them. From a research standpoint, the growing body of learning space research is evident from the publishing of notable works in journals like the *Journal of Learning Spaces*. The disconnect between these different bodies is costly given the enormous capital allocation for education space. The ongoing maintenance and modernising of university physical capital in the UK approaches £3 billion annually, only exceeded by staff budgets (Temple, 2018). This magnitude of economic investment into the physical fabric of educational institutions surely demands that physical space is treated as a greater managerial and research priority (Temple, 2007).

One explanation for the lack of translation between learning space research and practice might be that knowledge about space is not being shared with the right stakeholders. Elkington and Bligh (2019) note that it can be difficult to generate universal or absolute knowledge about learning spaces, given much of the literature consists of deep, contextualised accounts of spaces in certain institutions; they exemplify this challenge by explaining, if '...painting classroom walls in some shade of blue led to "15% better learning", then

such knowledge would be attractive to many stakeholders' (p. 6). They attribute the lack of translation to a paucity of absolute knowledge, which is made even more difficult by incoherence between stakeholder ideas, ignorance of spatial context and the ignorance of research by designers. Norman (2010) argues that this problem would be partly solved through the employment of a 'translational designer' as someone who operates between research and practise to bridge the knowledge and operation gap.

Carnell (2017) further argues that university staff focusing on enhancing the physical environment and colleagues dealing with improving education should collaborate. In a similar vein, Goodyear and Ellis (2019) argue for an ecological conception of university strategy and note the importance of students partnering in this process to achieve '...a richer and sharper understanding of what is involved in co-creating their own learning tasks and environments' (p. 97). This partnership results in a more joined-up design methodology which Matthews et al. (2019) perceive as distributing leadership more widely to students and other end users who require empowerment, shared tools, methods and concepts. As early as 2010, La Trobe University invested $586,600 into the conversion of under-utilised informal spaces across the university campus, redesigning indoor and outdoor spaces with student needs in mind, including in-between 'eddy spaces' in corridors (Riddle and Souter, 2012). This project was informed by the seven design principles of the Spaces for Knowledge Generation (SKG) project, which sought to encourage student-centred, active learning in campus environments (Souter et al., 2011). These principles include comfort, aesthetics, flow, equity, blending, affordances and re-purposing. Carnell (2017) stresses the importance of designing spaces which fulfill research-based education strategic objectives to ensure a fit-for-purpose estate that is reflective of the *Connected Curriculum* (Fung and Carnell, 2017). Carnell's work similarly resulted in four key space principles, one of which alludes to the importance of 'Informal spaces for making social connections' (p. 3). This thesis echoes the importance of

designing informal spaces for connection and transition, and the potential of partnership for assisting design translation (Mahat et al., 2018).

2.4.1 Innovative Learning Environments (ILEs)

'Traditional' lecture theatres originated from the Greek's use of *theatres* as beholding areas where people would view a spectacle, and later from the Roman's use of an *auditorium* where an audience would listen to audio aspects (Beichner, 2014). Around 2500 years ago, these spaces served their purpose, and the role of the lecturer (from the Latin for 'reader') involved 'reading out' and disseminating 'knowledge' to a controlled scholarly elite. Lecturing in traditional raked learning spaces is therefore a continuation of ancient oral traditions in which students have an unimpeded sight line to the lecturer as the central focal point at the front of the room. This focus on the teacher and their display resources favours didactic transmission instruction and whilst student-student and student-instructor interactions are possible in these spaces, the spatial arrangement presents perceived and actual challenges for active learning. With the recent transition from the 'knowledge age' to the 'creative age' (Fisher, 2010, p. 3), traditional classrooms are still conceived of as 'learning containers' poorly connected to informal spaces on and off campus (Imms and Kvan, 2021, p. 9). Innovative learning environments (ILE) seek to address this disconnection by supporting 'Innovative teaching' and 'innovative learning' practices, defined by Mahat et al. (2018) as the sum of activities that help to develop the four 21st century learning skills: creativity, collaboration, communication and critical thinking (p. 8). The institution that provides the context for this study made reference to all four learning skills in its Learning and Teaching strategy, including an aim for graduates to 'Approach challenges with curiosity, critical thinking and creativity' (Imperial College London, 2017, p. 5). Whilst much of this ILE literature has sought to improve secondary school education, there is useful transference

of thinking into the higher education sector. However, Imms and Kvan (2021) in a recent book resulting from the Innovative Learning Environment and Teacher Change (ILETC) symposium note that the specific educational approaches, nomenclature and agreed standards of different institutions makes it difficult to understand generally what an ILE is, and to integrate scholarly work into the wider literature is difficult given the multidisciplinary nature of the area.

A subset of ILEs includes *Active learning classrooms* (ALCs) which have disrupted traditional spatial arrangements by centring design around what Fisher (2010) refers to as the *third space*; the space for student-student and student-instructor interactions. Changing learning space arrangement has been shown to make small group working and learning in this social third space more easily possible (Petersen and Gorman, 2014). Given the redesign of traditional learning spaces in this study, it is worth summarising some of the modern variations of ALCs and their associated pedagogies that have developed from the work of social constructivists like John Dewey (1859-1952), Montessori and Kolb. It is noteworthy that the formal classroom learning emphasised in this section and thesis is differentiated from experiential learning, which takes place outside of classroom contexts, such as in practical apprenticeship-like attachments of professional disciplines like engineering and medicine.

The introduction of laboratory work in the sciences to supplement formal lectures caused the introduction of more active, practical work in disciplines inside and outside of STEM. Later, problem-based learning (PBL) began in medical schools where students were required to solve complex, often real medical cases (Dochy et al., 2003). The Student-Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP) project embraced studio-based education for teaching introductory physics courses (Wilson and Jennings, 2000). Between 1997-2001, it resulted in the modification of teaching spaces to support 2-4 student groups, provide learners with access to computers, experimental equipment and internet, and still

facilitate student participation in class discussions (Beichner et al., 2007). Massachusetts Institute of Technology (MIT) developed their Technology-Enabled Active Learning (TEAL) spaces, with a similar focus on the teaching of introductory physics concepts (Fisher, 2010). TEAL spaces have blurred the boundaries between collaborative learning situated in the built environment and remote learning in digital technological networks, and have since expanded to successful application in chemistry, engineering, architecture and other disciplines (Fisher, 2010). The latest iterations of these SCALE-UP and TEAL flat-floor spaces use round tables for student groups, between which there is enough spacing for free circulation of instructors. These spaces are technology-rich, enable flexible transition between activities and can now be found at over 200 educational institutions globally.

The nuances of ALC spaces, such as whether students each have desktop computer units, individual laptops or share a laptop between three students, seem to affect the style of learning interaction (Beichner et al., 2007). Some spaces position the instructor podium at the centre of the space with screens and whiteboards on walls that allow students to record discussions with their peers. However, whilst spaces like this are well intended, they risk losing a central focal point such that students become distracted by too many reference points like technology during transmission. This is where the educator must plan activities which take advantage of the space and be pedagogically skilled in directing the sensory attention and transition of students between periods of different reference engagement (Deaton, 2015). ALC spaces possess a configuration that is more facilitating of these transitions and which change what Ravelli and Stenglin (2008) refer to as the 'social distance', that is the physical position of a participant in a space and their power relative to other interactants. This change in physical relationship has been shown to assist teachers in controlling undesirable student behaviour, including by merely standing near a disruptive student (Petersen and Gorman, 2014). This ALC thinking and literature links to the redesign

of a traditional raked lecture theatre in this thesis; made interesting by the additional redesign of the adjacent informal space.

Innovations that enable active learning in traditional classrooms have also developed, including via the use of student response systems like Mentimeter and peer instruction, which show higher learning gain than traditional pedagogies (Fagen et al., 2002). Research overwhelmingly indicates that students in active learning classrooms outperform their peers in traditional classrooms (Brooks, 2011). The greatest barriers to realising the true potential of ALCs reported by Petersen and Gorman (2014) is tied to students and teachers having to adapt to learning and teaching in a new space. These adaptations include the incremental adjustment of a teacher's course based on them no longer being the focal point, the inability of students to revert to passivity and the difficulty of transitioning from small group to class-level discussion. The upshot, however, is that if the space is designed competently and teachers are assisted with transition into using the space correctly, students working actively in these spaces experience increased social support, higher learning satisfaction and learn better than students working individually (Qin et al., 1995; Johnson et al., 2007). Changing space alone seems not enough; it must align with the intent of the educator (Fisher, 2004).

2.4.2 Is changing space enough?

The short answer to this question according to literature seems to be no, and is linked to the second research question of this thesis:

> How does the redesign of learning spaces influence transitions?

The statement made by Blackmore et al. (2011) that learning space research has been preoccupied with the design phase - with less attention paid to its occupation - carries with it an assumption that by merely changing space (through inbuilt intentionality) there will be organic transitions in teacher and learner behaviour that result in desired learning and

teaching. The social processes involved in these transitions toward more active learning are framed in the research question, given Lackney (2008) contends that:

> 'Regardless of improvements in classroom size, spatial configuration, physical features, furnishings or equipment, traditional patterns of direct instruction persist' (p. 134).

Bøjer (2020) similarly argues that simply changing space will not lead to changes in the way we teach and learn. For example, studies suggest that implementing a renovated studio space alone would not ensure improvements in learning, but that the accompaniment of research-based pedagogical techniques led to significant gains on student tests (Wilson and Jennings, 2000; Beichner, 2014). In contrasting low-technology and high-technology ALCs, Nicol et al. (2018) attributed the variable student outcomes between each to the lack of instructor experience for creating an environment conducive to self-directed learning. To redesign and change space alone seems insufficient for achieving strategic changes in education and teaching, such that a more joined-up dialogue (Carnell, 2017; Elkington and Bligh, 2019) and effective training of staff are required.

Imms and Kvan (2021) in their recent book about transitions into innovative learning environments cited Winston Churchill's argument who claimed that by reducing the number of seats within the parliamentary chamber to be fewer than the number of members, members had to respond to overcrowding by engaging in spontaneous conversation and more urgent debate. Fundamentally, Churchill recognised that given the users of space always have agency in how they use it, it is our behaviour within space that makes us, not the space itself. This means that architectural design is by no means deterministic, and while we respond to space in expected ways, we fundamentally have agency in how we choose to act (Oolbekkink-Marchand et al., 2017).

Nonetheless, physical arrangement does dictate the embodied constraints (Hornecker and

Buur, 2006), affordances (Gibson, 1977) and infrastructural legibility (Pantidi, 2013) of physical space. By re-configuring these aspects of physical space, these theories suggest that users re-negotiate social cues and expectations - what Pantidi (2013) calls 'social legibility' - which can lead to transition in people's behaviour and their understanding of how they can use it. The trade-off between financial investment in the renovation of physical space, and the more cost-effective approach of thinking about cultivation of place and ownership within it, frames an important challenge in higher education (Browndorf, 2014). This turns our attention to the role of teacher and student agency in facilitating transition toward active learning. The physical estate is a major perceived barrier to certain learning activity and with the recent phase of remote, online learning necessitated by COVID-19, there is clear appetite among both students and educators to return to in-person learning and teaching (Mishra et al., 2020). Our preparation for this transition requires a closer look not only at the way we design space, but the transitions that lead to its subsequent occupation and activity.

2.4.3 Teacher transitions into ILEs

Whilst the physical estate arguably presents actual barriers to certain modes of teaching delivery and transition, it is the user perception of those barriers that dictates their agency to act and behave differently (Emirbayer and Mische, 1998). The way educators inhabit design and leverage it to achieve their pedagogic aims was thereby explored as one of three key themes in the *Transitions* conference series. This conference work amounted to a recent book by Imms and Kvan (2021) under the aegis of the LEaRN (Learning Environments Applied Research Network). It is representative of the emphasis placed on the teacher perspective within the wider learning spaces literature (Campbell, 2020), with perhaps less focus on an authentic learner perspective of learning spaces. The increasing investment in

ILEs has warranted this educator perspective, given these investments will only translate into positive outcomes for students if teachers actually integrate learner-centred pedagogies into these spaces. This translation and transition, however, is never assured.

The question of whether teachers know how to integrate space into their pedagogy was posed to attendees at the 2017 ILETC Symposium. As valid as this question is, Buchan (2017) asks a different question to offer an alternative consideration; 'Do teachers know how to integrate pedagogy into their space?' (p. 48). The efficacy of educators in how they use space to achieve their pedagogic aims is what Fisher (2004) refers to as their '...architectural vocabularies and spatial literacies' (p. 37). A question asked by Leighton (2017) in the Transitions conference helped to build upon this reflection: are teachers and learners influenced by, or do they influence, the buildings they inhabit? This question links back to the second research question, and raises a separate question around if students also require support to develop literacy to integrate space into their learning.

Imms and Kvan (2021) rightfully note that 'The act of teaching is not immutable; even the most seasoned of teachers are constantly reacting and responding to changes in demography, curricula, popular culture and professional insights' (p. 5). Given the unchanging patterns of instruction, it is important to consider not only the space, but the way educators use space and develop spatial literacy. Deed and Lesko (2015) add that educator peer judgement and professional autonomy are significant factors which dictate a teacher's pedagogic choices. Oolbekkink-Marchand et al. (2017) used the concepts of professional space and agency to empirically demonstrate that there are two teacher trajectories, *bounded agency* where teachers act on their goals according to perceived boundaries, and *contested agency* whereby teachers fight experienced limitations to uphold their professional values and beliefs. The actual case may be more complex than this simplistic agentic division, given authors like Pendleton-Jullian (2019) suggest that different spaces present different conditions, some of

which are more behaviourally elastic and conducive to conflict. What is well documented, however, is that teachers react to change with 'perceptions of risk', which has been posited as a fundamental barrier to transition (Twyford et al., 2017).

Therefore, it seems important that through changing space, one is seeking to change the relative perceptions and relationships between teachers, students and other members of the learning community. Teachers interviewed by Campbell (2020) reported that they would have benefited from observing other teachers use a new innovative space as a way of refining their own practice. On the one hand, the conversion of traditional spaces into ILEs has been shown to increase collaboration among teachers and provide an enhanced sense of belonging to a professional community (Thousand et al., 2006), whilst on the other it can alienate teachers as they become resistant to senior management's increasing control over their practice (Deed and Lesko, 2015). Space must therefore have the capacity to change the power-geometry (Massey, 2007), as to empower *both* the learner and teacher to take agency in active learning (Lim et al., 2012). Achieving this healthy pedagogic relationship has also been shown to be important for teacher retention, given problematic pupil behaviour can massively hinder teacher satisfaction (DfE, 2018). A space needs to empower educators to negotiate their role, expectations and etiquette with students so that they can command discipline and mutual respect (Petersen and Gorman, 2014).

Changing space is one step in supporting the transition to active learning. Whilst many educators opt not to adopt collaborative approaches because of the increased planning time required (Jones et al., 2008), teachers generally recognise the importance of constructivist pedagogies for millennial learners (Cleveland, 2011). Whilst changing space invites transitions in behaviour and practice, it seems that the supplementary role of educational development units in developing the pedagogical competence of educators is also important (Campbell, 2020). This thesis seeks to further explore this interplay.

2.4.4 The formal and informal divide

Within the learning spaces literature, and for the purposes of this study, there is an important distinction made between *formal* and *informal* learning spaces. This distinction sits within a spectrum of learning places seen in figure 2.1 which risks oversimplifying the actual complexity of learning spaces. Informal learning spaces are best defined here as '...non-discipline specific spaces frequented by both staff and students for self-directed learning activities' (Harrop and Turpin, 2013, p. 59). Physical informal spaces include campus common rooms, breakout areas or hall residences. Formal learning spaces are defined as spaces '...provided for scheduled teaching and learning' (Middleton, 2018, p. 54) and typically comprise lecture theatres, seminar rooms and laboratories. The literary emphasis on formal spaces in this chapter is representative of the wider learning space design literature. Hodkinson and Hodkinson (2001) equate formal learning in the workplace to intended, planned activity and informal learning as that which is unintended and unplanned. La Valle and Blake (2001) bolster these notions with their distinction between taught formal and self-directed informal learning. It must be noted that whilst the terms formal and informal denote the degree of expectation and control over activity within a learning space, a space can never be entirely informal given it is always contrived and formal according to its design (De Certeau, 1984). Whilst the literature provides a number of other binary divides between local and remote learning, or synchronous and asynchronous learning (Fisher, 2010), the formal and informal terminology chosen here best simplify the variety of campus-based activities and transitions investigated in this study.

Deed and Alterator (2017) warn of a need to accelerate the possibilities of where, how and when learning takes place, given the shift toward student-centred pedagogy and personalised mobile technology. This shift is also reflected in work by Chism (2006) who challenged the following traditional assumptions about learning spaces (p. 7):

- Learning only happens in formal classrooms
- Learning only happens at fixed times
- Learning is an individual activity

The refutation of these traditional assumptions has led to greater attention being paid to the design, occupation and evaluation of informal spaces (Boys et al., 2014). A survey of over 1000 full-time undergraduate students by the HEDQF revealed the growing need to design a 'sticky campus' for retention of students beyond formal timetabled learning (HEDQF, 2019). A landmark report by Elkington and Bligh (2019) on their conspectus of the learning space literature stated that the sector-wide shift from 'instructor paradigm' to 'learner paradigm' are driving changes in space, and that a new taxonomy is needed to re-imagine the possibilities presented by technology. This conceptual recognition of informal independent and collaborative learning has led to architectural investment into 'learning centres' and 'learning commons' (Jamieson, 2009) which seek to be agile and collaborative for better connection and transition. Radcliffe et al. (2008) endorse the Next Generation Learning Spaces (NGLS) project which seeks to shift greater ownership of space to the learner.
The way informal and formal spaces are defined and conceptualised can be thought of in different ways. Hunt (1986) for example lists a series of factors that help to distinguish between formal and informal mentoring, including the degree of external control, the degree of planning, the level of intentionality and the degree to which participation is voluntary. The influence of educator-imposed activity, intent and degree of control on learning space link to a set of factors reflected by Basil Bernstein's (1924-2000) sociological theory of pedagogic discourse (Bernstein, 1990). He uses ideas like *classification* and *framing* as a way of thinking about the degree of control possessed by the teacher and/or student over the selection, sequencing, pacing and evaluation of the knowledge transmitted and received in the pedagogical relationship; it follows that in formal lecture settings, one would

expect a strong framing and in informal spaces, a weaker framing. In studying the diversity and inclusion agenda, Burke et al. (2016) reviews the suitability of pedagogic spaces for parity of participation, rightfully noting that aside from the diversity of background and social class between each student, the physical space available to each student is one of few commonalities. Space is therefore a fundamental starting point for understanding the development of learner and social identity and how students integrate their personal learning ecology into their tertiary education (Barnett and Jackson, 2019).

Scribner and Cole (1973) contrasted formal and informal learning by comparing schooled and non-schooled children, reinstating the importance of informal social learning in communities that more closely mimic the realms in which knowledge is applied. However, with a rapidly changing world, it could be argued that our conceptualisations of learning space need to remain sophisticated for informing better design and practice for learning. Imms and Byers (2017) address this need for sophistication by adding *third spaces* to formal (traditional classroom) and informal (transactional student-centred) spaces where social activities overlap informal and active learning activities. Savin-Baden (2007) presents her elaborated constellation of learning spaces as formal, bounded, social, silent, writing, dialogic, reflective and digital spaces (p. 12). Deleuze and Guattari (1988) presents a more binary typology, distinguishing between *smooth* and *striated* learning spaces. Striated spaces are characterised by their strong sense of authorship, boundedness and a clear expectation of where the learner should reach in space and time (resembling formal spaces). Smooth spaces are flexible, contested, defined by the creator of the space and result from a displacement in time and space from and within striated contexts, continually challenging the identity of the individual and resulting in disjunction. Deleuze and Guattari (1988) note in spite of this semantic separation, that striated and smooth spaces are not easily separable by boundaries, but rather pervade one another and often contain each other.

With education discourse permeated with spatial language (Sagan, 2011), it is arguably less important to dwell on semantics than it is to establish metaphors that allow learning spaces to be better imagined, such that their intrinsic nature and transitional potential can be harnessed. With the introduction of pedagogic models like the flipped classroom where there is a greater emphasis placed on the self-directed aspects of learning, and with the transference of formal course material to informal spaces (Burke and Fedorek, 2017), there is a growing need to understand the relationship, connection and transition between formal and informal space (Middleton, 2018). As Wright and Lawson (2005) note:

> '...bridging of in- and outside-class work encourages students to spend more time preparing for class, having conversations with team members outside of regular class time, and making more frequent connections between the sociological perspective and their personal lives' (p. 133).

This complexity of learning space has increased with the recent advent of the COVID-19 pandemic, where the majority of HE learning has been situated remotely in informal spaces like halls of residence or student homes (Symonds, 2020). Different countries have responded with innovative solutions to home-schooling necessitated by the pandemic, including China's cloud-based learning platform and Hong Kong's use of interactive apps (Tam and El-Azar, 2020). These circumstances are forcing us to examine the spaces and transitions between the formal and informal, and to an increasing extent the physical and virtual.

2.4.5 In-between, hidden and liminal space

Boys et al. (2014) remark that in-between space is of equal importance to formal and informal spaces, given the reality is often that informal encounters take place in formal spaces, and vice versa. This blurring of lines is echoed by Whitton (2018) who warns against the lack of nuance in 'formal versus informal learning', 'didactic teaching versus experiential

learning' and 'flexible versus prescribed curricula' (p. 7). Dewey (1986) coined *collateral learning* as the accidental learning that occurs inside and outside of the classroom and argued that the physical learning environment can be harnessed to influence this.

In-between space chimes with a separate body of literature around the *hidden curriculum*. Eisner (1985) prefers 'implicit' curriculum, describing it as the interstitial space influenced by artifacts, espoused values and underlying assumptions which lead to professional behaviours in different fields. These spaces are engaged with in corridors or lifts and are unencumbered by the formal rules of 'explicit' curricular spaces. Flinders et al. (1986) concluded that although these hidden curricula are omnipresent and cannot be defined precisely, they have a worthwhile application in the areas of curriculum design and practice. Hume and Coll (2010) for example analysed the mismatch between the experienced and intended school curriculum to understand how authentic scientific inquiry could be developed in classroom environments. This thesis explores these physical, social and cognitive in-between spaces as sites of transition which connect formal and informal spaces, meaning they are both signatures of and change agents for formal spaces and practices (Oblinger, 2006).

The hidden curriculum has been explored most commonly in health professional education, including by Hafferty and O'Donnell (2015) who refer to a Harvard study which recorded hundreds of hours of conversation in small-group classroom settings and on-call rooms in a general surgery programme. It was found that the professional and moral development of students occurred when faculty were absent and peer-influenced learning was able to unfold, unfettered by the formal classroom rules. Hafferty and O'Donnell (2015) propose the hidden curriculum as a third space that sits at the level of culture beyond formal and informal curriculum, stating that the artefacts and spatial configuration of an institution are a product of these hidden social and political forces (see Lefebvre and Nicholson-Smith (1991)). This enculturation of students into medical practitioners, according to Lempp and

Seale (2004), is driven by an avoidance of humiliation by other members of the medical community. Adkoli et al. (2011) built on this by warning that negative role models can perpetuate improper professional behaviour, and that a mismatch between planned and experienced curriculum led to student dissatisfaction. In response to this, Holmes et al. (2015) use transition between classroom curricula and clinical practice as a lens to consider how to mitigate the negative attitudes and behaviours of physicians, suggesting that priming and reflection can assist in the modification of one's professional behaviour. There may therefore be value in abstracting and making explicit these hidden curricular spaces.

Other conceptualisations of in-between space include 'liminal space'. Liminality describes a sense of in-betweenness and was first applied to rites and rituals in small human groups as a psychological state of being at the threshold of two existential planes (Van Gennep, 1960). In the context of learning, it is a cognitive in-between space that frequently arises internally due to a sense of lostness, often prompted externally by something that threatens the life world of the individual (Savin-Baden, 2008). Land et al. (2014) call these in-between positions *disjunctions*, which are encountered when an individual recognises that knowledge is troublesome and that a need for movement through a liminal tunnel is required. Given these disjunctions challenge previously held ideas and prompt misunderstanding, they can lead to transitions in learner subjectivity, ontology (identity shifts) and epistemology. Liminality has featured in a progressive ecological approach to learning, which encompasses contexts and opportunities for engaging with people or resources through the learning process (Jackson, 2013). With higher education itself arguably a liminal space, it seems important to create spaces in which intellectual risk is possible, especially now that the UK sector is accountable to the TEF (Savin-Baden, 2019). University education is arguably not just about transmitting knowledge - or acquisition (Sfard, 1998) - but a place in which liminality is raised for students to innovate and discover in response to real-world problems.

Movement through a liminal tunnel in response to disjunctive space is believed to be an important prompt for transitional and transformative learning (Fredholm et al., 2020). Mezirow (1985) perceived transformative learning in adults as a deep structural shift in the premise of thought, feeling and action from changes in an individual's frame of reference. This type of learning often results in seeing the world afresh and valuing the subsequent shift of disjunction (Kitchenham, 2008). Whilst the concepts of liminality, disjunction and transformative learning are well theorised, less attention has been paid to the physical spaces and conditions in which these states are best prompted and dealt with (Zimmerman, 2008). Savin-Baden (2019) presented her constellation of problem-based learning which seeks to promote *learning fluency*, defined as '...the ability to use learning media, of whatever sort, to manage knowledge and learning across diverse spaces' (p. 53). The notion that ignorance is not simply a neutral void (Eisner, 1985) underscores the importance of liminal space as a driver for learning and transition; this is revisited in section 3.4.1.

The influential work of Barnett (2009) has expanded thinking about in-between, hidden and liminal spaces to consider the epistemological and ontological properties of curricula spaces that encourage students to let learn via self-directed explorations. Barnett (2007) cautions that open-ended curricula pose greater risk on the part of the student due to greater responsibility and demand for self-organisation, which must be managed carefully by both students and teachers. Authors like Disch et al. (2000) share similar caution by defining 'use of time' and informal space as sources of unnecessary stress and predictors for student well being. With the implementation of flipped classroom approaches and the consequent growth of remote and self-directed learning, these risks increase significantly and force us to reflect on the factors shaping student transitions between directed and self-directed spaces. The development of ecological learning theory, including in recent progressive work by Barnett and Jackson (2019), has helped to unify much of this thinking.

2.5 Transition

Transition can be understood as:

> '...a process or period in which something (or someone) undergoes a change and passes from one state, stage, form or activity to another' (Perry and Allard, 2003, p. 75).

Like 'space', the term and concept 'transition' is fluid and able to conceptualise many of the tangible and intangible phenomena inherent to learning. Transition is often associated and used interchangeably with terms like 'change' and 'transformation', particularly in relation to organisational systems (Senge et al., 1994; Engeström, 2001). Transition implies an individual or group undergoing physical, cognitive or social movement from one state, space or activity to another, whereas transformation can be imagined as a deep structural shift in a person's identity or frame of reference (Mezirow, 1985). Savin-Baden (2008) attributes this individual transformation to our response to a sense of lostness, of disjunction (Land et al., 2014), often prompted externally by something that threatens the life world of the individual. Transformation and change are therefore distinguished from transition in this study.

Higher Education can be thought of as consisting of multiple, concurrent transitions that take place in context, as well as in interpersonal relationships (Jindal-Snape, 2009). It is a student's encounter with new knowledge that makes university a liminal space and which unseats their image of who they are. The presentation of literature into active learning and space in this review has positioned learning as taking place in the space in-between the internal and external, the taught and the learned, and has thereby been argued as a transitional, relational phenomenon (Sagan, 2011). This in-betweeness also chimes with cultural-historical activity theory and the idea that learning stems from the cultural mediation of actions via a triad of subject, object and mediating artefact (Engeström, 1987).

As Kegan et al. (2009) remind us: 'We now live in a global economy characterized by rapid change, accelerating scientific and technological breakthroughs, and an unprecedented level of competitiveness.' (p. 31). This is demanding a higher level of education, but perhaps more specifically, a need to navigate change and transition better than ever before. The recent COVID-19 pandemic has already forced a series of transitions from classroom to Zoom, physical to virtual, and in-person to remote (Mishra et al., 2020) which might persevere beyond the pandemic (Tam and El-Azar, 2020).

2.5.1 Models of transition

Much of the literature into educational transition has explored student movement and experience between primary, secondary, further and higher education, with much less focus on the finer-scale transitions that enable learning. Frost and Hoggett (2008) for example drew upon research into children transitioning from primary to secondary school, reporting loss of friends as the most feared scenario. Tudge et al. (2003) used Bronfenbrenner's bioecological model to understand preschooler transition to school by focusing on the relations between everyday activities of students and their teachers' perceptions of their competence. This literary focus on transitions between stages of education seems warranted given the need to minimise attrition rates and the negative emotions experienced by students as they adapt to the university environment (Perry and Allard, 2003). The sentiment of these studies is reviewed here because although they do not relate directly to the level of student transition explored in this study, they present useful ways of conceptualising transition.
Various models have theorised about the transition into and through university education. Bridges (2009) presented an adapted 'transitional model', intended for organisational change management, consisting of three overlapping stages: *ending, losing and letting go* is the first stage entered when presented with change, such as moving away from home, which leads to

fear, sadness and disorientation; the individual is then said to enter the *neutral transition zone* where they are still attached to their old situation and as such experience ongoing anxiety as they meet new people and encounter academic challenges; the *new beginning* phase results when the individual begins to embrace the change by building new skills and values that allow them to adapt to university learning. The 'V-curve theory of adjustment model' (Risquez et al., 2007) is also derived from organisational literature and again consists of three phases of transition: the *honeymoon* phase is often the shortest where students expect a life of opportunity for growth prior to entering university; a period of *culture shock* then follows along with feelings of disillusionment and anxiety linked to academic demands, homesickness and feelings of isolation; the final phase is the *adjustment* phase where students become more motivated and integrate themselves into the community.

Menzies and Baron (2014) present their 'Model of Student Adjustment' which consists of five phases: *Pre-departure*, *arrival*, *honeymoon*, *party's over* and *healthy adjustment*. Each phase has moods and feelings associated, for example happiness and excitement during the honeymoon phase, followed by confusion and isolation during the party's over phase. The principles common to all of these models of educational transition, whilst originally intended for longer-term transition, may share similarity with transitions operating on a shorter timescale in this thesis. It seems clear in all models that, depending on the individual and context, there are documented emotions, moods and affective behaviours in response to changing expectations and uncertainty. Having the opportunity and empowerment, through interaction and friendships, to socialise these internal states is important in supporting learning and well being (Disch et al., 2000). Beyond attending to the content dimension of learning and transition, these studies suggest that the incentive (affective) and social dimensions must also be explored (Illeris, 2002). To strengthen the notion that space and transition intimately affect well being, Muhammad et al. (2014) used focus groups to measure

Quality of College Life (QCL) (Sirgy et al., 2007) to demonstrate that space must sustain directed attention for learning, restore intellectual capacity and enable social interaction.

2.5.2 Transition as process

The way we think about transition is important for its effective study and manipulation in education. To refer back to the definition stated in section 2.5, transition is understood as a 'process' or period of change (Perry and Allard, 2003). Thinking about transition as a process firstly fits with one of the core theories adopted in this study, bioecological theory (see section 3.2), which defines *proximal processes* as the relationships and interactions that take place between an active, evolving human organism and the persons, objects and symbols in its immediate environment over time (Bronfenbrenner and Ceci, 1994; Bronfenbrenner and Morris, 2007). While change is something that happens to all people, we may not necessarily agree with it or be in full control of it. Rather, transition is better thought of as the internal and ongoing process in which we respond to and cope with changes in the environment; social, academic and interpersonal (Kegan et al., 2009).

Process in a social science context implies a dimension of temporality, for example the Marxist view of capital as a process. This reflects the complexity of learning as a process that not only cross-cuts space, but which operates across different temporal scales (Riley, 2007). Esposito et al. (2013) uses the concept of *chronotopes* to understand the transitions of doctoral researchers '...across shifting space/time configurations (affordances) arising from scholarly environments increasingly permeated by digital mediation' (p. 15). The intersection of space and time is inherent to both transition and the ecological approach (Luckin, 2008). These processes cross-cut the bounded transitional spaces in which they behaviourally emerge and are situated, linking to other microsystems via proximal processes (Bronfenbrenner, 1979). Pendleton-Jullian (2019) coins this *scalable learning*, which is learning that extends

beyond a particular instance of learning that has a defined space, knowledge boundary and content, to connect to multiple instances, scenarios and applications.

Understanding a singular transition in isolation, without cognisance of its preceding activity, overall intent or connectedness, seems unwise. Dewey (1966) notes in relation to human experience that 'Curiosity is not an accidental isolated possession; it is a necessary consequence of the fact that an experience is a moving, changing thing, involving all kinds of connections with other things' (p. 116). It is the connections with other things, the relational nature of experience, that prompt and enable transition (Massey, 2005). In their reference to an ecological conception of the university, Goodyear and Ellis (2019) note:

> '...learning activity needs to be understood as physically and socially *situated*; a better understanding is needed of relations between learning activities and the material qualities of tools and spaces that situate those activities' (p. 106).

It is not change as such that is difficult, but the psychological transition from old to new as people let go of an old state, traverse through the in-between zone and establish a new state (Bridges, 2009). The self is unfinished and malleable, leading to what Barnett (2009) refers to as *becoming*. It is often our acceptance or not of this becoming that influences who we become. Inherent to this idea is a belief that this changing of self and becoming is a co-creation of self via others; environment, relationship and culture (Winnicott, 1971). Transition suggests that we are continually remade through conscious and unconscious factors, and that the way we engage with power relations subsequently changes through time (Frost and Hoggett, 2008). Therefore, a human psychosocial being carries with them the question of 'Will I fit in here?' upon entering a new space in which they mirror and seek validation to self-regulate (Sagan, 2011, p. 72). This ties intimately to feelings of safety and belonging (Coyle, 2018; Ahn and Davis, 2020), to the idea of a liminal, transitioning identity (Field, 2012) and to the significance of establishing a space-for-being (Barnett, 2007).

2.5.3 Transition as space

It is in transitional space that '...aspects of the self are created and transformed in relationships with others and with the matrices of culture' (Sclater, 2003, p. 10). Therefore, transitional space does not belong to the internal world of the learner or external world of the environment, but is a hybrid in-between space that has potential for shorter and longer-term changing of each (Sagan, 2011). Learning space frameworks, such as in figure 2.1, attend to core learning spaces yet overlook the potential transitional spaces between each which mediate their connection. At one end of this spectrum, students have power and ownership to self-direct learning, while at the other they are 'shackled' by educator control; transitional space helps us to understand how each type of space can best be harnessed. Winnicott (1971) delivers a psychoanalytical perspective terming transitional objects and phenomena as the intermediate area of experience through which a child develops. In any stage of development, a third object or 'space' is required in which the processing of historical experience and learning can ensue. Winnicott refuted previous psychoanalytical theories, notably that of Freud and his emphasis on instinctual drives (Freud and Strachey, 1930), stressing instead the importance of one's relations with objects and culture (Praglin, 2006). Transitional spaces are therefore important social spaces underpinned by the fact that we come to know ourselves not in isolation, but in relation to others, and that making connections with others is important for managing longer-term transitions through education (Perry and Allard, 2003). Pedagogical spaces are one such social space which represent not only potential epistemological spaces, but ontological spaces in which authentic behaviour can develop as a student develops their own identity (Barnett, 2017). Sagan (2011) draws from this work into transitional phenomena to demonstrate the importance of *in-between* space as potential, not created, and for the opportunity to engage in original encounters in learning. Space is made through our interactions and is pervaded by different signs, symbols

and images which enable or occlude different ways of seeing and being (Sagan, 2011).

Transitional space has also been explored in the architectural literature, given these physical spaces are thought to constitute around 25% of a building, sometimes up to 45% in buildings with large atria (Pitts et al., 2008). Nassar and Hosam (2014) state that beyond acting as important circulatory routes for a building, transition spaces process change from one condition to another and act as '...both buffer space and physical link' (p. 3). Von Meiss (2013) explains that each space has an interior and exterior, and it is the limit between each that provides both separation and connection; these spaces become places themselves and it is the 'Steps, porches, eaves, gates, doors, balconies, windows' that control the permeability of the limit (p. 215). Pitts (2013) divides transition spaces into areas with strong connections to the exterior (such as entrances), interior circulation spaces with greater separation from the exterior, and semi-occupied spaces in which secondary dwelling time is assumed to be longer. Studies like Srivastava (2007) posit that transition through space causes changes in mood, mental state, sensory experience and even personality. Architectural work into 'blurring' has explored how the in-between can blur transfer from the old to the new and lead to an experiential transformation (Benjamin and Architects, 2003). Space is therefore the initiating condition for experience and transition through it becomes an experience and space in and of itself.

Only a handful of works have explored the relationship between physical transitional spaces and their influence on learning behaviours. Nassar and Hosam (2014) studied transition spaces as elastic environments in which students can gather and interact with other students and professors, seeking to help designers make better use of these behaviour settings. They usefully distinguish between *independent* utilisation of transition spaces as activity related to the space itself and its elements, including for example studying at tables within the space, and *dependent* utilisation as related indirectly to the transition space, instead relating to

surrounding functions such as accessing and exiting surrounding lecture halls. The short dwelling periods in these spaces is what makes them elastic and which gives both user and designer freedom of expression within them (Benjamin and Architects, 2003). Ramu et al. (2018) treated transitional spaces as informal academic learning spaces, categorising standing patterns of dependent and independent utilisation behaviour within transitions between two destinations. Popenici and Brew (2013) argue that transitional spaces (like corridors) are marginal spaces which offer a unique window into organisational culture, given students are uninhibited, and the real codes of social behaviour influencing student sense of belonging and engagement can be deciphered.

Some works have thereby suggested that converting these in-between spaces into student-owned classrooms not merely for passage of time from class to class, but where people meet for discussion and connection, can increase the possibility for learning (Merrill, 2010). Hurdley (2010) carried out an ethnographic study of university corridors to defend their importance for openness, innovation and a site of informal exchange that can threaten conventional spaces and practices (Michelson and Mouly, 2000). This is by no means a novel idea, given the aforementioned heteroptopic space (Foucault, 1984), smooth space (Deleuze and Guattari, 1988), non-place (Augé, 1995), disjunctive space and liminal space (Savin-Baden, 2008) which all carry elements of in-between fluidity. These contested spaces defy institutionally allocated space, such as formal learning space, and once sequestrated into allocation, lose their intrinsic value and nature (Bell, 1995). To predict the use of these transitional spaces, one must firstly be aware of the planned formal curricular activity imposed by timetables, which organise bodies in space with attached expectations (O'Brien et al., 2017). The self-directed usage of informal space is less predictable, however, calling for a greater reliance on user data and 'smart tools' to prevent spaces being reserved but not used. Making university campuses data-driven, 'smarter' and more amenable to transition is

not only important for pragmatic and economic reasons, but also for environmental reasons, given buildings account for a significant amount of our energy consumption as a society: 35-40% of CO_2 emissions (Valks et al., 2018).

The inexorable transition in higher education toward less physical contact and greater virtual contact is believed to deprive students of places they can call their own, deeply affecting the availability and quality of transitional space for learning (Hurdley, 2010). This ironically calls for an even greater understanding of these physical transitional spaces as we traverse between remote and in-person learning (Sagan, 2011).

2.5.4 Ecotones and boundary spaces

Pendleton-Jullian (2019) is an architect and educator who defines *ecotones* as ecological zones '...where two distinct ecosystems overlap or grade into one another' (p. 112). The word etymologically derives from two Greek terms, eco from *oikos* which means house, and tone from *tonos* which means tension, together meaning ecologies in tension. In addition to marking a mere zone of transition where one set of environmental conditions merges into another, like estuaries in the natural world, ecotones are themselves distinct entities that represent zones of change, disturbance and conflict. To elaborate the estuary metaphor, the ecotone results from the mixing of saline and freshwater conditions which supports an abundance of diverse species, some that can only thrive in the ecotone. The estuarine inter-tidal zone is constantly in tension given the dominant tidal force is constantly changing direction. The estuary might be argued as increasingly analogous to the HE learning environment, where students (species) become more diverse and thrive most in the ecotone between traditionally conceived ecosystems like physical lectures and virtual learning spaces. Given ecotones are less constrained by the inertia of core activity within their adjoining ecosystems, they represent unique and authentic sites of transition, discovery and innovation.

Based on the integration of literature in this review, ecotones have been identified as a potentially useful metaphor for transitional spaces, because their in-betweenness can lead to new situations for which no code of conduct has been passed down and preserved by tradition (Luttmann, 2008).

Understanding learning at the edges where there is productive friction and possibility to discover things before others do provides impetus for research into ecotones (Hagel et al., 2005). Given space acts as both a construct and reproducer of social relations and power structures (Lefebvre and Nicholson-Smith, 1991), and in a sense is a crystallisation of time (Castells, 1996), it is something constantly changing and thereby heavily affected by activity at its edges. This is why Sennett (2018) argues for incomplete form in buildings such that they are not over-determined and able to be altered flexibly over time. Pendleton-Jullian (2019) applies the concepts of ecotones, elasticity and agency to designing environments of innovation. In these interstitial spaces, disturbance can provide conditions which promote evolution and a greater diversity of species. These disturbances can help students to develop new capacities and behaviours that are adaptable to change promised in the 21st century. Students are therefore the species of evolutionary novelty who gain advantage when operating at the edge of spaces, processes and disciplines where there are richer flows of knowledge than those at the core, which are more institutionally allocated and protected (Bell, 1995).

Epstein (2019) has written about the unlocked potential of generalism, stating that it is ironic that research grants continue to be awarded to highly specialised proposals when it seems clear that '...progress is made at the interface', when individuals and teams step away from their core specialism and work across disciplines (p. 279). Other research has shown that organisations which have porous boundaries between teams have the most success when solving '...wicked scientific problems from sequencing the human genome to curing cancer' (Contractor, 2013, p. 1). Il'enkov (1977) recognised the existence of internal contradictions

within and between activity systems, defining them as powerful driving forces of change and development and a key aspect of cultural-historical activity theory. The third generation of activity theory was adapted to incorporate the idea of interacting activity systems and shared objects, which is akin here to the notion that two systems depend upon and sustain each other via the connecting ecotones and boundaries that separate them (Engeström, 2001; Bligh and Flood, 2017).

In the spirit of ecological thinking, ecotones seem to represent transitional spaces in which important negotiation, disturbance and innovation take place at the edges. Ecotones may provide a more sophisticated metaphor which reconciles the distinction made between transition as space and process, and which captures the increasing complexity and nuance of learning spaces in tension; this discussion emerges later in the thesis.

2.5.5 Thinking ecologically

Space and transition are two key concepts that I have explained my understanding of in this review. To connect these concepts, I adopt an ecological approach. The word *ecology* is defined as '...the whole science of the relations of the organism to the environment' (Stauffer, 1957, p. 140). Thinking about learning as an ecological phenomenon embodies contemporary notions of life and growth, of connectivity and relationships, of evolution and resilience and of interdependence to achieve what individual parts cannot achieve alone (Brown, 2000).

The ecological approach is also underpinned by systems thinking, which emerged in the twentieth century as a critique of the reductionist belief that phenomena can be understood by breaking them down into their constituent parts. A key part of the systems idea is that the whole is better understood in holistic terms as emerging from the sum of its interrelated parts (Von Bertalanffy, 1956). Systems thinking has been popularised in a number disciplines including systems dynamics (Forrester, 1971), socioeconomic systems (Senge et al., 1994)

and sociocultural systems (Engeström, 2001). Ecological thinking may encourage us to conceptualise the international HE sector as an increasingly complex ecosystem, within which each individual possesses a personal learning ecology, based on his or her life circumstance, hopes and ambitions. Nonetheless, individuals posses agency (Elgin, 2013) and an ability to significantly orchestrate learning ecologies for themselves. Humans might best be thought of as agents who not only affect their environment at unprecedented scales and rates, but who are part of the contiguous matter of these larger material systems (Pendleton-Jullian, 2019). My adoption of Bronfenbrenner's ecological systems model (Bronfenbrenner, 1979) (introduced in section 3.2) fits well with my study of previous and present learning spaces that co-enable learning inside and outside of the traditionally learning-centred, time-bound formal setting. By imagining learning spaces as nested within larger systems, this bioecological thinking perceives the learning environment not only as the immediate environments we sense and perceive, but the fertile cognitive environments that are producible in our minds (Barnett and Jackson, 2019). These systems by definition are bounded by space and time and defined according to their structure and purpose. Bioecological theory usefully encourages attention to the transitions and connections between these systems which are connected in the *mesosystem* and which operate across different timescales in the *chronosystem* (Bronfenbrenner, 2001).

Ecological thinking has featured centrally in recent work by Barnett (2017). Barnett and Jackson (2019) note in a more recent book, *Ecologies for Learning and Practice*, that it should be of interest to actively connect formal educational settings to other environments (like the informal) so that the rich funds of knowledge can be accessed. This highlights the increasingly invalid distinction made between formal and informal learning space in section 2.4.4, given students now have more agency to increase their own learning complexity. Through in-between space, '...scrutinising the intersections and boundaries of practice and

learning, ideas about learning and space become richer', such that 'Learning is experienced ecologically and dynamically' (Middleton, 2018, p. 4). These in-between spaces have been conceptualised as ecotones in section 2.5.4 which interestingly capture not only the transition, but the blend and tension within a separate boundary space (Pendleton-Jullian, 2019). Rather than thinking about the learning environment as 'saline' or 'fresh' water, it might be increasingly appropriate to conceptualise it as an estuarine ecotone which blends these ecosystems to support a more diverse range of species (students).

Ecological thinking encourages us to reflect on an important question posed by Barnett and Jackson (2019) and addressed in this thesis: 'How do we prepare people not just to sustain themselves through a long and complex lifetime of learning, but also to play a conscious and active role in sustaining the future world?' (p. 6).

2.6 Chapter synopsis

This chapter has reviewed the literature around learning space, active learning and transition which are all key concepts in this study. Whilst there are overlapping bodies of literature that deal with space and learning activity, there is a paucity of literature that explores the role of space in supporting shorter and longer-term transitions necessary for active learning. I have therefore located literature that explores these areas independently and have attempted to draw links between each to foreground the thesis. I recognise ecological thinking as a potential way of linking these areas and concepts. In chapter 3 I introduce my construction of a theoretical framework and many of the key theoretical concepts adopted in the thesis.

Chapter 3

Constructing a theoretical framework

3.1 Introduction

This chapter explores my construction of a theoretical framework. I begin by introducing Bronfenbrenner's bioecological theory which has allowed me to focus on the individual student within nested systems that influence how they behave and transition. I have then introduced supporting theories which serve the needs of my research questions by helping me to understand the *drivers* for, *mechanisms* for, *influences* on and *products* of transition. Beyond my introduction of bioecological theory, the remainder of the chapter is structured according to these transition elements and the theories relevant to each. This chapter then culminates into section 3.8 which presents my integration of theories and adaptation of the bioecological model, which is revisited in chapters 5, 6, 7 and 8.

My review of the literature in chapter 2 introduced relevant definitions of 'space' and 'transition'. It also highlighted the lack of empirically-grounded frameworks that deal with interacting systems of transition in learning behaviour (micro), space design (exo) and strategy (macro). Given social science is fallible and context-dependent, my 'pragmatic' approach to drawing from a number of theories to construct a framework is justifiable

(Ormerod, 2006, p. 905). Furthermore, operating in a multi-field of research has meant me using theories which span different disciplines and sub-disciplines, including for example sociology, geography and ecology (Punch, 2013). In selecting and employing the most appropriate theories, I have remained transparent in this chapter and throughout the thesis about what I deem to be shortcomings of or deviations from aspects of each theory. My reading and thinking about different theories has helped to advance my evolving positionality and ontology to ultimately answer the research questions. Furthermore, my adaptation and synthesis of original theoretical frameworks have potential theoretical and practical value, especially as this area of research potentially grows.

However, this thesis has not intended on generating new theory, given I primarily used theory to '...understand the subjective world of the human experience' (Cohen et al., 2013, p. 21). It then became clear that transition was a foundational concept and that I needed a way to move between multiple systems within a multi-field of research. This led me to begin visualising both the phenomena I observed and the theories I selected as parts of an interconnected ecosystem with complex interactions and relationships between different components. My introduction of ecological systems thinking in section 2.5.5 underpins this framing and has helped me to draw relationships to inform a critical perspective (Madden, 2017). What is encountered in this study is subjective data, and the interpretation of that data by an individual researcher who has socially constructed a rich picture of interrelated systems of transition within the institution.

3.2 Bioecological theory

The social ecologist and psychologist Urie Bronfenbrenner (1917-2005) theorised about human development and advanced his ecological to bioecological theory right up until his passing (Tudge et al., 2009; Rosa and Tudge, 2013). Bioecological thinking usefully demands

attention not only to the immediate environment, but to other related environments which comprise different systems in relation to the individual. It shares similarity with theories like sociocultural theory (Vygotsky, 1980) which also treat the social environment and culture as instrumental in human development and learning. One strength of bioecological theory is its interdisciplinary, operational nature, given it is particularly conducive to the integration of other psychological theories and theoretical perspectives (Lumsden, 2012).

A core part of Bronfenbrenner's mission was to better understand child development. This seemed to stem from his recognition of an excessive developmental research focus on the organism (person), with less attention paid to what was previously treated as a 'static' environment devoid of any values (Bronfenbrenner, 1977, 1979). The ethos of this theory is underpinned by a belief that all individual's should possess what has been recently termed a *growth mindset* (Dweck, 2008). This recent conception follows the work of Alfred Binet (1857-1911), the founder of the IQ test, who asserted that we must protest against the contemporary belief that intelligence is a fixed quantity. Through practice, training and the educational method, in conjunction with a growth mindset, we can increase our attention, memory, judgement and become more intelligent than we were before. This implies that the disposition of an individual together with their environment will dictate the transitions they undergo in their learning. This person-environment relationship also underscores one of Bronfenbrenner's earlier hypotheses: budge one and see what happens to the other. The strategically-driven refurbishment of learning space in this study has provided opportunity to empirically test this relationship and hypothesis.

Bronfenbrenner's theory underwent several phases of evolution during his lifetime: phase 1 culminated into *The Ecology of Human Development* (Bronfenbrenner, 1979), after which phase 2 (1980-1993) began to valorize the role of the individual and developmental processes, until the final phase 3 (1993-2006) where proximal processes were defined and

the Process-Person-Context-Time (PPCT) model rose to prominence (Rosa and Tudge, 2013). Whilst all of these phases formed into what is now coined 'bioecological theory', I have mostly drawn from the structure of the original ecological systems model (see later figure 3.1) and the core tenets of the PPCT model. These aspects of the theory fit well with my thinking about learning outside of the traditionally learning-centred, time-bound formal setting. They have allowed me to recognise previous and present learning spaces that co-enable learning and transition across different timescales and system scales.

3.2.1 Ecological systems model

Kurt Lewin's formula, which is that behaviour (B) is a joint function of person (P) and environment (E), is written as:

$$B = f(PE)$$

was adapted by Bronfenbrenner and Morris (1998) to development (D) being a joint function of person (P) and environment (E):

$$D = f(PE)$$

Whilst Bronfenbrenner focuses on development, my focus in this study on behaviour and transition are equally fitting given these formulae. The real strength of bioecological theory is that the relative influence of ideologies, beliefs and sociocultural histories at different levels of the system can be linked to an individual's development and transition in learning (Bronfenbrenner and Morris, 2007). To structure this, Bronfenbrenner (1979) divided the person's environment into five different systems that form a nested arrangement of structures: the *microsystem*, the *mesosystem*, the *exosystem*, the *macrosystem*, and the *chronosystem*. This ecological system model was Bronfenbrenner's attempt to understand the impact of a layered environment on the development of the child, later coined and referred

to as bioecological theory (Bronfenbrenner and Ceci, 1994). This nested system culminated into a diagram model which has been simplified in figure 3.1; note the chronosystem has been incorporated atypically as a cylinder.

This joint influence of proximal environmental and organismic influences on the processes that lead to transition are '...within the person, or from physical features, objects, and persons in the immediate face-to-face setting' (Bronfenbrenner, 1988, p. 32). Although longer-term development of the individual has not been a key focus in this thesis, I have sought to understand transition at different levels of the system. Some of these transitions are close to the individual, operate across seconds and minutes within the classroom and feed back into the wider system. Other transitions explored are harder to frame at the individual level and are institutionally strategic operating across months and years. Fundamentally, the nested levels in the original systems model introduced in figure 3.1 has enabled me to direct my attention to transitions within systems functioning on different spatial and temporal scales. I now introduce the different components of the ecological systems model and provide examples that are linked to the context of this study.

Microsystem

> 'The ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by relations between these settings, and by the larger contexts within which the settings are embedded' (Bronfenbrenner, 1979, p. 21).

The microsystem is the immediate setting occupied by the individual, including home and places of learning like the classroom that have direct contact with the individual

(Bronfenbrenner, 1977). Bioecological theory suggests that the individual plays different roles (student, teacher, mentor) based on the expectation of these different settings and spaces. Although this study has not focused heavily on the role of home and other distal informal spaces like halls of residence, it remains cognisant of these settings in influencing the formation of the individual's personal learning ecology (Barnett and Jackson, 2019). Bronfenbrenner (1979) concluded that '...further advance in the scientific understanding of the basic intrapsychic and interpersonal processes of human development requires their investigation in [the] actual environment, both immediate and remote, in which the human beings live' (p. 12). The microsystem is the level at which the individual's interaction with others and their environment is observable and considered; that is to say that this learning and transition occur *in-situ* (see section 3.5.1).

The individual's repeated interactions with animate and inanimate actors leads to formation of relationships in the microsystem. These interactions are deemed to be bi-directional (Bronfenbrenner, 1979), given the individual is affected by people and artefacts with whom they interact, and in turn these people and artefacts are affected by the individual. Hence a core assumption based on bioecological theory is that through bi-directional interaction in the microsystem, not only can an individual's actions shape their own transition in learning, but these actions feed into processes which influence other people and activities. Understanding how these transitions in the microsystem are affected by and influence transitions in the macrosystem (the level of culture and strategy) has been important for answering the second research question in particular.

Mesosystem

The mesosystem arises from interactions and interconnections between the individual's microsystems i.e. connections between two or more settings in which the individual is an

active participant (Bronfenbrenner, 1979). The mesosystem essentially views microsystems not as functioning independently, but as interconnected and asserting influence on one another. Connection between formal learning activity in a classroom microsystem and group work assignment in a library microsystem, in which concepts from one module are applied in another, would be an example of this connection in the mesosystem.

For a mesosystem network to result, the developing individual is required to enter a new setting and to undergo an *ecological transition* from one setting to another (Bronfenbrenner, 1979). 'An ecological transition occurs whenever a person's position in the ecological environment is altered as a result of a change in role, setting, or both' (Bronfenbrenner, 1979, p. 26). These transitions were emphasised in Bronfenbrenner's earlier work and although they disappeared in his later writings, they are important in this study. These transitions are believed to implicate transitions in power conditions and despite their positioning in the mesosystem, they are thought to occur at all levels of the system. They can therefore be treated as both a consequence and instigator of developmental processes (Bronfenbrenner, 1979). Ultimately, the strength of the connection and transition between two microsystems in the mesosystem determines the nature of development and learning.

Exosystem

The exosystem encompasses social structures which do not themselves contain the individual, but which indirectly influence the microsystems and therefore the individual (Bronfenbrenner, 1977). An example of a setting which the student would not directly interact with, but which influences their learning experience, would be a departmental teaching committee which shapes the perception and practice of a lecturer that later teaches the student. This partly justifies my decision to interview lecturer participants who enabled me to understand the pedagogic and curricular intent of their observed modules such that I

was aware of these exosystem influences on student behaviour.

Other institutional committees shape factors like the design of curriculum, programme specifications, timetables and space, which all influence the expectation of learning activity and therefore how a student transitions. My attendance at the design board meetings for redesigning the lecture theatre provided me with similar exosystem insight. Including a system within which influences like curriculum, space redesign and pedagogic transformation can be positioned is important given the research context and aims of the study to understand different levels of transition required for active learning.

Macrosystem

The macrosystem deals with the level of culture and '...patterns of ideology and organization of the social institutions common to a particular culture or subculture' (Bronfenbrenner, 1979, p. 7). Given it is the outermost layer of the model in figure 3.1, it is the system that envelops all other systems, influencing (and being influenced by) each of them. A recent example of a change in the macrosystem that has drastically affected learning and education is the advent of the COVID-19 pandemic and the resulting restriction imposed on physical on-campus interaction.

According to this model, the culture that individuals are immersed in at the level of the macrosystem will influence their beliefs and perceptions about activity which they directly interact with in the microsystem. The ideologies, values and norms set within the macrosystem between different institutions and societies is more variable than the other system levels (Bronfenbrenner, 2001).

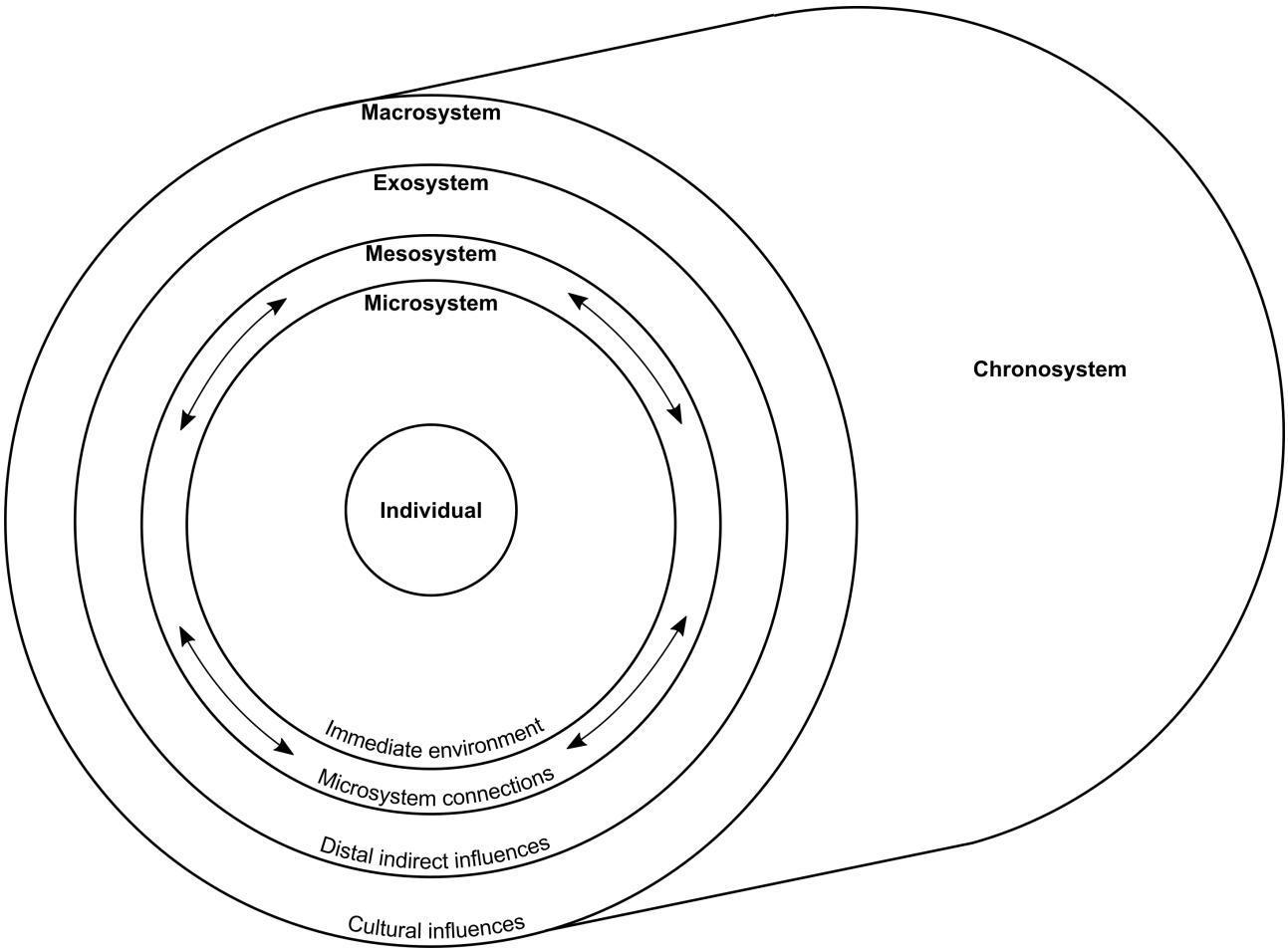


Figure 3.1: Ecological systems model adapted from O'Toole et al. (2019) (p. 22)

3.2.2 Person-Process-Context-Time (PPCT) model

Bronfenbrenner's revised bioecological theory amounted to the process-person-context-time (PPCT) model (Bronfenbrenner and Morris, 2007). This model presents the idea that an individual's development is a function of the dynamic relationships between the developing *person*, immediate and more remote environmental *contexts*, and the *time* periods in which the proximal *processes* take place (Bronfenbrenner and Morris, 2007).

Proximal processes

Bioecological theory suggests that good educational spaces provide diverse, respectful environments in which all learner's funds of knowledge can unfold, be shared and grown. Such education is reliant upon what Bronfenbrenner defined in the 1990s as *proximal*

processes (Bronfenbrenner and Ceci, 1994; Bronfenbrenner and Morris, 1998). These are the relationships and interactions that take place between an active, evolving human organism and the persons, objects and symbols in their immediate environment over time. Proximal processes are deemed to be the engines of development and are most influential when they are lasting forms of interaction that occur relatively often over extended time periods (Bronfenbrenner, 2001).

Proximal processes are also a mechanism for transformative education, given they can assist students in challenging the reproductive nature of static systems if educators are able to furnish the environment to cultivate positive and supportive relationships with learners (Hayes et al., 2017). The right environmental conditions can therefore empower students as important change agents in their own and others education, including through partnership and participatory design (Casanova et al., 2018).

Person characteristics

Resource characteristics are emotional and mental resources, such as personal experiences and skills, that influence an individual's ability to engage effectively with proximal processes (Bronfenbrenner, 1988; Bronfenbrenner and Morris, 2007). In earlier writings (Bronfenbrenner and Ceci, 1994) *demand characteristics* were coined to describe the influence of factors such as age, gender and physical appearance on the individual's development. In later work, *force characteristics* were introduced to encompass factors like the motivation, persistence and temperament which determine an individual's desire to change themselves or their environment. Tudge et al. (2009) in their paper about the uses and misuses of bioecological theory suggest that a richer research design examines the influence of resource and/or force characteristics, with less focus on demand characteristics; I conform to this emphasis in this thesis.

In response to a discourse that has sought to improve the 'learning power' of students (Claxton et al., 2011), these characteristics have been further divided into *capabilities* and *dispositions*, and are subject to development through proximal processes as the individual internalises external experiences in different contexts (Barnett and Jackson, 2019). Disposition is defined as the 'sum of all innate tendencies or propensities' (English and English, 1958, p. 158). Dispositions are divided into *generative*, inviting positive responses from others and thereby supporting the development of future generative dispositions, or *disruptive*, inviting impatient, aggressive or other negative responses from others that lead to the exacerbation of disruptive tendencies (Bronfenbrenner, 1988). Generative force characteristics include curiosity and readiness to actively engage with others, and will sustain proximal processes, whereas disruptive characteristics will impede these developmental processes (Bronfenbrenner and Morris, 2007). A number of other disciplinary perspectives honour the individuality and difference between human beings. Savin-Baden (2007), for example, similarly defines *learning stances* as our unconscious beliefs, prior experiences and perceptions that shape one's attitude and disposition toward a person or context in that point in time.

Fostering generative dispositions in students seems to be a necessary starting point for a wider transition to active learning behaviour. It is reassuring therefore that an individual's preexisting resource characteristics are subject to change during learning as a result of proximal processes and transitions. A practical example of this may be when a student changes their perception of knowledge as something defined by the teacher, toward something contestable in research or problem-based settings. The PPCT model's consideration of the 'person' and their characteristics in their behaviour and development is meritorious. However, there are other schools of thought which provide alternative explanations for human behaviour, including by the psychoanalysts (Freud and Strachey, 1930) who refer

to *drives* as instinctual needs. Early attachment theorists like Terry (1991) distinguish personal and environmental resources, noting that in every coping process, an individual undergoes a primary appraisal where they judge the irrelevance or perceived stress of an event, followed by a secondary appraisal in which he or she assesses coping resources and options (Alexander et al., 2001). Social psychologists like Thibaut (2017) treat social behaviour as highly selective according to costs and rewards. Regardless, attending to the capabilities and disposition of an individual is a useful way of attributing their influence on proximal processes and transition.

Context

Developmental processes vary according to the immediate and remote contexts that the individual is subject to. In the PPCT model, context involves the four interrelated systems of microsystem, mesosystem, exosystem and macrosystem previously introduced. Context is therefore central to the bioecological model and is emphasised by other theorists like Dewey who refers to *situation* as the contextual whole that spans across wide spaces and long periods of time (Brown et al., 2015). Context is more than just the concentric circles surrounding the individual in figure 3.1. It is also the the role played in enabling development via proximal processes and identifying aspects of the environment that are more favourable for development and transition (Bronfenbrenner, 1988). For context to be properly considered in empirical studies that investigate the development of an individual, at least two microsystems with which an individual is an active participant should be studied (Tudge et al., 2009). In this study, I repeatedly observed learning activity in and transitions between formal and informal learning spaces, treating each space as a separate microsystem bounded by space and time.

Time and the chronosystem

As befits any theory of human development, time plays a crucial role in bioecological theory. The final aspect of the PPCT model is therefore time, which was built in as the *chronosystem* into the earlier ecological systems model (Bronfenbrenner, 1979) in figure 3.1. This chronosystem encapsulates the individual's development as shaped by conditions and events occurring in the ontogenetic and historical period through which a person lives. In the latter iteration of the PPCT theory, Bronfenbrenner (1988) divided time into *micro-time* (what is taking place during the course of a particular activity or episode of proximal processes i.e. across seconds to hours), *meso-time* (the extent to which activity takes place within the person's immediate environment i.e. across hours to days) and macro-time (akin to the chronosystem with transitions in wider culture affected by historic, present and future activity i.e. across days to years) (Tudge et al., 2009). These systems of time have been equally useful to consider as systems of space for understanding transition.

A body of literature focusing on the significance of time as an enabling dimension of different levels of space and development supports this chronosystem thinking (Merriam, 1999; Riley, 2007). Esposito et al. (2013) note the importance of the institutional and personal spaces, and the formal and informal spaces that provide a dialogue of tension and interdependence for doctoral researchers; their use of *chronotopes* helps to explain how self-directed students shift across space/time affordances and interweave the past-present-future as part of their identity trajectory as PhD students. Pendleton-Jullian (2019) in their chapter about ecotones defines *scalable learning*, which is learning that extends beyond a particular instance of learning that has a defined space, knowledge boundary and content, to connect to multiple instances, scenarios and applications. This cognitive transition between historical and present microsystems is usefully captured by the chronosystem aspect of the bioecological model.

3.2.3 Bioecological shortcomings

Bioecological theory was intended for understanding child development and has been used mostly in contemporary family and developmental empirical studies (Riggins-Caspers et al., 2003; Tudge et al., 2003). Its use in this study is a deviation from its conventional adoption, for it has been integrated with socio-spatial theories to provide a way of understanding the microsystems available to the individual student in their learning. It also overlooks the increasing role of the virtual world. With these shortcomings in mind, there has been documentation of studies that misuse bioecological theory by Tudge et al. (2009), who note that proximal processes and the modification of these by the individual engaged in them, should be central to any adoption of the maturer bioecological theory; the author also advocates for a closer connection between theory, methods and analytic strategy if a study seeks to be rigorous. These proximal processes have been treated as transitions and interactions required for learning in this study and as vehicles that influence ecological factors (the individual and their physical and social environment).

To elucidate this trade-off, the founder of the humanistic psychological approach, Rogers (1951), highlighted the power of healthy relationships and human agency in directing an individual's life in both therapeutic and educational settings. Such thinking made contributions to the 'student-centred learning' approach which was founded upon the thinking of Vygotsky (1980) and Dewey (1966). Centring on the individual as a more powerful agent and independent actor than is assumed by bioecological theory could therefore be important. The following quote helps to encapsulate this:

> 'The individual needs to be seen as a complete human being. Only then, it is possible to take his or her potential, including the affective one, into consideration in a serious way. Only then, individual and collective actions can be really understood' (Johannisson, 1987, p. 10).

Paying attention not only to cognitive functions but to the affective dimension of learning and transition is also important. After all, humans are largely motivated by emotion and according to the neuroscientific perspective of Damasio (2019), emotions and feelings dictate the homeostatic mechanisms that regulate decision making, culture formation and social cognition. All of these underpin human survival and flourishing. Emotion is inherent to the difficult experience of transition, and serves to orient students to behave and interact in ways that cope with the liminality and associated emotion. The endurance of these emotions, for example in the face of uncertainty, also requires an individual to be resilient which in turn influences the resilience of social–ecological systems (Krasny et al., 2010). With the exception of Bronfenbrenner's resource and force characteristics, bioecological theory risks overlooking the development of an individual's resilience to deal with the affective dimension of development and transition.

In addition to considering the role of individual disposition and agency in how they transition, the PPCT model seems to overlook hidden political forces in microsystems which are believed to cause momentary changes in how an individual will engage with proximal processes (Foucault, 1992). These transitions in power and control mean space is inherently social and political (Lefebvre and Nicholson-Smith, 1991) and reproduce expectations that shape an individual's behaviour, and therefore development. Whilst bioecological theory compensates for the lack of emphasis on the 'person' rife in other developmental theories, it provides less explanatory power for these hidden political forces. It is arguably less apt at recognising the relative magnitude of influence of different systems on the individual's development based on their sociopolitical climate. Furthermore, with the exception of proximal processes, there is little mention of the role of in-between spaces which provide a more 'democratic' political space for transition between microsystems. I seek to address these shortcomings by using theories introduced in the following sections.

3.3 Understanding transition

I have used bioecological theory as a core theory to focus on the individual student within nested systems. In constructing a theoretical framework, I developed table 3.1 which situates key aspects of Bronfenbrenner's theory and additional theories according to their purpose in understanding transition. This table structures the remainder of this chapter and helps to link these key theories to the drivers of, mechanisms of, influences on and products of transition as a foundational concept in this study. To address the criticisms made by Tudge et al. (2009) about other studies that misuse bioecological theory, I have pragmatically used these various theories to aid interpretation and do not claim that these pre-existing theories apply in a predictive way.

Table 3.1: Key theoretical concepts and their purpose for understanding transition

Purpose	**Theoretical concept**
Drivers for transition	Disjunction/liminality (Savin-Baden, 2008)
Mechanisms for transition	Proximal processes (Bronfenbrenner and Ceci, 1994) Referencing (Nicol, 2019)
Influences on transition	Ecological systems model (Bronfenbrenner, 1979) CHAT (Engeström, 1987) Person characteristics (Bronfenbrenner, 1988) Power-geometry (Massey, 2007)
Products of transition	Ecological learning (Bronfenbrenner, 1979) Spatial triad (Lefebvre and Nicholson-Smith, 1991)

3.4 Drivers for transition

3.4.1 Liminality

One of the starting assumptions in this study is that for an individual to engage in any level of transition, they must have reason to do so at a conscious or unconscious level. In the context of this study, these reasons and drivers for transition are manifold, including reasons very personal and internal to the learner, as well as reasons that conform to external social

expectation. One of the key reasons for transitions in learning is believed to be linked to the need for students to overcome internal liminal states that according to work by Savin-Baden (2008), are prompted in response to disjunction (Land et al., 2014). Learners inevitably encounter troublesome knowledge and disjunctions in their learning, which challenge previously held ideas and their life world (Savin-Baden, 2008). Students respond to this disjunction, often by creating a liminal space which enables transitions in learner subjectivity, ontology and epistemology, all of which amount to eventual transitions in identity.

The notion that transition begins with a disjunction and subsequently a liminal space is inherent to the Oxford dictionary definition of *liminal* as '...relating to a transitional or initial stage of a process'. Liminality therefore provides us with a concept to imagine an in-between space of stuckness, misunderstanding and a '...realm of pure possibility whence novel configurations of ideas and relations may arise' (Turner, 1998, p. 97). Whilst liminality and transition both assume a given endpoint, such as a fresh understanding or a new identity (Field, 2012), the path of learning is never a linear transition from one state to another, but as what Cook-Sather et al. (2014) describe as an:

> '...unending process of dialogue and development in multiple indeterminate states, suspended between and among established institutional roles and mindsets, always unfinished, always requiring revisiting, revisioning, and re-enacting' (p. 51).

In her thinking about transition and transformation, Savin-Baden (2019) presents her *rhizomatic tunnel* as a metaphor that better describes learning than a linear, unidirectional transition. This tunnel metaphor is good at capturing the complexity of transition through a liminal space and is why I use liminality as a concept to explain how students inevitably encounter and deal with troublesome knowledge and disjunction in their learning. The transitions in understanding and identity which result from a generative response

to liminality are both conscious, including what the sociocultural theorists refer to as goal-directed activity (Postholm, 2008), and unconscious. My observation of learning behaviour and exploration of student perception in interviews led me to primarily investigate conscious drivers for transition, including how these relate to an individual's agency. Agency could be deemed both a driver of and response to or consequence of successful navigation of/within liminality, and has been treated as a prominent theoretical concept which assumes individuals have the ability to significantly orchestrate learning ecologies for themselves (Elgin, 2013).

3.5 Mechanisms for transition

3.5.1 Referencing

Liminality is a concept which captures the nature and complexity of learning and transition. Supporting theory is introduced in this section for understanding the behavioural mechanisms that support transition through a liminal space through engagement with one's internal and external world. Even movement and transition through physical space requires a behavioural interaction with that space and is mediated via our sensory system (Lakoff and Johnson, 1999).

Referencing is a process that describes a student's sensory orientation and engagement with resources in their material and/or social environment. This interaction allows the learner to generate internal feedback through integration of the previous knowledge and experience with the reference information (Nicol, 2019). This internal feedback not only pertains to cognitive aspects of learning, but enables socialisation of one's learning emotion and schema with the social group. Referencing therefore serves both a cognitive and affection function, and is a useful theory for conceptualising student engagement with transition.

Reference points include *material references*, which consist of inanimate resources such as course notes, PowerPoint slides and the internet which students consult for textual information. Bronfenbrenner (2001) added a semiotic system (e.g. symbols, objects and signs) within his revised bioecological theory, given symbols, objects and signs can invite or inhibit activities and relationships within the microsystem. *Social references* then include verbal or non-verbal social interaction between the individual and other people like fellow students, lecturers or other members of the learning community. Social referencing in particular encompasses a complex set of interactions between the individual and one or more other individuals. Whilst this social interaction could easily be conceived of as unidirectional, it is treated in this study as a bi-directional and reciprocal process which honours the relational dimension of learning interaction (Bronfenbrenner, 1979; Rosa and Tudge, 2013). According to my social constructivist framing (Vygotsky, 1980), referencing is a process that not only fulfills a very personal learning need, but through social construction allows a learner to contribute to the learning community they interact with. Referencing therefore results in internal and external products as part of a bi-directional process. External products refer to tangible outputs such as the presentation of results and written output from a task, whereas internal products refer to '...changes in cognitive and affective/emotional states that occur during task engagement (e.g. increased understanding, changes in self-perceptions of ability)' (Nicol, 2020, p. 4). Nicol (2020), in their paper exploring internal feedback, go on to note that a student's ability to:

> '...self-regulate is both constrained and facilitated by the social and material environment in which they operate, as well as by their own internal knowledge, beliefs and dispositions' (p. 5).

This is not to say that referencing is an atomised interaction between the person and object. Through contemporaneous mediation of various references or artefacts (Engeström, 1987)

in an instance of learning, a space(s) is created which according to bioecological theory is nested within a broader set of systems. Reference points might therefore be imagined as 'nodes' between which an in-between transitional space is (co-)constructed and negotiated. Chi et al. (2008) demonstrated that having a richer referential environment can improve learning through generation of what Hattie and Timperley (2007) refers to as *self-regulatory feedback*. This chimes with the *Zone of Available Assistance (ZAA)* defined by Luckin (2008) as the '...types of resources, both human and artifact, that are available within a particular context to help a more able partner to offer appropriate assistance to a less able learner' (p. 451). The ZAA builds on Vygotsky's Zone of Proximal Development (ZPD) (Zaretskii, 2009) by considering the ecology of resources or references available to a learner in any given context. Whilst this external material and social environment is important, learning requires simultaneous referencing with internal microsystems and cognitive spaces, many of which cross-cut time and space. An individual's psychological characteristics and disposition heavily influence how they reference. Bioecological theory has helped me to configure this internal and external complexity (Bronfenbrenner, 1988).

Affordance theory

My interest in the link between space and transition has led to the adoption of affordance theory which considers the 'action possibilities' of space based on how the observer perceives it (Gibson, 1977). Affordance theory naturally encourages us to pay attention to how aspects of the physical space, what Lefebvre and Nicholson-Smith (1991) term 'conceived space' and what Sennett (2018) terms the 'ville', influence behaviour. Affordance is not only about the embodied constraint of architectural space (Hornecker and Buur, 2006), but is linked to four cognitive determinants of environmental preferences: coherence, complexity, legibility and perception (Altinbasak, 2016). The transitional spaces of primary interest in this study, by

virtue of their in-between nature, are not only a function of their physical properties, but according to affordance theory a function of their elastic conditions and resulting possibility for learning and transition. Hornecker (2005) refer to *embodied facilitation* and how physical space enforces social configurations that direct user behaviour and facilitate or hinder movements, thereby shaping ways we can and cannot collaborate.

Empirical studies which adopt affordance theory include Pantidi (2013) and her ethnographic study of innovative learning spaces, who concluded that infrastructural legibility and social legibility collectively determine actual usage of space. Other empirical studies such as Deed and Alterator (2017) have used affordance theory to understand the impact of informal learning spaces and Souter et al. (2011) who incorporated affordance as one of the seven design principles of the Spaces for Knowledge Generation (SKG) project. Each of these studies bear some resemblance to the focus of this study and have successfully operationalised the use of affordance theory within the broader learning space literature.

Whilst affordance theory may seem to contradict aspects of the social constructivist thinking underpinning this study, I maintain that interaction shapes space as a social product and must thus be considered in relation to transition (Leijon, 2016). The learning environment '...can be seen as 'scaffolding': a temporary framework that enables the social construction of knowledge to take place and then be removed as students become autonomous learners' (Dovey and Fisher, 2014, p. 45). The role of individual perception in leveraging affordance to construct knowledge will mean transition in the same environment varies between different users. This individual variation is partly because some people are more seasoned with furnishing the environment and possess a different set of '...architectural vocabularies and spatial literacies' (Fisher, 2004, p. 37). Affordance theory links well to agency and the perceived power that different individuals have to exploit aspects of physical space and external references for learning and teaching activity.

In-situ and ex-situ transition

Terminology that emerges in chapters 5, 6 and 7 is *in-situ* and *ex-situ* transition. This spatial language has been used to distinguish between observable transitions situated within the learning spaces studied (in-situ) and transitions that connect to these learning spaces but which are non-observable by virtue of occurring in other more distal learning spaces (ex-situ). The term 'situated' is used by other scholars, including situated action (Suchman, 1987), situated cognition (Lave, 1988) and situated learning (Lave and Wenger, 1991). Whilst I have not employed these theories centrally, their assumption that all knowledge is situated in activity bound to social, cultural and physical contexts is useful to consider when encountering 'in-situ' and 'ex-situ' transition later. The physical, social and cognitive in-situ transitions explored in this thesis, both at the level of the individual and group, are assumed to be similarly bound to a context and social situation shaped within nested ecological systems (Bronfenbrenner, 1979). Ex-situ transitions enable in-situ transitions in observed spaces to connect with and 'ripple out' to transitions in other non-observable spaces and social groups. This 'rippling' metaphor is used later in combination with ex-situ transition to propose a mechanism for broader behavioural and cultural change resulting from refurbished learning spaces.

3.6 Influences on transition

3.6.1 Cultural-Historical Activity Theory (CHAT)

Cultural-Historical Activity Theory (CHAT) argues that purposeful human behaviour is best understood within the context of activity as a culturally, socially and historically contextualised phenomenon (Leont'ev, 1978; Vygotsky, 1980; Engeström, 1987). Leont'ev (1978) founded activity theory which treats activity not merely as doing something, but

as doing something motivated by a biological need such as hunger, and/or as something culturally constructed. Yrjö Engeström expanded Vygotsky's idea of cultural mediation of actions into a triangular triad of subject, object and mediating artefact (Engeström, 1987). This developed into the CHAT triangle (see figure 3.2) as a more '...collective, multi-voiced, artefact-mediated and object-oriented' unit of analysis (Lazarou et al., 2016, p. 3). CHAT provides an alternative theoretical, methodological and analytical framework for understanding the complexity and inter-relatedness between the individual and the artefacts they reference with through the affordances in the environment.

Instead of treating the Cartesian mind as a monopolistic possession (Postholm, 2008), Luria (1970) thought of it as a *functional system* which forms when our electro-chemical processes come under control of mediating cultural artefacts to enable higher mental functions of the mind, including voluntary attention, problem solving, planning and learning (Bligh and Flood, 2017). Vygotsky argued that if we were to make any progress in understanding these functional systems, we need to study not only their structure, but their formation (history) and activity. This suggests firstly that learning occurs in a third space constructed between an acting subject, object and mediating artefact (Engeström, 1987; Sagan, 2011), and secondly that an individual always relates to a larger contextual whole that spans across wide spaces and long periods of time; what Dewey defined as their situation (Brown et al., 2015).

The CHAT triangle in figure 3.2 is a useful way of visualising the dialectic between the *object* exemplified as formal learning, the variety of physical and psychological *tools* or references available to the undergraduate student *subject*, the *rules* or expectations of how to behave in the formal classroom setting and the *community* and their *division of labour* regarding the direct and indirect human contribution to the goal-directed learning activity (Bligh and Flood, 2017). CHAT provides a framework that '...lays out the key factors, constructs,

or variables, and presumes relationships among them' (Miles et al., 2018, p. 440). CHAT and bioecological theory alike embrace the complexity of context or situation, and share a useful systems thinking which help to disentangle the transitions which lead to the mutual transformation of the mental and material world (Engeström and Middleton, 1996). Both theories seek to understand *perezhivanie*, translated as the 'emotional lived experience' (Davis and Dolan, 2016, p. 51), which is a contagious phenomenon which arises from transitions in the internal and external, the cognitive and affective, and the individual and social across space and time. This lived experience is difficult to interpret in isolation from the broader activity system and sociocultural context (Lazarou et al., 2016).

CHAT usefully treats knowledge, concepts and/or procedures that are internally oriented as mediating artefacts for gaining self-control of activity (Chaiklin, 2001). Human self-regulation is therefore ontogenetic since our psychological functions develop from the outside (social) to the inside (individual). Given activity is inseparable from psychological knowledge (theory) (Chaiklin, 2001), the dilemma becomes how to 'transport' knowledge and rules produced in the theoretical world to the world of praxis, so that participants can incorporate this knowledge into their activity system (Engeström, 2000). This study perceives this transportation process as a series of interactions and transitions mediated by artefacts with which individuals reference with. Beetham and Sharpe (2007) similarly perceive this process as 'specific interaction' between the learner with others using 'specific tools and resources', oriented towards 'specific outcomes' (p. 28). This is akin to what has been treated as formal learning in this study, which through shared goals and outcomes can be distinguished from the in-between, incidental learning in which the learner is more suggestible.

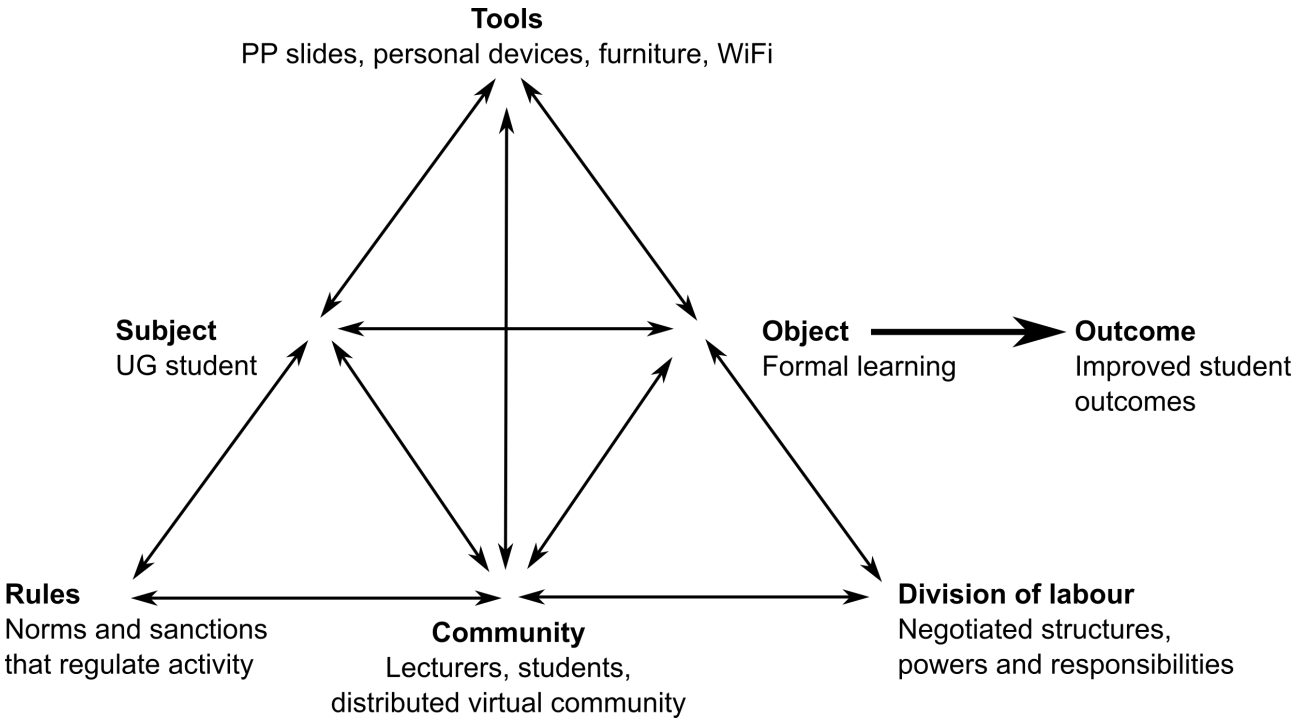


Figure 3.2: Original CHAT triangle based on Engeström (1987) with focus on formal classroom learning as an example of an activity system

Third generation activity theory

Similar to bioecological theory which evolved through three phases (Rosa and Tudge, 2013), CHAT has evolved into its third generation. Third generation theory treats the interaction of two activity systems as the minimal model (Engeström, 1995), thereby addressing the failure of a single framework to understand the dialogue and variability between different traditions and perspectives. CHAT can be understood in terms of five key principles: system relations, diversity, historicity, contradictions and expansive transformations (Engeström, 2001). One of the intentions of this third generation theory was to find ways to better visualise systems relations. This intended to facilitate a collective agency among practitioners faced with the challenge of redesigning their activity systems.

The third generation of activity theory has been used in a variety of studies inside and outside of education, including in relation to redesign work in the field of child medical care (Engeström and Middleton, 1996), in relation to promoting argumentation in science education (Lazarou et al., 2016) and in the identification of contradictions between virtual

and physical classrooms in a high school (Murphy and Manzanares, 2008). Strengths of CHAT include the close attention paid to context, culture and history, the recognition that the object (learning) overlaps with multiple activity systems (spaces) and actors, and the role of power, rules and expectation in influencing the subject's behaviour. To understand the transitions within and between different formal and informal activity systems, it has been preferable to use third generation activity theory rather than sole reliance on a static framework like in figure 3.2. This single activity system better captures instances of activity within a bounded period of time and space (such as a repeatable timetabled lecture).

Il'enkov (1977) defined *internal contradictions* as tensions within and between activity systems which are powerful driving forces of change and development. Contradictions are a useful aspect of CHAT for two reasons. Firstly, they treat people and institutions as part of unstable, constantly evolving systems. Secondly, contradictions are an inherent part of *expansive learning* which leads to transformations in activity that shape an organisation (Engeström, 2001). Primary, secondary and tertiary contradictions prompt participants to question reproduced norms, which can sometimes transition into a collective change effort whereby the object and motive of activity are reconstructed (Bligh and Flood, 2017). One key strength of CHAT is helping to consider these norms and expectations by abstracting the true object of activity to open fresh vistas for improving theory and practice.

I do not strictly subscribe to all of CHAT's principles and later adapt the framework as a way to structure my ideas in the thesis. CHAT has particularly assisted me with understanding how users of spaces perceive and manage tensions between different activity systems, including those prompted by strategy and space redesign. Contradictions arise in the transitions between these activity systems, and might therefore be spatialised as transitional spaces.

CHAT shortcomings

In all variations of the CHAT framework, the subject is a 'constant' that will encounter multiple actors across multiple activity systems. Whilst CHAT is capable of being used to observe and interpret phenomena at the level of the individual subject and system, it is more strongly framed at the programme and departmental level. It arguably has a weaker framing at the individual (micro) and institutional (macro) level, which have been important components in this study. Engeström (2000) states that 'Activity systems are driven by communal motives that are often difficult to articulate for individual participants' (p. 960). CHAT requires us to grasp these communal motives by interpreting them against the background of entire activity systems, making it difficult to focus on individual experience. An additional shortcoming of treating the student subject as a constant for analysis is the tendency to overlook differences in individual disposition. As the student transitions between different activities and spaces, their centrality as the acting subject in relation to activity can change, making it difficult to capture this dynamism through abundant iterations of the framework in figure 3.2. This encourages us to consider the *roles* played by students and other members of the learning community across different activity systems, which are the ideas and principles that guide what a person should do and how they should behave in a given situation (Hewitt, 1976). The static snapshot of activity seen in figure 3.2 enslaved me to exploring transition from the perspective of the undergraduate student subject which aligned with my starting ontology. Nonetheless, my reflexive approach led me to realise that understanding both student and lecturer roles was required to acquire a more complete understanding of transition. I therefore surpassed the limitations of CHAT and sought out other theories that afforded me different perspectives of transitional phenomena, including as a nested ecosystem of activity systems interacting with one another against a broader sociocultural context (Bronfenbrenner, 1979).

In attempting to understand transitions between different systems in this study, it has been difficult to capture the complexity and influence of time. Whilst CHAT principally advocates for a close attention to how past and present processes acquire meaning for future actions (Postholm, 2008), the CHAT triangle doesn't incorporate time very successfully. Bioecological theory and the PCCT model are arguably more adept at focusing on human development within the chronosystem (Bronfenbrenner, 1979) which has helped me to consider how an individual's preexisting disposition and historic knowledge will influence how they engage with transitional space in the present and in future.

A more generic shortcoming of CHAT is the lack of canonical knowledge and international working community within this branch of cultural-historical psychology. This is for a number of reasons including the suppression of the Vygotskian tradition in the Soviet Union and the uptake of CHAT independently in different countries, leading to an international disjointedness (Chaiklin, 2001). The independent uptake of CHAT has meant a lack of dialogue between different traditions or perspectives which third generation activity theory has helped to reconcile (Engeström, 2001). This has added to the challenge of applying CHAT to a novel research problem in this study.

3.6.2 Power-geometry

Whilst bioecological theory deals competently with the flow of matter, energy and information between the human organism and their environment, it overlooks the relations of power to these flows that have been explored more in depth by other social scientists (Bernstein, 2003; Massey, 2005). Doreen Massey (1944-2016) posits a geography of power and defined the term *power-geometry* to bring together space and power as mutually imbricated elements (Massey, 2005, 2007). The concept not only recognises that space is imbued with relations of power, but that geographies and cartographies of power exist which

themselves have a spatiality. Power-geometry is a flexible concept which attends to the wider relations of power within which actors and spaces are set, shaped by economic, political and cultural influences and resources (Massey, 2009). Whilst the concept of power-geometry has been mostly applied at the city and national level to highlight inequalities (Massey, 2009), its notion of power distribution is applicable at all levels of society, including in institutional learning spaces. This is evident according to Massey's geographical concept of space as a product of interrelations constituted through all levels of interaction, from the '...global to the intimately tiny' (Massey, 2005, p. 9). There are three theoretical tenets proposed by Massey (2009) (p. 16):

1. Space is the *product of relations* from the intimate level of our daily lives to the global level of corporations. Space must be something else for the individual to relate to, meaning it is also social.

2. Space is the *dimension of multiplicity* and allows for the simultaneous existence of more than one thing. Space is thereby the product of relations within this multiplicity.

3. Space is always in the *process of being made*. There are always relations being constructed, deconstructed or reconstructed given space is open to political forces.

Considering the relations of power in space can help to determine which social groups and individuals are empowered and disenfranchised. Power is never concentrated in spaces for random reasons; rather it is heavily influenced by the physical and social resources within spaces with which power is related and reproduced. This is concomitant with the relationalist view of space and power (Mulcahy et al., 2015) and the socio-spatial thinking of Lefebvre and Nicholson-Smith (1991) introduced in section 3.7.1. Thinking about space as constantly remade and renegotiated through materially-embedded practices is useful for understanding how individual and group activity contribute to the construction, deconstruction and

reconstruction of physical and social space. This requires an understanding of the relations of a learning space to other proximal and distal spaces. These relations between spaces are not only mechanisms for constructing and reproducing 'elastic' power-geometries, but conduits for transition and negotiation. Antonelli et al. (2008) define the concept of *elasticity* as:

> '...the ability to negotiate change and innovation without letting them interfere excessively with one's own rhythms and goals. It means being able to embrace progress, understanding how to make it our own' (p. 14).

Thinking about the elasticity of transitional spaces, and thereby the elasticity of student perception, expectation, power-geometry and identity within them, allows us to speculate on when and where liminality and transition might best be managed by learners. Elasticity is one thing, the capacity to respond to and shape circumstances in the environment is another and is affected by the *agency* of the individual (Elgin, 2013). Pendleton-Jullian (2019) for example integrated elasticity with ecotones, design and agency to suggest that ecotones represent elastic interstitial zones in which students can become accustomed to change, inquiry, friction and risk, and thereby deal with liminality in all of its forms.

The other progressive aspect of geographical thinking is its treatment of time and temporality, whereby time is the succession of change, and space is the dimension of multiplicity and the social (Bourdieu, 1989; Lefebvre and Nicholson-Smith, 1991; Massey, 2005). To open debate, Massey et al. (1993) used the concept of power-geometry and time-space compression (Harvey, 1993) to posit that what provides a space with a sense of place is not a long internalised, bounded history, but a particular constellation of relations at a particular locus. This notion of place as articulated networks of social relations that are linked to the wider world is adopted in this study and Massey et al. (1993) suggest that instead of viewing place as a thing, it should be viewed as a process.

3.7 Products of transition

3.7.1 Spatial triad

In this thesis I subscribe to what Mulcahy et al. (2015) refer to as a relationalist perspective to understanding space and its occupation as things produced together. This opposes the 'realist' perspective adopted in much of the learning space discourse where space is researched based mainly on tangible aspects like design features. I therefore take as my starting point a rejection of this realist, Cartesian perspective.

This relationalist perspective is aligned with the work of the human marxist Henri Lefebvre (1901-1991) who as a socio-spatial theorist, believed that the material and mental should be considered together if the lived experience of humans was to be properly understood. The idea that space is produced as a result of social activity and as a mental construction (Elden, 2007) was Lefebvre's attempt to reconcile Hegel's idealism (the finite world as a reflection of mind) and Marx's materialism (history as a result of material conditions not of ideals). Lefebvre's thinking amounted to his 'spatial triad' presented in the *The Production of Space* (Lefebvre and Nicholson-Smith, 1991, p. 38) which can be found summarised in table 3.2 where it has been mapped on to synonymous terms used by Lefebvre and this thesis.

Table 3.2: Lefebvre's spatial triad adapted from Elden (2007) (p. 110)

Triad arm	**Triad space**	**Space**	**Construct**	**Focus**
Spatial practice	Perceived	Physical	Materialism	Behaviour
Representations of space	Conceived	Mental	Idealism	Perception
Representational spaces	Lived	Social	Materialism and idealism	Expectation

This conceptual triad addresses how space is produced as a result of physical, mental and social relations. These three arms possess a dialectical relationship and respectively map on to *perceived space* (spatial practice) which is the outcome of the individual's use of physical space, *conceived space* (representations of space) which are the mental constructions of space

that materialise as campus plans and maps, and *lived space* (representational spaces) which is the meaning assigned to space through social activity (Lefebvre and Nicholson-Smith, 1991). This theory partly guided my choice of methods in chapter 4 based on the need to explore three aspects of human lived experience: behaviour, perception and expectation (also mapped in table 3.2). This study treats perception as the most fundamental conscious act linked to an embodied mind which puts us in 'direct contact' with our immediate external environment (Lakoff and Johnson, 1999; Fish, 2010). Tolman (1932) defined 'cognitive expectation' as that arising from changes in animal and human goal-directed behaviour resulting from a new reward being experienced one or more times (p. 71). Expectation is believed to play a significant role in regulating purposeful behaviour (Engeström, 1987) and is reinforced by perception, shared goals and rewards within the social group.

Lefebvre's theory has been used with success in a number of empirical studies that intended on analysing learning spaces (Beyes and Michels, 2011; Leighton, 2017; Nelson and Johnson, 2017; Whitton, 2018). Temple (2019) usefully integrated Lefebvre's conceptual triad with social capital theory to understand how best to cultivate place and cité (Sennett, 2018) in university spaces. I similarly use Lefebvre's theory to remain aware of the relationship and tensions between those who conceive and design space as a hegemonic 'tool' (university estates, senior management etc.) and those who consume space (students, lecturers etc.) (Lefebvre, 1970). I have used the triad to link longer-term transitions in the macrosystem associated with institutional strategy with transitions in the exosystem associated with space redesign and capital investment, with shorter-term transitions in the mesosystem associated with observable learning behaviour between learning spaces. These transitions can be understood as constituted of physical, mental and social relations which lead to the production of space, and hence might be considered 'products' of transition.

3.8 Integration of theories

Bronfenbrenner's bioecological theory has been supplemented by theories which have allowed me to understand the drivers for, mechanisms of, influences on and products of transition in this study. I have taken the skeleton of the ecological systems model in figure 3.1, integrated it with contextual information about the institution and divided the microsystem into physical, cognitive and social space (Lefebvre and Nicholson-Smith, 1991) to create figure 3.3. I have substituted Lefebvre's original 'mental space' for 'cognitive space' in this integrated framework model. Mental space is a broader term used to describe an internal representation that is purely conceptual, whereas cognitive space connotes a more meaningful literature around cognitivism (Tolman, 1932; Piaget and Cook, 1952; Vygotsky, 1980). Cognitive learning theories advocate for learner-centred active instruction, and encourage us to pay greater attention to individual differences in cognitive structures to better understand how students can integrate new knowledge with previous knowledge (Yilmaz, 2011).

Ecological framing is powerful because it can be applied in different contexts, namely *meaning*, *model* and *metaphor* (Pickett et al., 2010). Meaning pertains to a definition in relation to a certain domain, which in this study is learning in transitional space. A model then specifies how these definitions are being employed in a specific case or range of cases, translating them into usable tools so that the system of interest can be understood. Metaphor relates to structural metaphor which could be behavioural metaphors like resilience and adaptation (Barnett and Jackson, 2019). I have treated meaning, model and metaphor as related dimensions of the ecological concept, given models like in figure 3.3 are a way of simplifying nature and risk missing important complexity (Pickett et al., 2010). The additional mechanisms for, influences on and products of transition not explicit in this framework model arise through interactions of different parts.

I have had more chance of collecting data observing relationships in the proximal

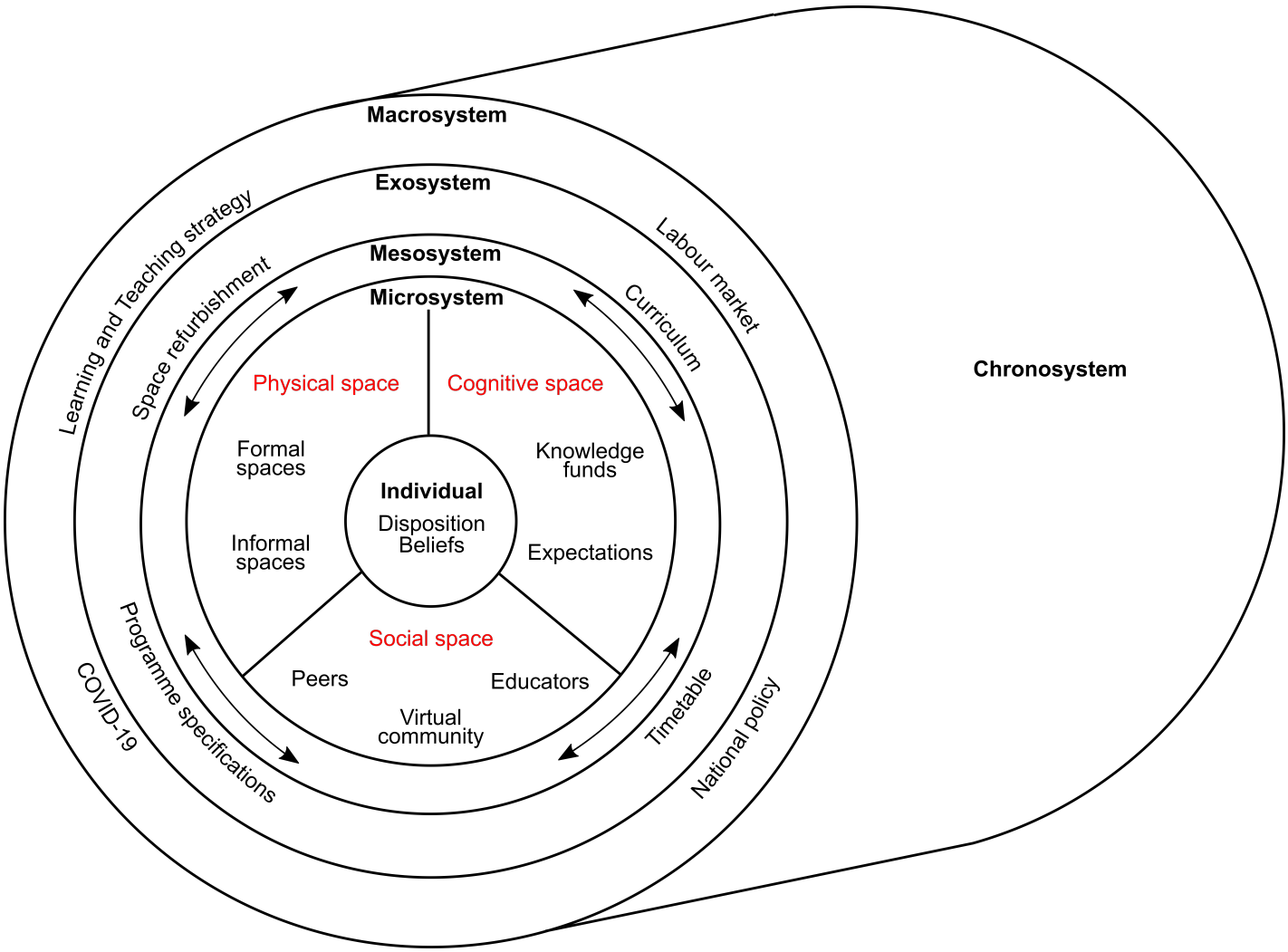


Figure 3.3: Adapted ecological systems model developed from figure 3.1

microsystem and mesosystem, whereas the distal exosystem and macrosystem has been more difficult to constrain. However, there seem to be increasing distal influences in the sector with greater regulation from bodies like the OfS and CMA, and with unforeseen global crises like COVID-19. Integrating theories to assemble the framework model in figure 3.3 has allowed me to readily move between interrelated transitions in the microsystem, mesosystem and macrosystem to infer relationships. This is important given the institution's Learning and Teaching strategy (Imperial College London, 2017) and its desire to transition toward more active learning approaches (see section 1.2.1).

I return to a version of the framework model in figure 3.3 at the start of chapters 5, 6 and 7 to highlight the spaces and transitions that were explored in each chapter.

Chapter 4

Methods and collecting data

4.1 Introduction

In this chapter I begin by introducing the two departmental building settings in which the methods were used: ACE Extension (ACEX) and Blackett. I then introduce the methodology and methods, participants and ethical implications of carrying out the research. I conclude the chapter by discussing my approach to data analysis.

4.2 Settings

The first phase of research began in the Aeronautics and Chemical Engineering Extension (ACEX) building followed by the second phase in the Blackett building, both located on the South Kensington campus (both highlighted on the campus map in appendix 13). The Blackett phase enabled the behaviours and transitions recorded in the ACEX phase, relating to undergraduate students from the Faculty of Engineering, to be contrasted with a different disciplinary context in the Department of Physics. Blackett houses a larger department than ACEX and is similarly research-intensive; this information can be found comparatively summarised in table 4.1.

Table 4.1: ACEX and Blackett setting information and demography

Characteristic	**ACEX**	**Blackett**
Main department	Chemical Engineering	Physics
Formal spaces	Lecture Theatre 1	Lecture Theatre 2
Informal spaces	Breakout space	Foyer space
Undergraduate student numbers	500	870
Postgraduate student numbers	320	430
Academic staff numbers	43	110

The ACEX spaces (Lecture Theatre 1 and breakout) were selected partly because of their adjacency seen in figure 4.1, which enabled me to explore student transition between each space. The opportunity to gain access to novel occupancy monitoring data further contributed to my decision to select these spaces. Moreover, these ACEX spaces are proximal to the building main entrance and Sherfield walkway through which high volumes of people access catering outlets like the JCR and SCR (see appendix 13). The breakout space therefore invites a rich confluence of usage between different user groups.

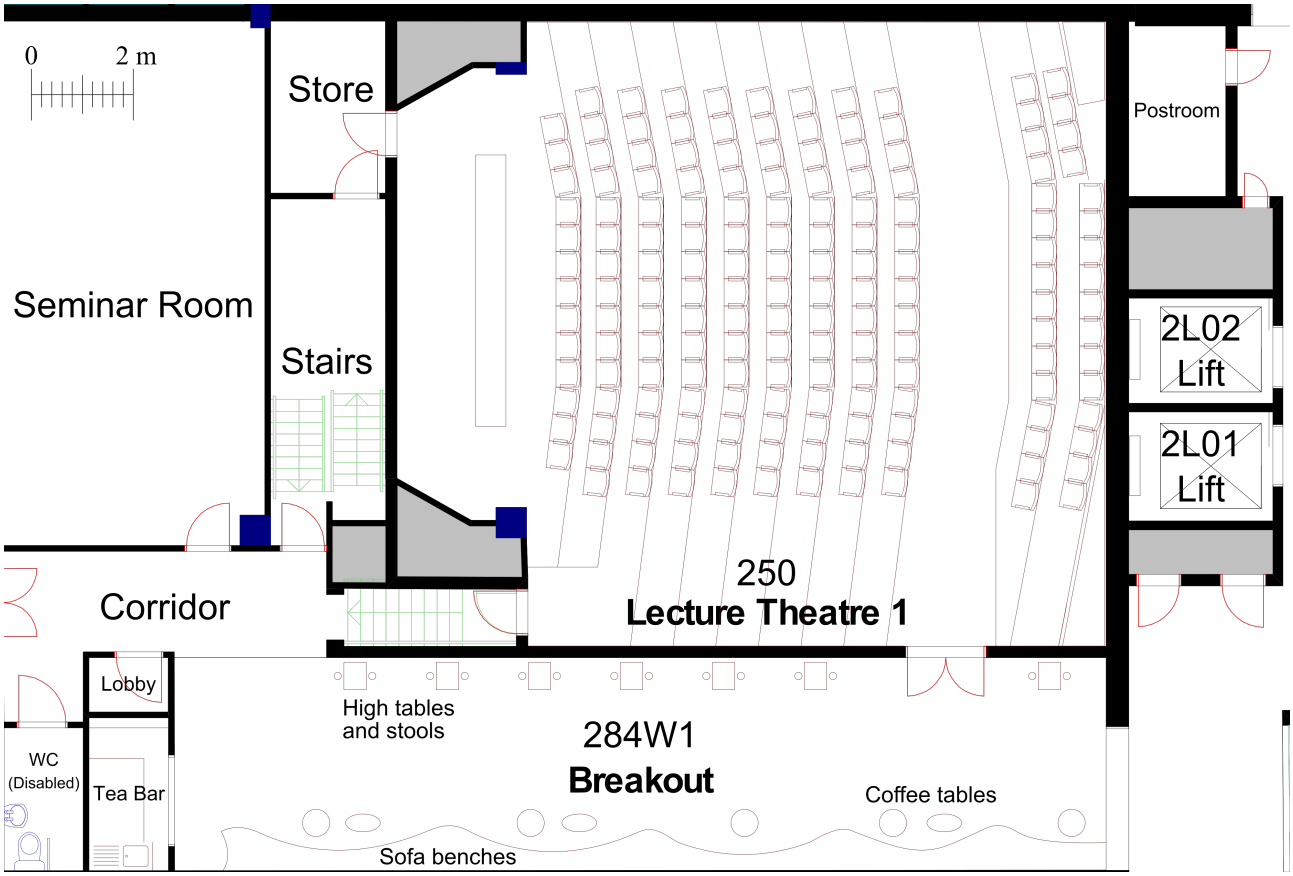


Figure 4.1: Floor plan diagram of ACEX breakout space and Lecture Theatre 1

Similar to the ACEX setting, two adjacent spaces were selected in Blackett: formal Lecture Theatre 2 (LT2) and an informal foyer space. The foyer space can be seen nestled between LT2 and raked LT3 opposite (resembling pre-renovation LT2) in figure 4.2. These spaces helped to address the first research question by exploring transition between and within formal timetabled and informal non-timetabled spaces. Secondly, these spaces became the site of planned refurbishment, such that I opportunistically fed into their redesign process to test how physical space might influence transition (linked to the second research question).

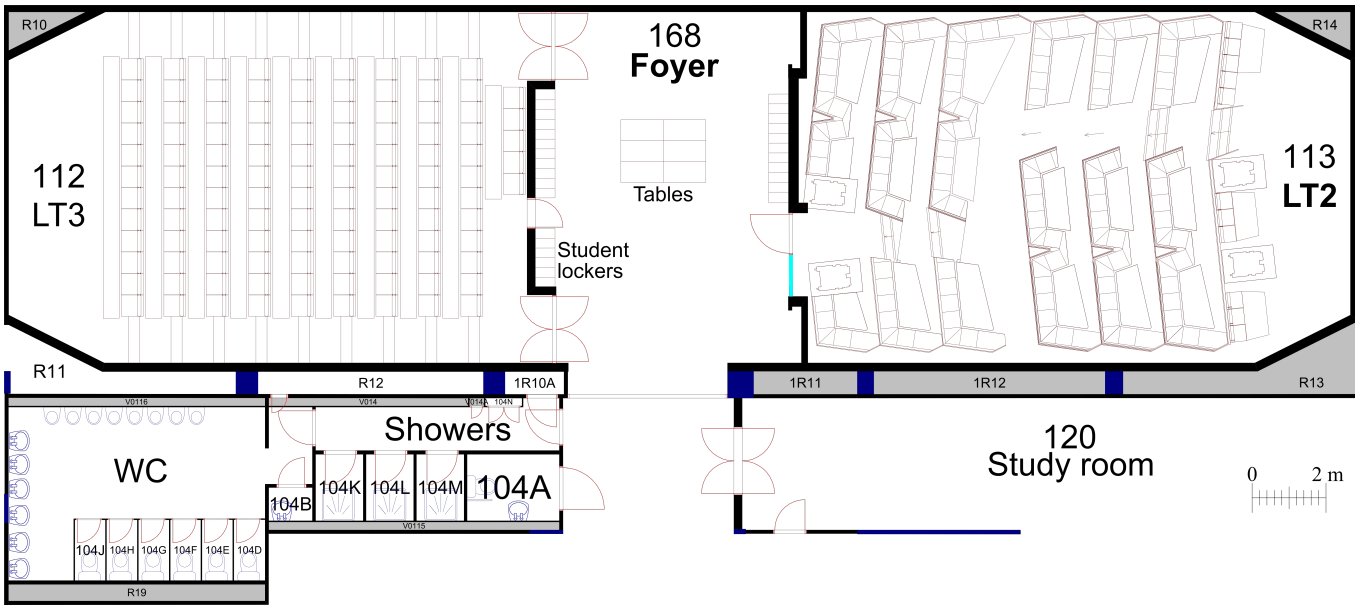


Figure 4.2: Floor plan of Blackett refurbished LT2 and the pre-renovation foyer space

4.2.1 Formal spaces

The formal lecture spaces in ACEX and Blackett are introduced in this section and are comparatively summarised in table 4.2.

Table 4.2: ACEX LT1 and refurbished Blackett LT2 space information

Characteristic	**ACEX LT1**	**Blackett LT2**
Space type	Raked lecture theatre	Interactive lecture theatre
Capacity	160	100
Net Internal Area (m^2)	160.81	132.37
Primary usage	1^{st} and 2^{nd} year undergraduate teaching	Undergraduate teaching

ACEX Lecture Theatre 1

Lecture Theatre 1 (LT1) (figure 4.3) seemed to be the most suitable lecture theatre in ACEX given its primary use for 1st and 2nd year undergraduate teaching and its connection to the ACEX breakout space through which students enter and exit LT1 (see figure 4.1).



Figure 4.3: Photograph of ACEX Lecture Theatre 1 showing traditional raked seating

Chemical Engineering is a full-time degree 4 years in length (MEng). 1st and 2nd year undergraduate students attending timetabled sessions in LT1 are expected to attend lectures, problem classes and small group tutorials comprising 25% of their *teaching* contact, with the remaining 75% of time spent independently studying. This emphasis on informal work is dictated by the degree *assessment*, which in the early years consists of 10% practical, 20% coursework and 70% examination. Students attending formal teaching in campus spaces like LT1 have recently attended online teaching as a result of COVID-19.

Blackett Lecture Theatre 2

My exploration of transitions linked to ACEX LT1 led to my selection of the similarly 'traditional' raked, row-by-row Blackett Lecture Theatre 2 (LT2) seen in figure 4.4. This allowed me to test ACEX findings in a different context.



Figure 4.4: Photograph of Blackett pre-renovation Lecture Theatre 2

Similar to ACEX LT1, the Blackett LT2 space was used by the Department of Physics to teach modules for full-time BSc and MSci undergraduate degrees. Early year undergraduate students are expected to attend 50% formal teaching comprising 10-15 hours of lectures/tutorials and 6 hours of laboratory work per week; the other 50% of time is spent independently working on problem sheets, lab reports and other informal study. There is a heavy emphasis on informal study like other degrees in the institution, including Chemical Engineering.

LT2 refurbishment

LT2 was converted from the row-by-row lecture theatre in figure 4.4 to the interactive, connect-booth auditorium in figure 4.5 two months into the Blackett research phase. Refurbished design features included improved acoustics, a new visualiser/projector and USB charging/power sockets in booths. Better equipping LT2 for interactive pedagogy caused it to become a shared resource among other departments in the faculty and institution.



Figure 4.5: Photograph of refurbished Blackett Lecture Theatre 2

The institution worked with Burwell Architects and invested £1 million to undertake this lecture theatre conversion, following similar conversions at Loughborough University in 2011 and University of Leeds in 2016. I was afforded the opportunity to attend the LT2 design board meetings in which I shared my research findings from ACEX and pre-renovation Blackett about the importance of physical space for active learning transitions. This translated into a series of conversations with the design committee about how LT2 redesign may support ease of interaction and transition between different activities and people.

4.2.2 Informal spaces

The informal spaces in ACEX and Blackett are introduced in this section and are comparatively summarised in table 4.3.

Table 4.3: ACEX breakout and pre-renovation Blackett foyer space information

Characteristic	**ACEX breakout**	**Blackett foyer**
Space type	Breakout area	Foyer circulation space
Artefacts	Sofa benches, coffee bar/tables, water dispenser	Student lockers, tables
Capacity	50	30
Net Internal Area (m^2)	76.42	73.25

ACEX Breakout Space

The amenity, public accessibility and connection of this breakout space to LT1 made it an ideal setting to begin exploring transition within and between LT1 timetabled sessions. Its public access meant it being frequented by a diverse campus user group originating from different areas of the ACEX building, making it particularly interesting for understanding negotiations for ownership among different user groups. The public nature of the space also meant that I did not require special authorisation for research observation such that I could freely observe activity. The space is originally a throughway corridor which was re-purposed as a breakout space with a coffee bar seen at the far end of figure 4.6. Whilst the coffee bar was closed during the period of data collection, the interactive-style furniture on the left of the space and the high rise tables/chairs with power sockets on the right (see figure 4.1) afforded interaction and transition documented in this study. The space also has a high back, enclosed booth area with a single table positioned in the corner of the space hidden in figure 4.6. The contrast in the affordance and intended activity between this breakout space and LT1 resulted in differences in power-geometry, which made the ACEX spaces a unique experimental ground for exploring transition.



Figure 4.6: Photograph of the ACEX breakout space showing door entrance to ACEX LT1 to right of photo (source: Imperial image library)

Blackett Foyer Space

My growing interest in the way undergraduate students perceive and engage with transitional spaces between formal and informal learning led to my selection of this foyer space. The position of this foyer space between two symmetrically configured lecture theatres, LT2 and LT3, seen in figure 4.2 meant this foyer is most typically used as a waiting area and transitional space. However, the limited amenities and affordance of this foyer space evident in figure 4.7 also meant it permitted a narrower range of potential activity than the better equipped ACEX breakout space. Rather than interact meaningfully, students more often used the nearby toilets, showers or their personal locker to retrieve or deposit belongings. Much like the ACEX breakout space, this foyer space is publicly accessible to anyone in the department and I did not require special authorisation for carrying out observation or being present in the space.



Figure 4.7: Photograph of the pre-renovation Blackett foyer space showing entrance door to Lecture Theatre 2 to right of photo

Foyer refurbishment

Following LT2 refurbishment, I observed behaviour in the pre-renovation foyer space before and after timetabled sessions. My involvement with a StudentShapers project team consisting of a 4th year undergraduate Physics student and members of staff supported translation of research findings into a remodelled foyer design. Although this participatory design approach (Casanova et al., 2018) was not a part of the PhD research, the team surveyed one third of the Physics student body, carried out sandpit-style focus groups with students and interviewed lecturers to explore user needs in the space. The addition of suitable furniture seen in figure 4.8 increased affordance for more effective learning and transition into and out of timetabled sessions in LT2 and LT3, enabling exploration of the change in behaviour following the change in space (linked to the second research question).

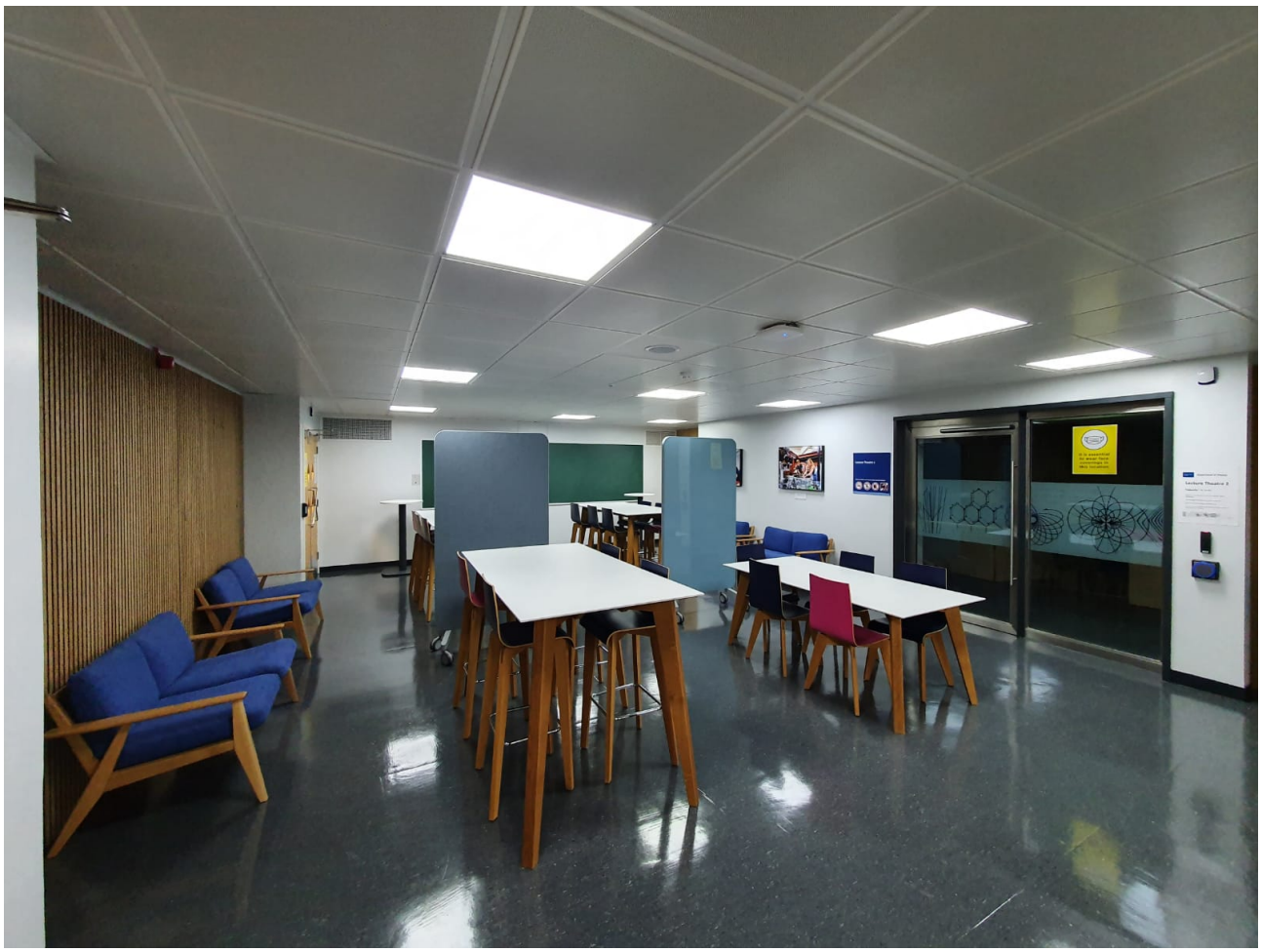


Figure 4.8: Photograph of the refurbished Blackett foyer space

4.3 Methodology

The complexity of the educational world requires us to study it in total if a true understanding is to be reached (Cohen et al., 2013). This embracing of complexity is reflected in theories introduced in chapter 3, notably bioecological theory and CHAT (Bronfenbrenner, 1979; Engeström, 1987). It would be inappropriate to atomise social phenomena using solely quantitative methods. Equally, a solely interview or focus group-based approach may produce less valid data because participants often report what they think they do, as opposed to what they actually do (Agar, 1996).

Mixed methods (Swain, 2016) were therefore selected pragmatically to address the research questions by understanding student engagement with and perception of different types of transition, some observable and some less observable. Mixed methods enabled collection

of and triangulation between increasing amounts of context about participants in the different learning spaces. Objective occupancy data allowed me to capture cohort-level transitions between formal timetabled and informal non-timetabled learning spaces with complete anonymity of individuals. Naturalistic ethnographic observations were used to capture apparent status and behaviour of individuals and small groups to add richness to the anonymised occupancy data. Ethnographic field interviews were used to confirm (or deny) my observations by asking participants about superficial context like year of study and the way they were actually using the spaces. Later in-depth interviews allowed me to collect deeper context about individual participants, including in the refurbished learning spaces. Pragmatism acts as the rationale for my choice of mixed methods, given it is a philosophical paradigm which recognises the importance of practical inquiry as a self-correcting process whose procedures should be evaluated based on subsequent experience (James, 1975; Ormerod, 2006). As a pragmatist, I have not been prescriptive in using multiple methods, rather I have opted for methods which best advance my understanding of transitions that are both external, behavioural and observable and transitions that are internal, subjective and reportable. Methods have therefore sought to explore participant perception, expectation and behaviour which equate to patterns that are '...ideal (what *should* occur), actual (what *did* occur), or projective (what *might have* occurred)' (Creswell, 2002, p. 498).

4.3.1 Phenomenology

As the study of the nature and meaning of phenomena, phenomenology represents an appropriate philosophical stance for this study because it is a kind of naturalistic inquiry which understands behaviour as a function of direct experience, otherwise known as the *lived experience* or the life world (Savin-Baden and Major, 2013). Phenomenology assumes that meaning is generated by observing things as they really are in their outward form, rather

than through taxonomic approaches (Cohen et al., 2013). Given the research interest in transitions between physical, cognitive and social spaces that co-enable learning in this study, fully understanding *perezhivanie*, or the 'emotional lived experience' (Davis and Dolan, 2016, p. 51) requires us to adopt the view that our senses and emotions colour our lived experience, rather than the Cartesian view that these senses and emotions distort semiotic meaning already out there in the world.

Edmund Husserl (1859-1938) founded the initial *transcendental* school of phenomenology (Husserl, 1952) and criticised psychology for retrofitting natural science methods to human issues. Husserl deemed these psychological approaches as too concerned with human reaction to external stimuli, as opposed to human response to their own perception and interpretation of what these stimuli mean (Laverty, 2003). Hence, phenomenology considers the intermediary processes between human response and stimuli that shape the lived experience. However, one challenge of phenomenology is that the very process in which a researcher interprets and defines a situation is itself a product of the circumstances in which one is placed. Martin Heidegger (1889-1976) thereby founded *hermeneutic phenomenology* and argued that Husserl's transcendental requirement for the researcher to bracket off their preconceptions was unfeasible. Heidegger believed that uncovering phenomena '...requires intellectual inquiry, which cannot be detached from subjective experience' (Morgan, 2018, (p. 71)). This stems from the pure hermeneutic definition of texts and lived phenomena as relations between the whole and their parts, otherwise known as the *hermeneutic circle* (Gallagher, 1992). Phenomena exist in the researcher's life world, leading Gadamer et al. (2004) to similarly contend with Husserl's bracketing and Flood (2010) to argue that a subjective understanding of the conceptions and historicality of both the researched and the researcher need to be acknowledged. The methodological approach taken in this study therefore subscribes to the hermeneutic phenomenological school, especially given my

ontological position which has been shaped by my previous involvement with the institution researched (see section 1.2.2).

Charles Peirce (1839-1914) recognised that there are general characteristics found in all phenomena; he called these *categories* (Sanders, 1868). Peirce logically categorised consciousness into first feeling (being), second our objective perception of that feeling which leads to its interpretation and third the means by which the first and second are brought into relation (Sonesson, 2013). Thirdness is the category of thought, language, representation and semiosis that colours our interpretation as researchers. Thirdness reminds us that the lived experience differs between individuals and reality, given experience is determined by our perception and internal embodied habit system. This chimes with aspects of Roy Bhaskar's (1944-2014) *critical realism* movement, which posits that all social events occur simultaneously on four planes, including material transactions with nature, social interactions between people, social structure and the stratification of the embodied personality (Bhaskar, 2008). Similar to Peirce's categorisation of phenomena, this layered nature of reality according to critical realism demands that '...multiple disciplines and methodological approaches may be needed to understand the multilevel relationships' (Haigh et al., 2019, p. 4). This further justifies my mixed methods phenomenological approach to understanding different 'layers' of transition.

Justifying interpretivist claims

Before delving into the methods used in this study, it is important to reflect on the validity of the interpretivist paradigm adopted. Interpretivism does not seek a single truth, but rather accepts Clifford Geertz's (1926-2006) claim that:

> 'What we call our data are really our own constructions of other people's constructions of what they and their compatriots are up to' (Geertz, 1973, p. 9).

Knowledge claims very much depend on the person who makes them, and that reality is socially constructed by negotiation between people about that reality. The very essence of this paradigm rejects positivistic assumptions, instead positing that knowledge is constructed through lived experience of reality (Giorgi, 1994). Departure from positivistic beliefs led to the inception of interpretivist theories like social constructivism, critical theory and ethnography which posit that, although a single, objective reality is untenable, making truth claims is still possible and consistent with the ontological and epistemological assumptions underlying interpretative research (Sandberg, 2005).

Interpretive research requires us to accept the principles of 'life-world' and 'consciousness as intentional', and for the researcher to be *reflexive* in bending back on themselves to adapt their positionality and ontology (Somekh and Lewin, 2005). Being reflexive is important because truth claims arising from interpretivist research cannot be absolute, but are rather informed knowledge claims in relation to the ontological and epistemological assumptions of the researcher. Reflexive empirical research can be thought of as a form of reflective research in which reflection takes place on several levels and in relation to several themes (Corlett and Mavin, 2018). In this study, I used informal written diaries and other tools to self-monitor my evolving feelings, thoughts and actions to understand my changing ontology and epistemology throughout ethnographic data collection. Ongoing conversation and sharing of thinking with fellow researchers during supervisory meetings and conferences helped me to acknowledge and 'benchmark' my changing standpoint (Denzin, 1996).

Given the phenomenological tenet that my interpretation is matched and fulfilled in experience of the object studied, the different philosophical schools present differing positions on how truth is achieved in this process. To use understanding a hammer as an example, a realist perspective on this investigation suggests that the object must have manipulable, internal mechanisms that can be separated and actualised to produce outcomes, akin to

scientific experiments. Husserl contends with this, arguing that through *perceived fulfillment*, the hammer must be observed in all of its forms to understand the truth. For Heidegger, the hammer is understood by *fulfillment in practice* and must therefore be used in practice to be properly understood (Sandberg, 2005). Sandberg (2005) concludes that the best way to achieve valid and reliable knowledge claims is to adhere to a 'truth constellation' between these different positions. I adopt more of a pragmatic hermeneutic approach to understanding the lived experience in this study.

4.4 Methods

4.4.1 Preparing for the field

Prior to entering the ethnographic field, I read and analysed the UK National Student Survey (NSS) data for the 2015/16 and 2016/17 academic years. The NSS is a national survey completed by all final year undergraduate students shortly before they graduate. The NSS invites quantitative satisfaction scores on areas like teaching, assessment and feedback, with additional opportunity for students to elaborate by sharing qualitative comments. My authoring of Imperial College Union's NSS Response 2016 (Imperial College Union, 2016), prior to starting this PhD, permitted my secondary analysis of student quotes (using word clouds) to identify themes of student satisfaction and dissatisfaction in the Departments of Chemical Engineering and Physics. This response made recommendations to the College for changes to practice and policy. Given this qualitative comment data became increasingly outdated throughout data collection, I used it solely for the purposes of achieving a single critical perspective prior to entering the field (Madden, 2017). The below quote captures some of the most significant educational challenges self-reported by Chemical Engineering students at the time:

> "It was impossible to maintain a healthy work life balance with this course as the level of effort and commitment that is expected leaves virtually no time for other social activities, despite being told repeatedly by senior members of staff that a balance is important. There appears to be an underlying assumption that students do not necessarily need to attend lectures during term time, therefore can commit extra time to projects. However, this just makes the revision period extremely stressful and students need to catch up on lectures and master the material in a short period of time"

The intense workload partly informed my choice of the ACEX setting and motivated me to better understand student engagement with transition and a 'healthy work life balance'. My rationale for selecting the Blackett setting was partly informed by the Department of Physics suffering the lowest NSS satisfaction scores in the institution, with 67% in 2015/16 and 66% in 2016/17; these compared with 89% and 84% for the Department of Chemical Engineering respectively. A student comment from the NSS Response 2016 (Imperial College Union, 2016) seemed representative of general student gripes in Physics:

> "I feel that the experience at Imperial College is lacking. There is a sense that we, the students, are not respected and welcomed parts of the community, but difficult customers the staff must deal with in order to fund the faculty. Overall, I feel I have been very let down by the experience" (p. 7).

The lack of departmental community was reported in conjunction with the "...little collaborative space for students to work on projects" (Imperial College Union, 2016, p. 25). This made the LT2 and foyer space refurbishment work relevant to the challenges historically faced by the Department of Physics and my second research question.

4.4.2 Naturalistic ethnographic observation

Ethnography is a qualitative method in which:

> '...the researcher describes and interprets the shared and learned patterns of values, behaviours, beliefs, and language of culture-sharing groups' (Creswell and Poth, 2016, p. 90).

The roots of educational ethnography lie in cultural anthropology, where anthropologists would immerse themselves in particular societies for prolonged periods to write 'objective' accounts. Whilst the earlier forms of ethnography took a participant observation approach in which the researcher overtly embedded themselves within the culture being studied, this study has used naturalistic ethnographic observation protocols (Somekh and Lewin, 2005). 'Naturalistic' protocols are chosen because they minimise the potential for the *Hawthorne effect*, which is when participants alter their behaviour in the presence of an observer (Punch, 2013; Madden, 2017). This has allowed me to capture an authentic record of student behaviour that often the actors themselves are not conscious of.

Unlike scientists, ethnographers operate within an open experimental field which is a combination of a geographic or social space and a mental construct of the ethnographer. Clifford and Marcus (1986) note that it is inappropriate to view the ethnographer as an 'objective' reporter, given they represent only one voice among their many participants. This warrants a focus on being *multi-sited* by treating observation and participation as relevant not only to the local, but to the global life world and system (Marcus, 1995). Observing and thinking about the influences on learning and transition at different system scales and timescales is concomitant with the choice of theoretical framing in this study, notably the bioecological model (Bronfenbrenner, 1979). Multi-sited ethnographic observation is difficult because of our human limitation to observe for limited periods of time in single spaces. Whilst mixed methods have assisted with mitigating this ethnographic limitation,

the ability of the ethnographer to capture and integrate emotion, sensory information and even what people aren't doing in a setting makes it superior to other recording devices such as video cameras. This has also required me to remain reflexive and aware of how my *ethnographic gaze* '...registers and doesn't register aspects of field settings and human behaviours' (Madden, 2017, p. 96).

Few studies have used mixed methods approaches that include ethnography to understand the situated learning behaviours of students within physical transitional spaces; Pantidi (2013) explored a similar topic in her PhD thesis using participant ethnography to explore student interactions in innovative learning spaces. Given my research interest in the way students engage with and perceive transitions in learning, the ethnographic focus on *behaviour* as the actions taken by an individual in a cultural setting, and *beliefs* which are the way an individual thinks about things in a cultural setting (Creswell, 2002) form a core part of my approach. I distinguish another domain that ethnographers 'see' when watching people: *material structures* (Madden, 2017). Together with sociopolitical, historical and economic factors, these human and non-human elements determine the interrelation that is *context* (Fetterman, 2019). With this in mind, I recorded and analysed my somatic experiences across a total of four physical spaces: ACEX LT1, ACEX breakout space, Blackett LT2 and Blackett foyer space (see section 4.2).

Recording field notes and sociograms

Ethnography is description and analysis together, unlike other observation techniques that are solely descriptive (Madden, 2017). Ethnographers work primarily with unstructured data which does not conform to a fixed, a priori research design (Hammersley and Atkinson, 2007). I set out to write authentic accounts about learning behaviour and culture, rather than to test hypotheses about it (Denzin, 1996; LeCompte and Schensul, 1999).

I began observation of each setting with thick and detailed description which started at the level of the setting and honed into a description of the participants (Millen, 2000). Participants were recorded using apparent descriptors, such as 'Caucasian female', which were later coded as anonymised pseudonyms for the purposes of data organisation and analysis. I committed to using first person narrative in both my field notes and this thesis because the observations were my own, and the impartiality of using third person did not feel authentic. The first stage of the ethnographic process involved me recording faithful representations of observable facts within secure OneNote documents on my laptop. Field notes were always sectioned into contextual information such as start/end time of the observation, main observation record of activity and then a reflection/interpretation section that was populated post-observation (see appendix 9 for ACEX field notes example).

This separation was important given interpretation is the most subjective phase of the ethnographic process as the researcher relates the description back to their own personal assessment and the literature, often raising further questions on the data.

My deeply contextualised ethnographic accounts recorded in field notes were supplemented with sociograms in ACEX. Sociograms are mapping tools for interaction that comprise a plan view of the observed setting on to which interactions can be annotated. Tubaro et al. (2016) argue that sociograms can be positioned at the intersection between qualitative and quantitative methods to improve the communicability of results and to benefit data gathering and analysis. Sociograms are most effective when recording stationary activities that involve few participants across short periods of time (Sanger, 1996). Much like Pantidi (2013) in her PhD thesis, sociograms were used to capture 10 minute intervals of '...simultaneous people interacting with artefacts and each other' (p. 57) in the ACEX breakout space. I printed sociogram diagrams on paper, fixed them to a clipboard and annotated person-person and person-space interactions during observation (see raw sociogram in appendix 10).

4.4.3 Ethnographic field interviews

Only so much information can be gained from observing activity. How students internally experience transition and changes in perception, expectation and their world view (LeCompte and Preissle, 1993) is something better inferred from them self-reporting in interview. The need to explore the internal world of the participant beyond naturalistic observation of their behaviour led me to use brief, follow-up ethnographic field interviews (Spradley, 1979). These in-situ, face-to-face interviews were typically 5-10 minutes in length and conformed to a structured style in which I asked a set of predetermined questions to all participants approached (Newby, 2010). Conducting interviews in the field setting honoured the significance of context and a social constructivist perspective. Field interviews were often held one-on-one with individuals, with some instances where small groups of 2-3 students were interviewed. Initial questions served to collect unobservable context and demographic information about the participant such as their year of study and how often they used the space, and confirmed or denied the observation of their apparent behaviour by inviting them to describe an account of what they were doing in the space (see appendix 4 for example of questions). Questions were asked informally and kept as open as possible to minimise participant apprehension/inconvenience, establish rapport and elicit meaningful information (Spradley, 1979; Sudman and Bradburn, 1982). Whilst an informal style was adopted, the use of leading language such as 'don't you think' and 'wouldn't you say' was avoided so that responses were not directed in anyway (Madden, 2017). Much like observation, I recorded interview notes on my laptop during and just after each interview. I opted not to audio-record field interview interactions because of the time that would have been spent in seeking consent from participants and potentially distancing them from the observed behaviour; this did mean that my record of transcripts may have at times been inaccurate.

4.4.4 Occupancy monitoring insights

Ethnographic observations and interviewing together resulted in detailed, contextualised accounts that allowed me to further my understanding of student behaviour during transition. These ethnographic methods were, however, limited by my inability to spend extensive periods of time observing and recording phenomena. The unique opportunity to support this qualitative data with more objective, automated space occupancy monitoring data helped me to address this ethnographic limitation. Occupancy monitoring was a useful method in the ACEX setting particularly when triangulated with Celcat timetabling data (institution's central timetabling system) and ethnographic snapshots, which provided information on planned and actual activity in the spaces respectively. For example, non-timetabled lunchtime periods presented spikes in breakout space occupancy which I confirmed through observation as a result of lunchtime activity.

Occupancy monitoring resulted from an institutional pilot with Lone Rooftop (within which the ACEX building was an initial member) which intended to optimise campus space usage and room bookings/allocations. Real time occupancy data was generated by identifying individuals within defined spatial zones as an anonymous count, using the connectivity of their technological devices to WiFi routers. Business Intelligence Dashboards (BID) generated raw excel data and plotted this occupancy data against time, producing temporally-stable logs of occupancy which I present in tabular and graphical form in this study. This data has been powerful for two reasons. Firstly, it enabled me to triangulate cohort-level occupancy patterns with my observations and sociograms, including during timetable transitions (e.g. lecture sessions beginning or ending). Secondly, it provided me with unique access to a repository of 24/7 occupancy data such that I could more freely explore autonomous occupancy trends independent of my ethnographic fieldwork to test ideas about cohort-level transitions in non-observable contexts.

4.4.5 In-depth interviews

Interviews are a socially constructed exchange in which the participant is invited to supply information which the interviewer gathers, making it possible to infer what a person knows (knowledge) and thinks (beliefs) (Tuckman, 1972). The short length of ethnographic field interviews prevented an in-depth, purposeful exploration of participant experiences in their social worlds (Atkinson et al., 2001). In-depth, semi-structured interviews compensated for this by inviting *descriptive* (what do you like about...?), *structural* (do you work differently...?) and *comparative* (how does it compare...?) responses from students and lecturers (Madden, 2017). Semi-structured interviews typically conform to a flexible style in which the interviewer will prepare questions that align with their research interest, but may not ask all questions and be tangential when pursuing interesting topics in interview (Punch, 2013; Savin-Baden and Major, 2013). Interviews were conducted one-on-one, lasted 45-60 minutes and provided the participant with the opportunity to think across space and time, such that they could reflect on their perception, expectation and behaviour in the Blackett spaces. This allowed me to deepen my understanding of participant perception of and engagement with transitional space, beyond the validation of previous methods.
Unlike ethnographic field interviews which were carried out in-situ, these longer in-depth interviews were conducted remotely via Teams due to the onset of COVID-19 restrictions. Whilst the contextualised nature of field interviews helped me to understand local transition in space, in-depth interviews were more distanced from the experience and produced a different type of insight (Banfield, 2004). Conducting interviews remotely also meant I was able to organise and conduct the interview at the convenience of the participant by agreeing on a set of conditions (time, length etc.) that would allow them to be most comfortable. The interviewee had full control over where to video call from and were not required to travel to meet me face-to-face (Braun et al., 2017). The video-based approach did, however,

reduce my ability to gather non-verbal information as effectively as face-to-face approaches. Nonetheless, remote interaction enabled video- and audio-recording for later transcription and analysis, allowing me to refer back to visual cues (such as body language) otherwise not articulated (Knapp et al., 2013). Although notes were recorded on my laptop to capture pertinent points, the audio recordings were more heavily relied upon in this interview phase so that I could focus on the conversation.

Interview questions were designed to invite participants to volunteer relevant information unprompted initially, before being further probed with more closed-ended questions (see appendix 7 for questions). Most of the prepared questions were asked, with some deviation when participants provided interesting responses. These longer interviews constituted the final phase of the research, at which point the thematic focus was clearest and the richest data could be gained in relation to the evolving research questions.

4.5 Data collection

The first half of data collection consisted of naturalistic ethnographic observation of activity inside ACEX LT1, the adjoining breakout space and the 'space' between. The second phase of data collection continued to adopt a similar approach, using ethnographic observation of activity in Blackett LT2, the adjoining foyer and the 'space' between. In both settings, I followed interesting observations up with purposeful field interviews in the informal spaces to ask participants brief questions about how they were using the space and how they perceived different aspects. Methods used in ACEX and Blackett are summarised in table 4.4.

My approach to when and how to observe in each setting was guided by timetabling data which I used to identify appropriate timetabled sessions in ACEX LT1 and Blackett LT2. Given my interest in transitions between formal timetabled and informal non-timetabled spaces, I often selected timetabled sessions with 'free' time either side which I would turn

Table 4.4: Data collected in ACEX and Blackett settings (N = not used)

Methods	**ACEX**		**Blackett LT2**	
	Breakout only	Breakout and LT1	Pre-renovation	Post-renovation
Ethnographic observations	20	10	10	20
Field interviews (student)	20	5	6	10
Field interviews (lecturer)	N	N	2	7
Occupancy data (hours)	60	60	N	N
Sociograms	10	N	N	N
In-depth interviews (student)	N	N	N	4
In-depth interviews (lecturer)	N	N	N	3

up to 15 minutes prior to capture pre-session activity in the informal spaces. I also observed activity in the informal spaces independent of these lecture transitions and carried out field interviews during informal space or post-session observations. Much of my observational activity throughout the ACEX phase was supplemented by analysis of 'objective' occupancy data. These 24/7 occupancy insights enabled me to redirect my observation attention to things other than manually counting space occupancy.

The 10 lecture observations in ACEX LT1 spanned 4 different lecture courses across 3 year groups, whilst the 10 lecture observations in pre-renovation Blackett LT2 spanned 3 different lecture courses; all of these sessions conformed to didactic transmission lecturing. Observing different lecturers and modules allowed me to better understand the influence of each physical lecture theatre as a 'fixed variable' on student engagement with different pedagogic styles and taught material. This led into my final 20 observations in refurbished Blackett LT2, which spanned 4 different lecture courses. In this phase, I selected timetabled sessions that conformed to a mixture of pedagogic modes, including 6 sessions which retained a didactic transmission format like those pre-renovation, and the rest of which were more

interactive and problem-based. For observation of interactive activity, a total of 10 sessions were attended for the 'Year 1 UG seminar' series and the remaining 4 interactive sessions belonged to the 'Research Interfaces' module with 4th year undergraduate students. Toward the end of ethnographic data collection, I conducted 4 observations within the Blackett refurbished foyer space before the onset of the COVID-19 pandemic. This led into my recruitment of students and lecturers for in-depth interviews.

4.5.1 Participants and recruitment

Having identified appropriate timetabled sessions from Celcat timetabling data, I approached session leaders on email to seek their informal written consent for my observation of their taught sessions. These emails attached a 'Research information sheet' (see appendix 1) to provide the recipient with information about my planned research activities. My attendance at these sessions provided me with assurance of participant identity, which gave me greater control over purposeful recruitment of undergraduate students for field interviews. For example, students waiting outside LT2 prior to a Year 1 UG seminar session were most likely 1st year students, and those seen leaving these sessions were almost certainly of that status. However, my observation of informal ACEX breakout space activity afforded me less control over participant identity and meant me pursuing interviews with a small number of postgraduate students or undergraduate students from other departments. The public nature of the informal spaces meant that anyone using the space automatically became an observee. Hence, the focus of this study has remained on student activity within and between the spaces explored, rather than the characteristics of users within them.

Of the 25 students field interviewed in the ACEX setting in table 4.4, 6 were 1st year, 6 were 2nd year, 4 were 3rd year, 6 were 4th year undergraduates and 3 were PhD students. 85% of these users were from Chemical Engineering, with the remainder from other departments in

the faculty. Of the 16 students field interviewed in the Blackett setting, 5 were 1st years, 2 were 3rd years, 8 were 4th years and 1 was a PhD student; all but 1 of these participants were from Physics. 9 lecturers were field interviewed in Blackett, 8 of whom had been observed teaching in LT2. Only one 4th year student was field interviewed following the refurbishment of the foyer space before the ethnographic phase ceased due to COVID-19.

To add depth to the ethnographic data, I in-depth interviewed 4 undergraduate students and 3 lecturers on Teams. The inclusion/exclusion criteria I applied was that all participants must have either taught or learned in refurbished LT2 and preferably attended one of the sessions I observed. I prioritised participants that had been subject to the greatest observation focus, such that I initially approached and leveraged the trust of lecturers who I had already interacted with when planning my observations or field interviews. All 3 lecturers approached on email agreed to partake in in-depth interview; following their interviews, the leaders of the Year 1 UG seminar series (Joe) and Research Interfaces module (Ruth) agreed to circulate a recruitment email to their student cohorts for in-depth interview. This resulted in voluntary response on email from three 1st year students and one 4th year student who all expressed interest in partaking in a Teams interview.

My predominant observation of the Year 1 UG seminar module justified the participant proportioning seen in table 4.5 which summarises pseudonyms for each of the 7 in-depth interview participants who I refer to in chapters 5, 6 and 7.

Table 4.5: In-depth interview participant pseudonyms and status

Pseudonym	**Status**	**Observed course attended**
Alex	1st year undergraduate	Year 1 UG seminars
Felipe	1st year undergraduate	Year 1 UG seminars
Huan	1st year undergraduate	Year 1 UG seminars
Maria	4th year undergraduate	Research Interfaces
Joe	Interactive lecturer	Year 1 UG seminars
Ruth	Interactive lecturer	Research Interfaces
Mark	Transmission lecturer	Quantum Optics

4.5.2 Fieldwork timing

Ethnographic fieldwork in both settings was carried out within the confines of the work day within academic term time periods. To ensure this, a similar approach was adopted to Pantidi (2013) in which all observations took place within one of three time zones throughout the study day: morning (9-12), early afternoon (12-3) and late afternoon (3-6). Individual observations typically lasted between 30-90 minutes, depending on if I attended timetabled lecture sessions or if my focus was solely on informal space activity. Access to Celcat timetabling data and dialogue with session leaders enabled me to plan when best to conduct these observations and meant that I captured a good spread of daily activity within each of the time zones. Occupancy data for the ACEX spaces gave me real time insight into actual activity and an ability to check the occupancy of each space prior to physically visiting. All field interviews lasted around 5-10 minutes and conformed to a structured style.

ACEX ethnographic data were gathered across a period of close to one year, beginning in May 2018 and finishing in April 2019. Whilst I endeavoured to observe at least once every week within the academic year, some weeks were missed due to holidays and in other weeks observation sessions were carried out more than once. Blackett ethnographic data collection was similarly carried out across a period of one year, beginning in February 2019 and concluding in February 2020. This meant there was a small overlap between finishing ACEX observations and beginning observations in the pre-renovation Blackett spaces. Refurbishment of Blackett LT2 meant there was a period of a few months in which the lecture space was refurbished and data could not be collected; I used this time to analyse data collected until that point, and to plan the rest of the Blackett data collection phase.

For the in-depth interview phase, interviews with student and lecturer participants began in April 2020 and finished in June 2020. The onset of the first UK lockdown in March 2020 required Teams interviews to be carried out from home within the confines of the work day.

4.5.3 Ethical considerations

This study has conformed to the institution's ethical guidelines which align with British Educational Research Association (BERA, 2018) best practice. My completion of 30 observations and 25 field interviews in the ACEX setting served as a useful testing ground for the identification and management of ethical issues prior to my similar conduct of 30 observations and 25 field interviews in the Blackett setting (see table 4.4). The similarity in space configuration and timetabled usage meant that the characteristic behaviours of participants and associated ethical risks were similar in each setting. I therefore in this section introduce and contrast the ethical considerations for ethnographic fieldwork in the ACEX and Blackett setting, after which I explore a separate set of ethical considerations for the remote in-depth interview phase.

Ethnographic observation

It was not appropriate to obtain 'informed consent' from people observed in the ACEX breakout or Blackett foyer space. To have sought it may have interrupted normal behaviour and invalidated the data collected. As an Imperial PhD student, my presence in each public space was not inappropriate and did not pose any particular ethical difficulties given the demography of each setting. However, the process of conducting research and recording field notes required me to seek consent from each faculty to ensure they were comfortable with my plans for observation. Similarly, given that ethnographic observation took an unobtrusive, naturalistic approach, it did not raise any inappropriate power issues or coercion as students were largely unaware of, and unaffected by my presence. Whilst my intent was to be non-participant, I behaved in a similar way to other users, sitting or standing at the periphery of the informal spaces using my laptop to invite acceptance and better learn the cultural rules of behaviour by seeing through the eyes of the user (Spradley, 2016).

The main potential ethical issue that arose from naturalistic ethnographic observation was that of anonymity and protecting the identity of those observed. Whether or not an individual was recognisable during an observation, they were always recorded anonymously in my field notes. Appropriate descriptors were then used to capture the apparent status of people and activity, such as 'female member of staff' or 'group of male Caucasian students' to capture richness of context in the data. Therefore, at no time during observation were individuals identified or intervened with. The only scenario in which I was prepared to intervene for non-data collection purposes was in the unlikely event that a person appeared to need help, as would be the case in normal circumstance. My personal judgement, previous experience and use of campus support services appropriate to the situation would have been engaged, and in extremis, identification of the individual would have been made if they were deemed at risk. Fortunately, no such circumstance was encountered during the ACEX or Blackett phases, given the spaces, times and planned activity selected for observation posed no particular risk to the people within them. Observation of educational activity at busy or stressful times, such as during examinations, was able to be avoided due to my access to both Celcat timetabling data and real time occupancy data. Even still, the observations I made in no way influenced these situations, likely resulted in me remaining 'invisible' to those observed and resulted in no academic advantages or disadvantages for observed or non-observed individuals, besides the potential longer-term benefit of this research on the educational environment.

I spent 4 hours prior to ethnographic fieldwork familiarising myself with the formal and informal spaces in each setting (Pantidi, 2013). This led to me positioning myself toward the back of ACEX LT1 and Blackett LT2 to remain inconspicuous to students attending. Session leaders never had any obligation to acknowledge my presence, and rarely did so. My apparent status as a slightly older PhD student meant that whilst I 'blended

in' among undergraduate students, I could have been mistaken as a Graduate Teaching Assistant (GTA) in undergraduate seminar sessions in LT2. The refurbished LT2 space and normalisation of interactive learning therefore posed slightly different ethical risks to the didactic transmission lectures, given students talked more and were therefore more likely to initiate conversation with me as an individual present in the session. The only time I was subject to student-directed interaction was in the rare instance a student would enter a seminar session late, mistake me for a teaching assistant and ask me a question about their seminar group allocation. In this scenario, I admitted my status and intended presence and redirected the student to an appropriate staff member in LT2. My positioning in a booth toward the back row of LT2 helped to minimise the chances of this interaction.

Ethnographic field interviews

There were no particular ethical issues concerning me taking the time of others during observation, apart from in my progression from observation to purposeful field interviews. Individuals were always approached politely and sensitively in the informal spaces, allowing me to introduce myself as a 'PhD student conducting research about how students interact with learning spaces' to reduce any perceived power difference and the possibility of coercion. An explanation of the nature of the interview followed, expressing my intent to ask them a 'short set of questions' which will take no longer than '5-10 minutes' (see appendix 4 for field interview introduction). There was no exclusion or inclusion criteria for interview beyond the presence of users being involved in a behaviour of interest within the observed space. All participants were assured of not being identified, anonymity of their data being retained and no risk or benefit attached to participating or otherwise. In a small number of cases, participants declined my invitation for field interview, this was noted in the field notes and an apology was given.

Recruitment for field interview was based solely on observed situations, whereby formal informed consent was not appropriate in these circumstances, as the time cost of the consent process risked reducing the quality of the collected data by distancing it from the observed behaviour. Brief informal oral consent posed less risk and was commensurate with the style of brief informal questioning (Spradley, 1979). Questions were structured, not contentious and instead served to clarify the observed behaviour of the participant and to retrieve non-observable context such as what the participant currently studied and whether they used the space often. It is extremely unlikely that a participant would have raised any ethically sensitive issues, should any have arisen, I would have appropriately dealt with them using available support services. I would protect anonymity unless I had genuine cause to suppose the participant or others were at risk, only then would I break confidentiality in a professional manner. The nature of this interview method meant that there was little way of knowing if a participant was busy or stressed prior to approaching them and so all people were given sufficient opportunity to decline with minimal interruption of their activity. Furthermore, the avoidance of stressful or sensitive times/places, such as students waiting to enter an exam, minimised the chances of this interruption. If, during the short interview, a participant changed their mind about contributing, they were not forced to do so, and the event was recorded in the field notes.

The main difference between student field interviews in each setting was the focus of the questions, given my focus in the Blackett setting concerned the refurbished LT2 space (see appendix 5 for script). Furthermore, field interviews with 9 lecturer participants in Blackett implicated a different set of ethical issues to those with students. I had formed a preexisting connection with 8 of these lecturers having planned observations of their sessions, at which point I mentioned the prospect of later interviewing them. This enabled me to more effectively approach these lecturers on email or at the end of a lecture session to invite

them for a field interview. All approached lecturers responded positively and either accepted an in-situ field interview within the LT2 or foyer space, or suggested we meet for example in their personal office. The greatest ethical concern was that by having already permitted my observation of their session, these lecturers may have felt obliged or coerced to partake in the interest of their own reputation and practice. Although my recruitment approach was targeted, I mitigated this coercion risk by sending a research information sheet to all lecturers which clearly specified that their participation or not in field interview would have no bearing on their professional development, and that I belonged to a research unit independent of their department. Whilst I was able to mitigate for this recruitment coercion, I had limited control over how this perception of me and my research may have biased field interview responses and thereby skewed the data.

In-depth interviews

Following ethnographic fieldwork, I carried out remote in-depth interviews with a total of 4 student and 3 lecturer participants (see table 4.5). All participants had attended sessions I had observed and some had already been field interviewed by me. My continued presence and recognition by certain members of the department may have obligated some participants to partake in in-depth interviews. For lecturers, I might have mitigated this coercion risk by opting for the 'fairest' sampling approach by asking departmental administrators to send a blanket email inviting all educators that had taught in LT2. However, this approach was inappropriate given the coincidence of recruitment with the stressful COVID-19 transition to working from home. Whilst emailing all LT2 lecturers would have limited recruitment bias and coercion, it risked placing undue strain on individuals whom my work and I were unbeknown to during this turbulent period. I therefore decided to take a more targeted sampling approach to lecturer recruitment by sending personal emails to lecturers with

whom I had a preexisting relationship. Their awareness of my research allowed me to better communicate the expectations of in-depth interviews, compared to those participants who might have received an invitation 'blind' having had no prior involvement in my work. Furthermore, leveraging preexisting relationships with lecturers benefited the online nature of the interview interaction where a common understanding had already been reached face-to-face (James and Busher, 2016). With this targeted approach, there was always a risk that lecturers who had already engaged with my research perceived a declination of interview as negative for their reputation and practice. Similar to the coercion risk associated with lecturer field interview recruitment, I mitigated this by assuring all participants that my research had no bearing on their professional practice, and that they could opt out from participation or withdraw their data up until the point of transcription and analysis.

For students, their recognition of me as a continued presence in, for example, the seminar series may have led them to falsely perceive me as a member of departmental staff attached to the module. To mitigate this potential misconception and recruitment coercion, I encouraged observed LT2 session leaders to send an open invitation for interview to their student cohorts attaching my research information sheet. By having lecturers send this recruitment email to their students, it legitimised the opportunity and provided recipients with full control over their decision to volunteer themselves on email if they were interested in participating. This was a successful recruitment approach given a small number of students enthusiastically approached me on email. Given I did not provide financial incentives for participation in interview, engaging lecturers in student recruitment increased their own motivation to participate in my study, as they became increasingly intrigued by student perception of LT2 and the outcomes of my research.

Once participants had indicated their interest in participation, I proceeded with informed consent protocols where I encouraged participants to read the 'Participant information

sheet' (appendix 2) and electronically sign an 'Informed consent form' (appendix 3). These documents assured all participants that their anonymity would remain protected, that their data would remain confidential and that they could withdraw themselves and/or their data up until the point of transcription and analysis. As with field interviews, the questions asked to both student and lecturer participants were non-contentious (see appendix 7 for questions). The longer nature of in-depth interviews, use of open questions and semi-structured style did pose greater risk than structured field interviews for the raising of sensitive topics by participants. Although this was never the case, I would have responded by steering the interview away from the topic unless further intervention was required for the well being of the participant.

Unlike field interviews which were face-to-face, in-depth interviews were carried out remotely online to avoid chance of infection transmission. I opted to use Teams for all remote interviews because participants were familiar with this institutional standard platform, helping to limit any power difference between us. All participants consented to the interview being audio recorded and were able to choose whether they turned on their video or not. Whilst the online approach meant that my *sight* with the participant was interrupted (James and Busher, 2016) and non-visual cues were more difficult to interpret (Seitz, 2016), the video recording function helped to mitigate this during later analysis. Remote interviews presented challenges for some older lecturer participants who were adapting to working from home and seemed concerned about interview interruption from family. I remained sensitive to these competing demands and offered times and dates that would help participants to minimise the risk of interruption and be as comfortable as possible during the interview; this flexibility to schedule remote interviews at the convenience of the participant was a benefit (Deakin and Wakefield, 2014). However, I only had so much control over the negotiation of a 'safe' online environment, given the privacy of the conversation was also

determined by the participant's chosen location. I used earphones to limit the chance of the interview being audible to others and encouraged participants to use them also. A separate challenge common to all interviews related to the reliability of internet connectivity, which at times affected the quality of the online interaction and rendered segments of the audio recording indiscernible. I suggested that participants might mitigate this by using Ethernet connection which I used myself. The trust acquired with participants through our previous face-to-face interactions caused most participants to be receptive to these suggestions. Whilst I made some notes on my laptop during in-depth interviews, I relied predominantly on the transcribed audio data which freed my attention during the interview.

In all phases of data collection there has been a potential risk of bias, given my observations and interpretations may be influenced by my personal interests. However, good ethnographic practice has been followed by recording full field notes and discussing their interpretation with the research supervisor and others to mitigate against unconscious and conscious bias. As with all interpretive research it is impossible to completely eliminate 'bias' (Creswell, 2002). The important thing has been to recognise it and manage it, through for example my keeping of informal written diaries, as part of remaining reflexive (Somekh and Lewin, 2005). Whilst my familiarity with context and positionality may have introduced bias, it has arguably provided contextual awareness and aided deeper engagement with the data.

Ethical considerations for data collection in the ACEX and Blackett setting were submitted to and scrutinised by the Imperial College Education Ethics Research Process (EERP). For the ACEX phase, a total of two detailed applications were submitted to EERP and for the Blackett phase, a total of one detailed application and two amendments. This incremental approach to ethical approval returned constructive feedback from experienced reviewers, which allowed me to be reflexive and to ensure that all aspects of the research remained aligned with BERA guidelines (BERA, 2018).

4.6 Data analysis

In this this section I introduce the thematic analysis method used to analyse data in this study. I specify the stages in this analytic process, the 'tools' I used to achieve these steps and reflect on the challenges of this approach.

4.6.1 Reflexive thematic analysis

I have used the thematic analysis method (Braun and Clarke, 2006) to analyse both my ethnographic field note and interview transcript data. This analysis approach is defined:

> 'Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes further than this, and interprets various aspects of the research topic' (Braun and Clarke, 2006, p. 79).

Whilst this is a broad definition, thematic analysis is about developing 'themes' in qualitative data which are patterns of shared meaning unified by a central organising concept (Braun and Clarke, 2013). These organising concepts arise from drawing relationships between different segments of the data which are assigned units of meaning called 'codes' (Miles et al., 2018). Themes ideally appear in a number of instances across the data set, although some themes are more prominent across data sets than others.

Thematic analysis is believed to be influenced by earlier content analysis and has evolved since its earliest use in the 1930s to include different approaches. One approach to thematic analysis is oriented around 'coding reliability' (Boyatzis, 1998) and conforms to a positivist paradigm where deductive (theory-driven) analysis is more typical. 'Reflexive' approaches (Braun and Clarke, 2006) are fully influenced by a qualitative paradigm and more commonly take an inductive (data-driven) approach; this is also more concomitant with phenomenology

(Miles et al., 2018). *Reflexive thematic analysis* has been used in this study since according to Braun and Clarke (2019), quality thematic analysis is about the researcher's reflective engagement with their data, and their reflexive engagement with the analytic process. Given the interpretivist paradigm adopted in this study (Sandberg, 2005), themes are best thought to be produced at the intersection between the researcher's theoretical assumptions, skills and the data themselves. Under this paradigm, I perceive myself, the researcher, as a social actor who has used their knowledge and experience to discover how other social actors perceive, construct and interpret spaces for transition (Geertz, 1973; O'donoghue, 2006). One of the strengths of reflexive thematic analysis is its theoretical flexibility (Braun et al., 2014) which unshackles the researcher from having to use certain theories, like activity theory, for analytical purposes; this is commensurate with my flexible theoretical framework. Rather than capturing themes in the data based on frequency of occurrence like with content analysis, thematic analysis is more strongly linked to the research questions and central organising concepts.

My ethnographic approach meant me inscribing primary field notes that were a product of my embodied experience and meaning-making in the field (Madden, 2017). Whilst these ethnographic inscriptions can be treated as raw data, they were 'cooked' by what I 'saw' and the choices I made as an ethnographer (Kouritzin, 2002). Through reflexive thematic analysis, I repeatedly (re-)read this data in an active way to extract latent meaning through my evolving critical perspective (Madden, 2017). In cycling back and forth between data collection and analysis as part of a simultaneous process, much like the 'hermeneutic circle' (Gallagher, 1992), I was able to identify 'transition' as a uniting concept which linked multi-faceted themes between each space to enrich the story I was telling. A priori theory like the ecological systems model (Bronfenbrenner, 1979) provided me with metaphors for understanding and analysing these transitional phenomena.

4.6.2 Phased process

My use of multiple methods in the ACEX and Blackett settings has meant a phased approach to data collection and analysis (Creswell, 2002). The essence of ethnography as description and analysis together meant that I always kept my observations and initial interpretations separate. Thematic analysis of this ethnographic data allowed me to elicit patterns of behaviour in the ACEX setting, which can be seen as the first phase of analysis in figure 4.9. Whilst this diagram positions analysis as a linear process made up of discrete phases, the actual process involved multiple iterations of returning to previous data and themes to reinterpret based on my changing ethnographic gaze (Madden, 2017).

In parallel to ACEX ethnographic data collection and analysis seen in figure 4.9, I analysed a total of 120 hours of occupancy data to inform and supplement this phase. Quantitative occupancy analysis involved me sifting through raw excel data and graphical occupancy trends for academic days conforming to certain timetable configurations, which could be corroborated with my ethnographic snapshots of in-situ behaviour. I also analysed occupancy trends independent of this ethnographic capture, such as on weekends or during holiday periods when no LT1 activity was timetabled. This gave me contrasting insight into unconventional usage of the ACEX spaces.

The first set of ACEX themes raised important questions which I sought to explore in my second phase of ethnographic data collection in similar traditional learning spaces in the Blackett setting. The analysis of data from the ACEX setting to some extent guided my choice of the Blackett setting, especially given the institution's plan to invest in redesign of the Blackett spaces. By being embedded within the culture I was studying, my ethnographic findings naturally fed into conversations with architects, designers and building managers involved in the redesign process. Whilst these research-informed 'interventions' were opportunistic and not a planned aspect of my methodology, they enabled me to test the

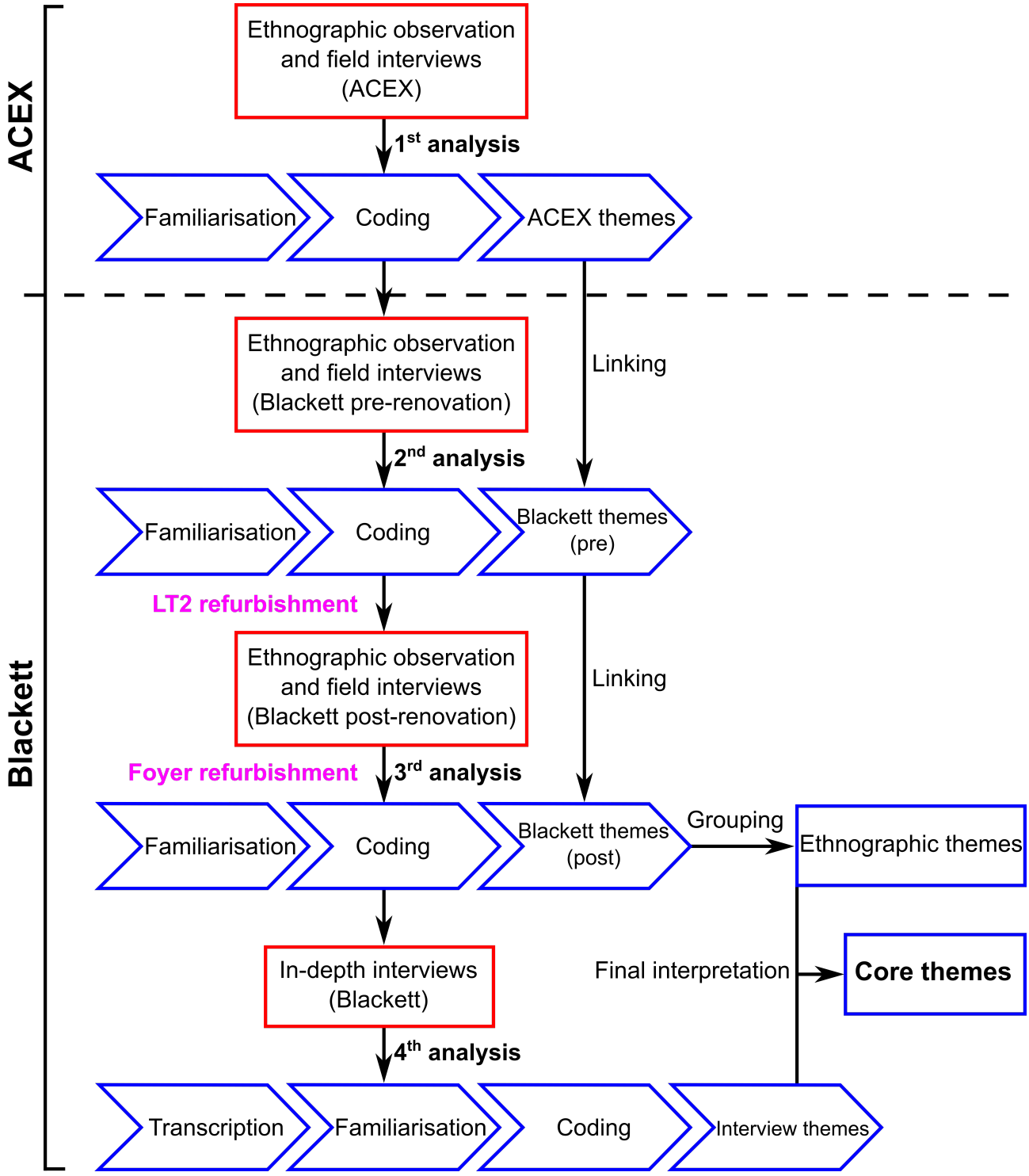


Figure 4.9: Data collection and analysis process

robustness of my data collection, analysis and findings relating to the ACEX setting.

I grouped themes across the two settings prior to the in-depth interview phase relating to the refurbished Blackett spaces. The final stage of analysis involved me grouping themes across all traditional and refurbished learning spaces to help answer the research questions. The stages of thematic analysis taken at each phase in figure 4.9 are detailed in table 4.6. These

phases in reality coalesced, because although meaning-making began during my inscription of ethnographic field notes, I kept my 'raw' observations and interpretations separate, and only coded the data once I had left the field. This led me to confirm or discard codes and themes as I continually mined and revisited the ethnographic data.

Table 4.6: Thematic analysis stages adapted from Braun and Clarke (2006) (p. 87)

Stage	**Description**
1. Familiarising myself with data	Reading ethnographic field notes (OneNote) Transcribing interviews (Otter.ai, Teams) Noting down ideas (OneNote)
2. Generating initial codes	Systematically coding interesting chunks of data (NVivo 12) First across ethnographic field notes Then across interview transcripts
3. Searching for themes	Grouping codes into themes (NVivo 12) Linking themes to all data (NVivo 12)
4. Reviewing themes	Generating a thematic map (Cmap) Ensuring themes work in relation to coded extracts (NVivo 12)
5. Defining and naming themes	Ongoing analysis to define themes (NVivo 12) Refining the story the analysis tells
6. Producing report	Relating analysis back to research questions and literature Producing a report of analysis (LaTeX Overleaf)

I have alluded to the software tools used within each stage in table 4.6. NVivo 12 allowed me to import all textual data, organise it into data sets, create codes highlighted in the raw data, and to group codes into themes. For observation, this began with my identification of descriptive themes of behaviour in the ACEX breakout space such as 'Using laptop' and 'Peering into lecture theatre' which I cross-checked with field interview responses. These initial behavioural themes were then categorised and analysed in relation to transition within, into and out of timetabled lectures. The ability to draw relationships quickly between segments of coded data accelerated the analysis process and was further assisted by concept mapping tools like Cmap. Although I used Otter.ai and Teams to assist with interview transcription, I manually produced written transcripts in Microsoft Word which assisted with familiarisation.

4.6.3 Challenges

The challenges faced during data analysis could be deemed typical of any qualitative investigation. Data analysis was a laborious process which required energy and persistence (Basit, 2003), given I collated and analysed a total of 120 hours of occupancy data, 60 observations, 50 field interviews and 7 in-depth interviews. One challenge involved my transcription and organisation of this data, and my relationship with that data. Whilst digital transcription can accelerate the analysis process, Jones (2007) notes that it can '...distance the researcher from their research by providing a buffer between the person and their data' (p. 8). I therefore opted to manually transcribe all interview data with minimal assistance from software like Otter.ai. Field interviews were not audio recorded like in-depth interviews, which made accurate recording of interview notes in the field challenging.

An additional challenge included linking themes from the ACEX setting - which were generated inductively and tied to the first research question - to themes in the later Blackett setting. This marked a transition from a 'semantic approach' earlier on in ACEX (where themes were identified within the explicit meaning of what a participant had said) to a 'latent approach' later in Blackett (where underlying ideas and conceptualisations began to shape the semantic content of the data) (Boyatzis, 1998).

An additional challenge was linked to my earlier findings feeding into the parallel institutional design processes, which resulted in a refurbished LT2 and foyer space that made my earlier hypotheses testable. I was required to be operationally flexible and intimately aware of my own influence on the modifications made to the ethnographic field I was studying. These parallel interventions were not planned in the context of my ethnographic research which meant that although I fed into them, my approach should not be deemed design-based research (Brown, 1992).

Chapter 5

Space for in-situ transition?

5.1 Introduction

This chapter embarks on the findings resulting from ethnographic observation, field interview and occupancy data for traditional Lecture Theatre 1 (LT1) and the adjacent breakout space in the ACEX setting. It also introduces ethnographic data from the traditional (pre-renovation) Lecture Theatre 2 (LT2) and adjacent foyer space of the Blackett setting to better understand *in-situ* transitions. In-situ transitions are those that are observable, reportable and situated within the temporally and spatially bounded spaces studied (defined in section 3.5.1). This chapter therefore addresses the first research question:

> What are the nature of transitions in learning spaces?

Whilst I carried out 10 observations in pre-renovation Blackett compared to 30 observations in ACEX (refer back to table 4.4), collecting data in different disciplinary settings with similar spatial configuration has helped me to understand the nature of transitions in 'traditional' learning spaces. I have plotted the traditional ACEX LT1 and breakout spaces as separate microsystems on the adapted ecological systems model in figure 5.1 to demonstrate how they connect in the mesosystem and support important in-situ transitions.

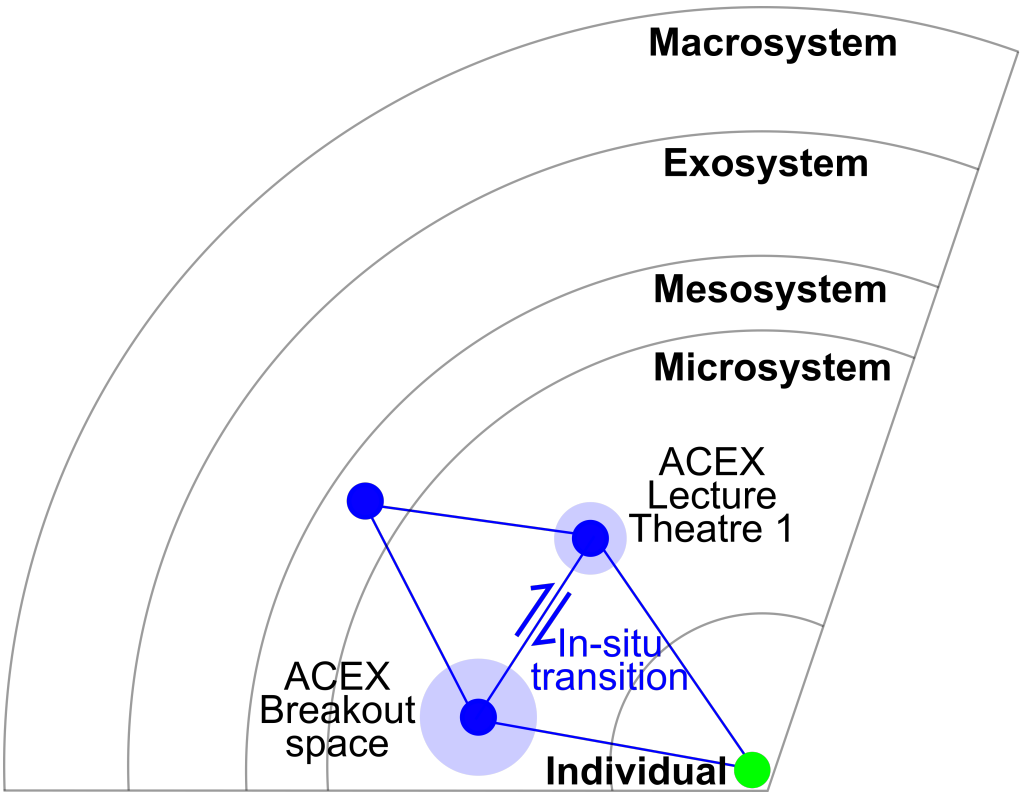


Figure 5.1: Traditional (blue) ACEX LT1 and breakout spaces plotted as microsystems on ecological systems model with in-situ transition within and between

5.2 ACEX breakout: a free space

This section introduces the properties of the ACEX breakout space identified and interpreted from my analysis of ACEX ethnographic data. These data pertain mostly to undergraduate users of the space and in combination with my analysis of objective occupancy data have helped me to characterise this space as a student-owned, social space with patterns of transitional activity linked to LT1. Contextual information about this informal breakout space can be referred back to in section 4.2.2.

5.2.1 A student-owned space

One of the first set of striking observations I made in this space was its predominant usage by undergraduate students. As a publicly accessible space connected to the entrance of the Department of Chemical Engineering and postgraduate research offices in the Department of Computing, the demography of the space was mixed yet heavily used by undergraduate

students. My observation of apparent undergraduate users was able to be confirmed when I approached individuals and small groups for field interviews. Of the 25 participants I approached for field interview in the breakout space, 23 were undergraduate students. 19 of these undergraduate students were from the home Department of Chemical Engineering and the remaining 4 students were from other departments in the faculty. These sample statistics are reasonably representative of the demography of users in this breakout space during a typical weekday in term time.

It became evident from ongoing observation that one of the main reasons for this undergraduate student demography was the proximity of this breakout space to undergraduate teaching activity in nearby Lecture Theatre 1 (LT1) (see figure 4.6) and more distally, to ACEX Lecture Theatre 2 (LT2). LT1 is used predominantly for timetabled lectures for 1st and 2nd year cohorts, whilst LT2 is used mostly for teaching 3rd and 4th year courses. In studying ACEX LT1, I naturally became more involved with early year chemical engineering undergraduate participants as a function of who used the spaces I was observing. This connected teaching activity seemed to result in a 'formal' negotiation of the breakout space as an undergraduate territory. This territory was, however, 'disputed' by other members of the department, including PhD students and academic staff members who were observed frequently passing through the space or eating lunch. The presence of these other members seemed to result in more 'informal' negotiations for ownership. The expectation of this breakout space as an 'extension' of LT1 was confirmed in field interview with a 2nd year PhD student from the department who was approached when waiting in the breakout space for fellow postgraduate friends, reporting that this space was:

> "Not a place for work, because the UGs are here - sometimes I can't even come here to eat because it is so full. UGs tend to do group work here a lot as they have nowhere else".

The quote from this postgraduate member of the department strongly suggests that this breakout space is undergraduate student-owned, particularly during term time when they attend lectures in LT1. He also links the predominant use of the space by early year undergraduates to the limited space alternatives for this group of students. This undergraduate affinity to the breakout space is in spite of its underlying function as a throughway corridor (see photograph in figure 4.6) which on first impression is used as a social space for relaxing with friends, eating lunch and waiting for activity elsewhere. This mixed and flexible usage was confirmed with all student participants in field interviews, who were asked how they tended to usually use the space. These reported activities were then grouped into activity categories during data analysis of the ACEX ethnographic data, which can be found summarised in table 5.1. My categorisation of these activities is based primarily on participant interview response and is therefore subjective. I was able to build confidence in these categories from ongoing observation of activity and documentation of patterns of behaviour.

Table 5.1: ACEX breakout space categories and percentages of reported activities

Reported activity	**Participants (%)**
Talking (non-work)	32
Talking (work)	12
Using technology (non-work)	36
Using technology (work)	28
Eating food	20
Waiting	16

The percentage of participants that reported activities characteristic of each category is also shown in table 5.1. Some participants confirmed in interview undergoing more than one activity simultaneously, for example, an individual waiting for a friend whilst also scrolling through social media on their laptop for non-work purposes. The percentage breakdown shows that based on this sample of 25 field interview participants, the most common activities were 'non-work' related talking (32%) and use of technology (36%).

The prevalence of these activities supports the characterisation of this breakout space as a student-owned, social space. Nonetheless, important 'work-related' learning behaviours arising from interaction with technology and people were equally prevalent to the non-work related activities, and are focused on later.

In addition to the mere presence of undergraduate students in this breakout space and their reported activities suggesting a high level of ownership, aspects of their observed behaviour helped me to confirm this. The observed material interactions of students with the space indicated a level of trust and agency within it. This was particularly evident during one observation when two students from a group of eight were seen moving stools from one side of the space to the other side where the rest of their group were sat discussing what I monitored as a "project". Other examples of this agentic interaction with the material space included my separate observation of two students who had just left an exam in the nearby LT1 space. They proceeded to place their belongings on a low coffee table in the breakout space and talk to friends further away in the crowded breakout space. This trustful material interaction and modification of the breakout space to suit the immediate needs of the student user suggests a high level of perceived ownership. Furthermore, I came to interpret material interaction and a high degree of user agency as something enabled by a mutual trust between space users which resulted in a 'free' social space.

5.2.2 Elastic power-geometry

Massey (2007) uses the term *power-geometry* to capture the social and political complexity of spaces by considering the wider relations of power within which they are set, shaped by economic, political and cultural influences and resources; this theoretical concept is introduced and explained more in section 3.6.2. The elasticity of power-geometries, that is the ability to negotiate change and innovation without letting it interfere excessively

with one's own rhythms and goals (Antonelli et al., 2008), seems linked to negotiation of ownership among users in a space. This determines who feels empowered and dis-empowered. My ethnographic observations and field interviews indicated that the ACEX breakout space has an elastic power-geometry that was influenced and reproduced by transition of undergraduate students into and out of their timetabled activity in the connecting Lecture Theatre 1 (LT1) space. This ritualistic movement between each space seems to have contributed significantly to the high level of undergraduate student ownership during term time. When asked why she chose to use the breakout space, a 3rd year chemical engineering student explained how the 'convenient' location of this space proximal to her timetabled lectures in LT1 guided her choice of study space:

> "I like departmental spaces because of convenience and because of the micro-community from being around other departmental members and friends. However, I would also say the way my friends and I use departmental spaces has changed over the course of our degree, as we now use different spaces to first year students for example".

This participant noted, rather perceptively, that her use of space had changed throughout the course of her degree according to the evolving entitlement of other undergraduate users. Her perception of the convenient proximity of the breakout space to LT1 and other nearby formal spaces was shared by 60% of all student participants field interviewed, a majority who reported that the 'convenience of location' was the primary reason they used it. 50% of this participant majority were unsurprisingly 1st and 2nd year undergraduate students from the Department of Chemical Engineering who were taught in LT1. The remainder were later year undergraduates taught close by in ACEX Lecture Theatre 2 (LT2) who would have attended taught contact in LT1 earlier in their degree studies. This bolsters the 3rd year participant's point that the way in which each cohort uses formal and informal space changes throughout

the degree course according to the expected location of timetabled activity and competing ownership of space from other user groups. This also supports the finding from the PhD student response which indicated that implicit negotiations between users of the breakout space take place, and that user choice of space seems motivated not only by convenience of location, but by where an individual and cohort's social space becomes situated through expected usage.

The implicit interactions between cohort groups that are expected to attend taught sessions in the nearby formal spaces (ACEX LT1 and LT2) has resulted in an elastic power-geometry in the breakout space that is socially and temporally dynamic. This elastic property is further evidenced by the perspective of another PhD student who I conversed with informally in the breakout space during a separate observation. He admitted to using the breakout space more during the summer period because there are less undergraduate students present, allowing him to avoid mixing with these students because of the "stigma" associated. The rhythm of breakout space usage throughout the academic year and changing hierarchy of power seems to dictate its power-geometry and who feels a sense of ownership and empowerment in this space.

5.2.3 In-situ timetable transitions

My observations and field interviews helped to confirm that the elastic power-geometry of the breakout space was largely a result of the confluence of different user groups and the transitions of early year undergraduate cohorts into and out of timetabled sessions in the adjacent Lecture Theatre 1 (LT1). The observed activity of users entering and exiting LT1 would be deemed *dependent utilisation* according to work by Nassar and Hosam (2014) who relate this behaviour to the surrounding functions of the space. The behaviours observed and analysed in the ACEX setting were also, however, linked to *independent utilisation*

where users were observed using the breakout space amenities, including in the activities reported in table 5.1. In many instances, undergraduate users were observed engaging in both dependent and independent utilisation of the breakout space as they, for example, waited for an LT1 session whilst using the breakout space's furniture to sit and talk with friends.

I used objective occupancy data to further explore the interplay between this dependent and independent utilisation of the breakout space in relation to LT1 activity. This occupancy data firstly helped me triangulate cohort-level occupancy patterns with my observations and sociograms to better constrain behavioural trends during timetable in-situ transitions as students waited prior to or left from timetabled sessions in LT1. I also analysed occupancy data separate to ethnographic fieldwork and in conjunction with timetable data to draw upon a larger repository of 24/7 temporally-stable occupancy data. This ethnographic-independent analysis allowed me to determine autonomous patterns of occupancy between the breakout and LT1 space, and can be found integrated with LT1 timetable information in figure 5.2. Examples like this helped me to visualise cohort-level transitions for a 'typical' 9-12:00 and 13-17:00 LT1 timetable configuration. This particular occupancy graph was for a weekday on which I did not observe activity, but as can be seen from the graphical representation of occupancy against time, still enabled me to easily decipher peaks in occupancy, changes in occupancy linked to the LT1 timetable and relative changes in occupancy between the breakout and LT1 spaces. This separate analysis also informed my later analysis of occupancy data sets conforming to different timetable configurations to understand the impact of the timetable on in-situ transition; this is revisited in section 5.4.3.

Given my access to real time occupancy data for the breakout and LT1 spaces, I was also able to explore occupancy trends during times I was not ethically cleared to ethnographically observe. This objective data therefore provided me with a useful 'helicopter view' of the

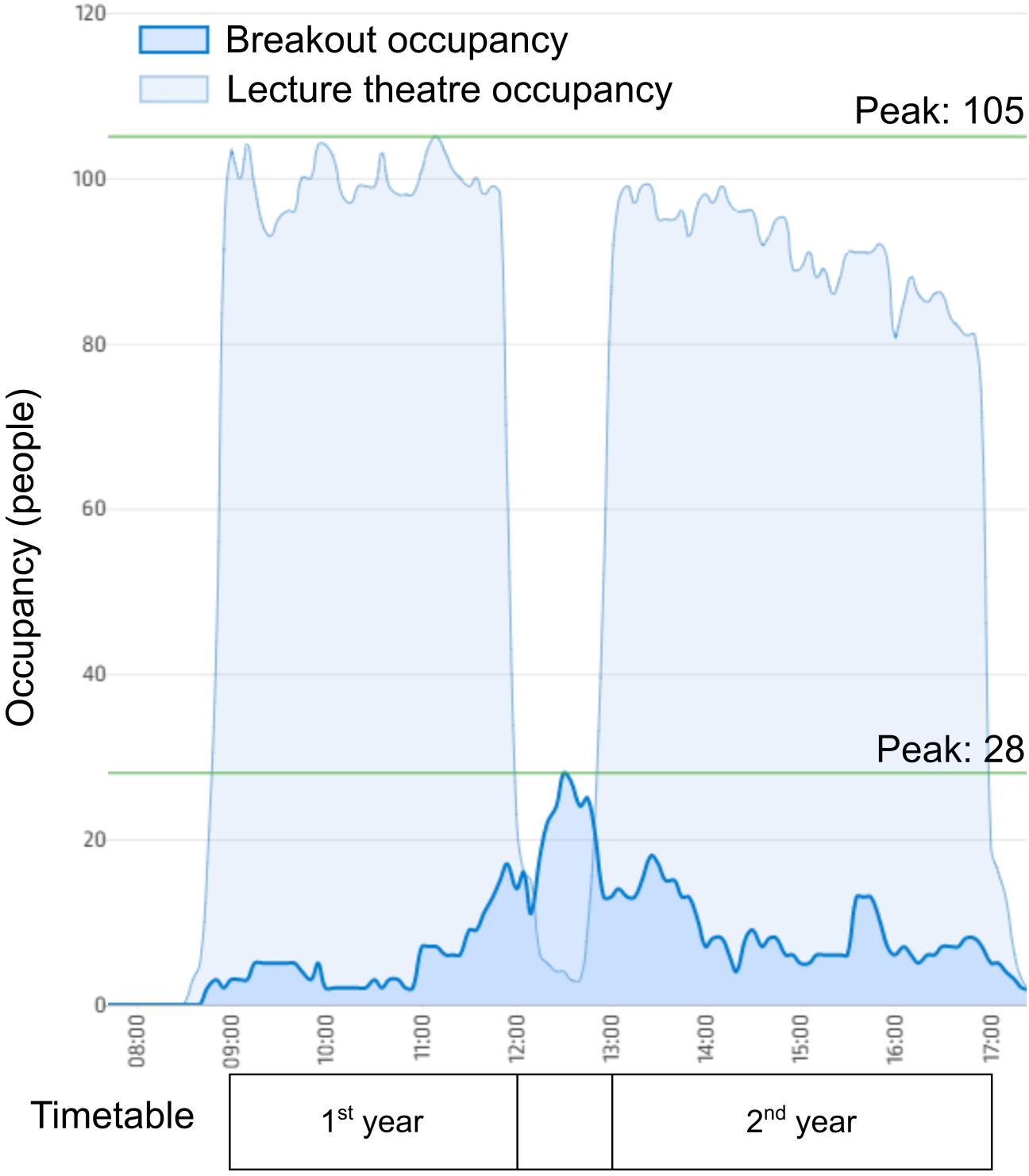


Figure 5.2: ACEX LT1 and breakout space occupancy plotted against time with LT1 timetable superimposed on a weekday during term time

ACEX spaces in this study, as well as other proximal informal and formal spaces in the ACEX building with which I could contrast and bolster trends. I also used occupancy data to compare breakout/LT1 trends on weekdays during term time with what would have otherwise been 'blind spots', including weekend and holiday periods when these spaces

were less hostage to timetabled expectations and were found to exhibit different patterns of usage. Occupancy data, whilst broadening my awareness of occupancy trends in these other spaces and periods, helped me to hone my research focus in the ACEX setting to exploring undergraduate student engagement with in-situ transitions linked to the ACEX LT1 and breakout spaces.

5.2.4 Incidental active learning

The in-situ transitions between the ACEX breakout space and LT1 were interesting not only because of how they influenced the elastic power-geometry of the breakout space, but because they came to be identified as important sites of 'incidental' active learning linked to formal learning in LT1. This active learning behaviour pertained to the reported activity categories 'talking (work)' and 'using technology (work)' in table 5.1. It included important forms of collaborative learning, defined here as '...a situation in which learners interact in a collaborative way' (Dillenbourg, 1999, p. 8) and develop social skills (Johnson and Johnson, 1987). Whilst some of these collaborative learning behaviours were planned and purposeful, such as two or more students meeting to discuss a group coursework assignment, the behaviours associated with LT1 transitions were found to be more 'incidental' and have been coined as such. This incidental behaviour included my observation of students reflecting on an exam question straight after an examination in LT1 and my separate observation of two 1st year students recapping a difficult concept immediately after a lecture. Other examples of collaborative learning included my observation of two or more students commonly engaged in a task, such as sharing a laptop or discussing lecture notes.

To confirm this observed learning behaviour in field interview, the two 1st year students who were observed reviewing material immediately after a lecture in LT1 confirmed in interview that they were "...discussing concepts from the lecture". This same pair of students were

recorded on the digitised sociogram in figure 5.3, observed leaving LT1 to use the breakout space collaborative sofas directly opposite the LT1 exit. This sociogram exemplifies how users typically arranged themselves in the breakout space minutes after a 1st year LT1 session. I used sociograms alongside my recording of ethnographic field notes to capture user interaction with physical and social space. Whilst I present one example of a digitised sociogram in figure 5.3, I include an example of another raw annotated sociogram for a different day in appendix 10. More information about my use of the sociogram method can be referred back to in section 4.4.2.

Observations, field interviews and sociograms helped me to determine that incidental active learning was a form of serendipitous behaviour and interaction associated with in-situ transition between the breakout space and other proximal spaces like the LT1 space. At these points of transition I came to realise that students were less hostage to an expected activity such as in their timetabled lecture sessions. The change in power-geometry between the 'suppressed' LT1 space and the more elastic breakout space appeared to result in behaviours that were incidental yet paramount to broader learning. These transitions consisted of active learning interactions which approximated collaborative planning and anticipation prior to LT1 sessions, and collaborative reflection after LT1 sessions. The affordances of the collaborative sofas to the left of the breakout space enabled users to form groups of up to five people and talk about work-related or non-work related topics (see table 5.1).

5.3 ACEX Lecture Theatre 1: a suppressed space

The incidental forms of active learning observed and interpreted to result from the in-situ transitions in movement and power-geometry between the breakout and lecture space motivated my decision to observe undergraduate timetabled activity within the adjacent LT1 space. I accompanied these planned LT1 observations with observations in the breakout

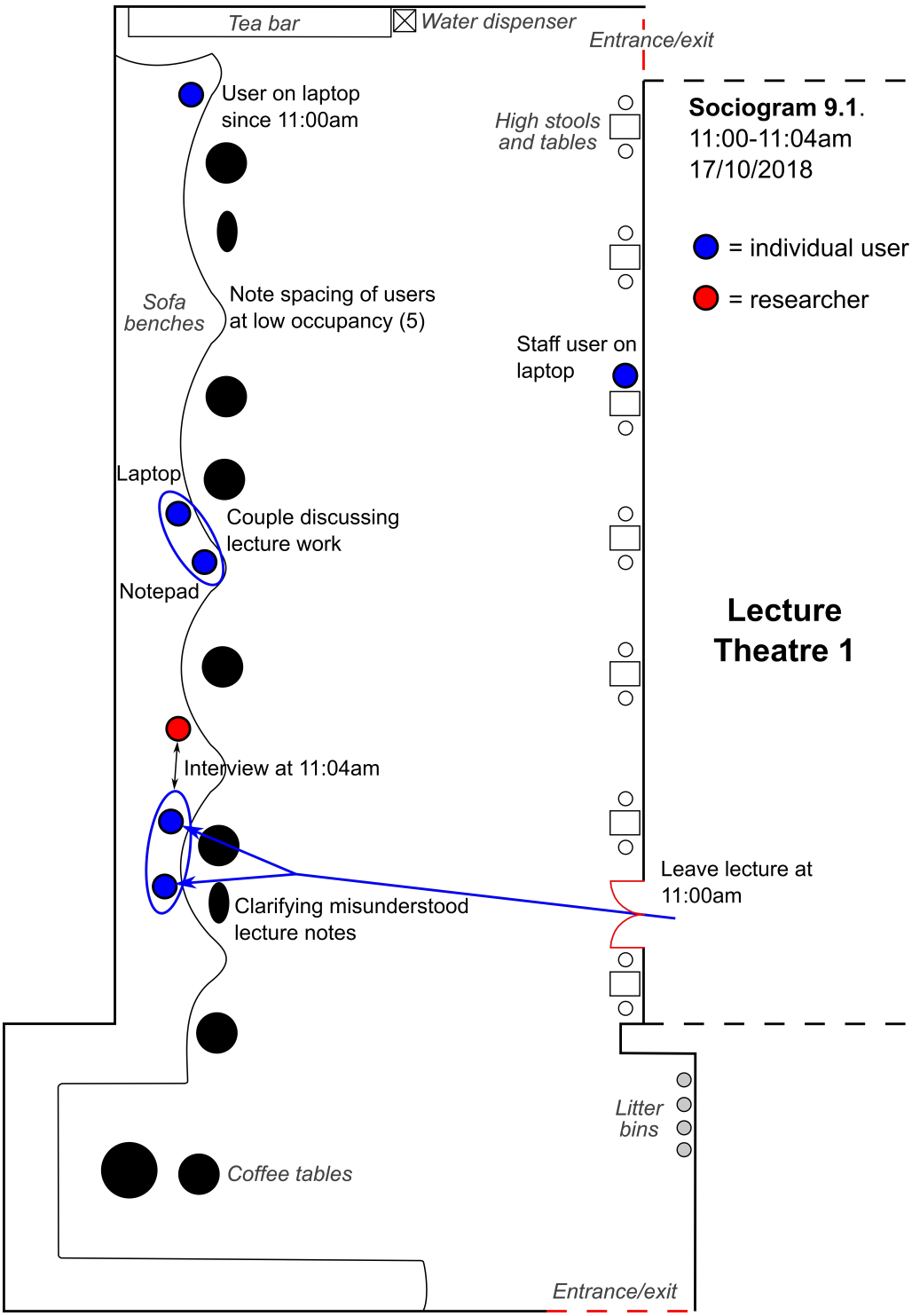


Figure 5.3: Digitised sociogram of breakout space showing typical learning behaviour immediately after a timetabled lecture session in LT1

space before and after the lecture session to capture the transitions and behaviours. In parallel, I also analysed objective occupancy trends for both the days I was observing and for days that I was not physically present in these spaces to build a broader picture about the relationship between the two spaces within timetabled contexts. This helped me to

understand the relationship between the collaborative learning in the informal breakout space and the planned learning taking place in LT1. It also allowed me to begin understanding how students engaged with and perceived the in-situ transitional space between the two spaces.

5.3.1 Comparison with Blackett Lecture Theatre 2

I also introduce data in this chapter relating to Blackett Lecture Theatre 2 (LT2) prior to its refurbishment. I adopted the same methodological approach in Blackett to ACEX, which was observation in the adjacent Blackett foyer just before timetabled sessions, observation of the LT2 timetabled session and then observation of informal activity just after in the foyer. This was to capture student behaviour during the timetable transitions into and out of LT2. A comparable summary of contextual information for ACEX LT1 and Blackett LT2 can be found in table 4.2. The data collected in each setting can be seen in table 4.4.
I introduce pre-renovation Blackett data at this stage to strengthen my findings in ACEX based on the similarities between the spatial configuration and phenomena in both traditional lecture theatres and adjoining informal spaces. Much like ACEX LT1, Blackett LT2 was used in a didactic transmission fashion due to the raked format of LT2 and reproduced expectation for learning activity (see photo in figure 4.4). The following sections contain data and themes relating to ACEX LT1 and Blackett LT2.

5.3.2 Fixed power-geometry

The physical configuration of traditional lecture theatres like ACEX LT1 and Blackett LT2, and the planned, expected nature of learning activity within them seems to have reproduced a power-geometry that is predictable and fixed. Unlike the informal breakout space, learning in LT1 and LT2 was more formal due to the clear expectation of activity which had been spatially, historically and socially preserved and reproduced. Typical manifestations of this

expectation for didactic transmission behaviour included my repeated observation of the lecturer talking at the front of the theatre, students listening and recording information, and students asking or answering questions when prompted by the lecturer in a teacher-controlled space. In the following sections I document student behaviours that deviated from these formal expectations and discuss their significance.

5.3.3 Didactic suppression of referencing

To conceptualise how students learn in formal, transitional and informal spaces, this study has drawn from authors like Nicol (2020) who posits that students 'reference' and compare their internal state and knowledge with *material* and *social* reference points to generate internal feedback. This self-regulation process appears to be important for helping students overcome liminal states, defined here as a state of in-betweeness encountered when students become stuck in their learning (Savin-Baden, 2019). It also enables students to connect in-situ learned content with their personal learning ecology and previous knowledge funds (Bronfenbrenner, 1979). More information about these theories can be referred back to in chapter 3.

In spite of the fixed power-geometry of the ACEX LT1, several informal student behaviours were observed that deviated from the expectation for didactic transmission in which students sit and listen attentively to the lecturer. Whilst these informal behavioural deviations were subtle and infrequent compared to the dominant formal behaviours, they seemed to represent freer spaces that were self-constructed and self-directed by students within the fixed power-geometry of LT1.

I planned lecture observations such that I could capture a range of didactic teaching styles and resulting pedagogic interactions within both lecture theatres. In some cases, lecturers were observed verbally or non-verbally discouraging any interaction or whispering among

students. In the most extreme case of this discouragement, a lecturer expected near silence and full attention from their 1st year class, commanding: "please listen carefully, this is extremely important". Remarks like these, made at times with a level of frustration and assertiveness by the lecturer, caused the weighting of control to remain with the lecturer. Perceived efforts by the lecturer to actively or passively suppress referencing interaction between students, and to thereby preserve a fixed power-geometry, was similarly observed in the traditional Blackett LT2 space. Whilst students 'breached' these expected rules by exhibiting deviating behaviours introduced later, their surrender to interaction suppression was evident from my observation of students sitting independently and spaced out from one another, including in one transmission session attended by 27 students. In this same session I observed a 3rd year Physics student sat at the back of LT2 with his head on the desk seemingly disengaged from the session. Despite his seeming disengagement in the session, this student interestingly answered two of the lecturer's questions throughout the session which was more than the average student. Whilst this self-directed separation of students was not always the case in Blackett LT2, it perhaps reflects the expectation attached to traditional spaces like this for students not to interact with peers and to learn independently. The suppression of student interaction by the lecturer suggests conformity on their part to this expectation, and a perception of interaction as something disruptive to the taught session; this inadvertently narrows the social referencing possibilities under such pedagogic conditions.

In a fewer number of cases, lecturers were observed embracing student interaction both inside and outside of the timetabled session. In addition to their punctuation of transmission with periods of class question invitation which I discuss later, some lecturers were observed constructing other opportunities for interaction. This was more commonly observed in the ACEX LT1 space. One example of this was when a younger 1st year cover lecturer interacted

with their students, optimistically announcing: "I want to try something with you..." prior to using an interactive Mentimeter survey. This exercise permitted interaction as one student in the middle of the space spoke out to the lecturer: "the image is too small" whilst other students were observed laughing as they had all submitted very different survey answers. This lecturer deviation from ritualistic expectation, out of a willingness to experiment and facilitate interaction, was explained by the perception of certain lecturers who seemed to value peer-to-peer interaction, but whom found it difficult to control and foster in the traditional raked lecture format. This included one lecturer field interviewed in traditional Blackett LT2 who had "Always wanted to introduce group teaching" but who confessed that the "...spaces used were not really suitable". This response suggests that some didactic transmission lecturers perceive physical barriers to fostering more interactive forms of learning and often remain aligned with more traditional approaches to teaching, even if they have appetite to adopt interactive approaches. This is a sentiment shared in other empirical work (Campbell, 2020). This clinging to traditional didactic pedagogy forced a number of self-directed, informal behaviours which I observed and now introduce.

'Failed' transitions and interactions

Between segments of observed didactic teaching, the majority of lecturers in both the ACEX and Blackett lecture theatres would routinely offer opportunity for students to ask questions in front of the class. This was the expected opportunity for students to raise their hand and verbally share confusion or misunderstanding to seek clarification from the lecturer and advance their understanding. These disjunctions in understanding are inherent to classroom learning, given individuals learn at different rates and are susceptible to misinterpretation of the same transmitted information. Students sharing their own internal liminal confusion in these question periods also had potential to benefit other students who might internally share

similar difficulty. In some cases, it was observed that a more confident student would raise their hand and take agency to volunteer a question in response to a class invitation from the lecturer. However, in more cases than not, this offer for questioning was met with a paucity of response from students. A representative example of this was when a lecturer in Blackett LT2 had just finished writing an equation derivation on the board in a rapid feedback session and said to the class: "Any questions on that?", to which the students remained silent. Whilst many students may not have genuinely had questions to ask, those that did may have feared judgement from peers and the lecturer, felt insufficiently empowered and therefore perceived greater risk than reward to ask questions in those moments.

My observation of a general lack of verbal response to teacher-invited questions and interactions is termed here a *'failed' transition*. Similarly to inviting student questions, lecturers would ask the class a question to test their understanding and invite answers to their question, seeking to encourage a similar style of class interaction. This commanded a similar set of ritualistic behaviours from students, including the raising of hands to seek permission from the lecturer for sharing an answer. In one instance, an authoritative lecturer in ACEX asked the class a question and responded to three different student answers with comments like "not quite" and "that is an interesting thought". Lecturer control over the validity of knowledge seemed to maintain a power gap between them and their students and was observed in other ACEX sessions in which a different lecturer also responded authoritatively to student answers. These 'failed' transitions might be attributed to both a perceived power difference between student and lecturer, and/or a ritualistic behaviour that has intent on conforming to expectation.

Didactic transmission sessions in the Blackett traditional LT2 space shared a similar theme of lecturers maintaining a facade of authority. This power gap appeared to almost place an expectation on students to submit to a fear of judgement from peers and the lecturer. Given

it seems in the lecturer's best interest to preserve the power-geometry that favours them retaining control, both for pedagogic purposes and personal reasons such as reputation, there may also be a reluctance to open for questions out of fear and risk on the lecturer's part. It could therefore be argued that the lecturer too feels insufficiently empowered in those question transition moments and that the fixed power-geometry of the physical space and attached expectation promotes transmission as a lower risk activity than interaction. Both teacher and students may have become trapped by the constraints of a ritualistic pedagogic behaviour. Hence, it seems more likely that the lecturer alone does not preserve this power gap and ritualistic 'failed' transition, but rather that a negotiation between them and students repeatedly takes place, where students may deliberately undergo 'failed' transitions to reproduce and appease a lower risk ritualistic expectation.

While public sharing of personal confusion has potential educational benefit, there is also risk that declarations of these knowledge gaps might lead to judgement that could influence ongoing assessment and personal reputation of the student. Less confident students might be reluctant or only be willing to share certain aspects, and do so with difficulty. The majority of both students and lecturers could be deemed 'victims' of these expected ritualistic behaviours and for both, only the more experienced and confident individuals were observed as willing to exercise agency to break out of these socially constructed interactions. In one observation, a 3rd year Physics student sat in the front row of Blackett LT2 spoke out and attempted to correct one of the lecturer's written equations, to which the lecturer responded defensively by explaining that they had misunderstood a term. This challenging style of student-directed interaction was rare and exemplifies agentic transition out of expected ritualistic activity into a more critical pedagogic interaction.

Whilst these periods of question invitation serve a perceived set of functions, their actual observed outcomes do not always reflect the dialogue that could and should result. Beyond

being a genuine invitation for learning interaction, they seem to serve to punctuate the timetabled activity, set the pace of the session and potentially appease the socially constructed ritualistic behaviours that result in student satisfaction. In addition, the initiation of these interactive periods by the lecturer means they are likely to be misaligned with the points in a timetabled session at which students actually encounter and deal with liminal misunderstanding, given the lecturer primarily controls when and how students reference and interact. It is noteworthy that this verbal dialogue is not the only form of communication between the lecturer and students within a typical lecture session, given non-verbal communication such as students looking at the front, writing notes and nodding their heads was observed, allowing both students and lecturers to generate important non-verbal referential feedback.

Ecological learning theory has warned against the danger of transmitting abstracted concepts separate from context, undermining the value of what is learned and the motivation of the learner (Barab et al., 2019). 'Failed' transitions may indicate a deficiency in the didactic transmission pedagogic approach because based on Vygotsky's *Zone of Proximal Development*, a learner can only achieve so much alone, and can accelerate development through active interaction with a more capable senior or peer (Postholm, 2008). This natural inclination to expand one's developmental possibility beyond their independent world seems to have forced students to take alternative routes to directing their personal learning interests and dealing with their internal liminality in 'hidden' ways.

Hidden transitions and interactions

My observation of self-directing students emancipating themselves from the formal expectation and suppression of the traditional didactic lecture came to be interesting. I observed this in a number of cases in ACEX LT1 during didactic transmission sessions. The

aforementioned discouragement by some lecturers of student-student interaction, perceived perhaps as a disruption of and distraction from the transmitted information, did not seem to stop some students from engaging in subtle interactive behaviour. I firstly noticed students using personal technology like laptops, tablets and phones alone during lecture sessions, and less commonly in pairs or small groups where students would talk quietly and seemingly share information with one another during the lecture session. In other instances, technology prompted what appeared to be distraction, causing students to laugh and chat more informally. Brief periods of whispering between neighbouring students was frequently observed. This sometimes included passing of general comments and other times involved discreet question exchanges about the taught material. As aforementioned, the lecturer at times would confront students engaging in such interaction with active discouragement, including a Chemical Engineering lecturer who sharply said to students interacting in this manner: "no talking please".

This apparent human and technological interaction was equally observed in Blackett didactic LT2 sessions, for example when a student shared work on their laptop screen by whispering with students sitting either side during a didactic lecture. Interactive behaviours like this drew my attention and were closely observed because they seemed to contradict (or conform to) an expected ritualistic behaviour typical of the didactic lecture. They also served to enrich the formal, planned learning of material by enabling important active learning interaction which seemed 'incidental', similar to the behaviours documented earlier in the transitions between ACEX LT1 and breakout space linked to conversation and use of technology. The active discouragement of these self-directed behaviours by the lecturer seemed to preserve the social expectation that the lecturer would talk and the students would listen. Any visible deviation from this conformity to expectation seemed to be perceived by some lecturers as a challenge to their authority, evident from their verbal

reaction with disciplinary measures. Although some of these interactions risked disrupting the lecturer and at times other students, I interpreted them as important opportunities for students to reference with peers as they contended with liminal states during formal lectures. This liminality presented cognitive disjunction and associated affective emotion which oriented students toward such interactions.

I have termed these brief and covert interactive behaviours *hidden transitions*. They could be compared to what Eisner (1985) refers to as the 'implicit curriculum' or hidden curriculum. There are a number of reasons why students might have been engaging in these hidden transitions during lecture sessions. One pragmatic reason might be students losing concentration whilst passively listening and thereby seeking out distraction. This attenuation in concentration is supported by my observation in several cases where some students would increasingly use their mobile phones during lecture sessions. In one session in which the final lecture of the module was being taught, a number of students were either using their phones and/or slouched in their seats 40 minutes into the session. In another 1st year lecture observation, I observed two students sat close to the back of the space using their phones 30 minutes into the session, one of which I saw using a social media platform. In a 2nd year lecture session, a few students were on their phone or other technological devices and were interpreted as having lost concentration of the lecture around 30 minutes into the session. Hence, I gathered from my 10 ACEX LT1 observations that students would most commonly resort to phone usage around 30-40 minutes into the session. Whilst I observed these distracting uses of personal technology, I also observed productive use of technology which aided learning, including during one lecture session when a student was observed partially listening to the lecture and partially taking written notes from something on his phone screen. In Blackett LT2, a 3rd year Physics student entered an observed session 30 minutes late, sat at the back of LT2 and then used his phone to scroll through what

looked like an academic paper as he simultaneously looked at the lecture board and made notes. Technology in these instances seemed to assist students with the formal learning and constituted important referencing behaviours. I found that in the majority of cases, lecturers permitted student use of personal technology and only intervened when students were also talking.

Another potential reason for these hidden transitions to reference points may have been linked to an expression of internal liminality i.e. a social signal to others that an individual felt confused. This behavioural intention may have helped certain students to setup a referential interaction with a peer and thereby tackle the cognitive misunderstanding. These hidden behaviours may also have acted as coping mechanisms for dealing with the affective emotions of learning and liminality, perhaps seeking attention and acceptance from the social group. The latter affective aspect seemed to orient students toward cognitive, social and/or material reference points to productively construct spaces to deal with the former cognitive aspect. Regardless of the purpose of these self-directed hidden transitional spaces, their prevalence in observed lecture sessions in both ACEX and Blackett suggests that students felt more empowered in these hidden spaces to share learning and the risk associated with one another. The selection of 'safer' hidden transitions over the formalised class-level question invitations (frequently resulting in 'failed' transitions) provides insight into how students perceived the relative transitional spaces available to them during and beyond didactic transmission lectures.

In addition to my observation of hidden transitions as a result of the suppression of interaction during lectures, other manifestations of this suppression were identified. I introduce in the next section examples of students reserving and postponing liminality and questions beyond the timetabled lecture session.

Postponed transitions and interactions

My observation and interpretation of 'failed' and hidden transitions during lecture sessions in ACEX LT1 helped me to confirm how the fixed power-geometry of the formal space seemed to suppress referencing behaviours and interactions. Students seemed to feel more empowered to share liminality in the self-directed hidden transitions out of passive listening than, for example, class-level sharing of questions. In addition to these brief interactions during timetabled sessions, I also observed incidental learning interactions toward the tail-end of sessions where students would ask the lecturer questions about any misunderstandings they had encountered during the session. These transitions were incidental in the sense that they were not expected according to the taught session, yet were purposeful as students used these periods to articulate misunderstandings to the lecturer and others in an attempt to acquire clarification.

I termed these tail-end interactions *postponed transitions* because of the delayed engagement of some students with periods of enquiry or discussion subsequent to when a student first recognised the liminality and misunderstanding within the timetabled session. Typically, these postponed transitions ranged from a student making their way to the front of the lecture theatre at the end of a timetabled session to interact with the lecturer, to students tackling misunderstanding several weeks later during an informal revision period. The degree of postponement varied between sessions and seemed linked to the expectation set by the lecturer. In one Blackett LT2 observation, the lecturer concluded the session by offering any questions via email or in person during office hours. This invitation for out-of-class assistance was common among lecturers in both ACEX and Blackett and hinted to students that more immediate interaction was perhaps less viable than follow-up on email for example.

My monitoring of a conversation between two 1st year students at the end of a session within ACEX LT1 helped to reveal the manifestation of postponed sharing of liminality, when one

student shared with the other: "I kind of lost it after...", to which the other responded: "did you understand...?". These post-session affirmations between students were commonly heard within both LT1 and carrying over into the breakout space. A good example of this postponed breakout space interaction is my aforementioned observation pertaining to the sociogram in figure 5.3 in which students confirmed in field interview that they were "...discussing concepts from the lecture". Prior to interview, I had observed these two 1st year students leave LT1 and immediately begin conversing in the breakout space: "The one thing I didn't get...?" and "How did he go from these three to these...?". Whilst these interactions may serve to tackle misunderstanding, they seem to also be important socialising of emotion.

This postponed interactive behaviour immediately following didactic transmission sessions was able to be more effectively observed as I exited ACEX LT1 to observe collaborative learning in the breakout space. These interactions seemed possible because of a transition in power from the lecturer back to the students who felt more empowered to explore their liminality and articulate it to others during tail-end periods. Whilst some of these interactions pertained to discussion of lecture material and concepts, other interactions resembled sharing of emotion and frustration relating to these liminal misunderstandings; this allowed students to 'benchmark' their emotion against others. This combination of cognitive and affective socialising behaviour collectively constitute referencing. Furthermore, the act of students physically exiting LT1 into the breakout space, which is a student-owned, social space that feels very different to the formal lecture theatre, is believed to have further reinforced the transition in power from lecturer to student by virtue of the temporal and physical space changing.

5.4 Transitional spaces

My identification of the ACEX breakout space as an informal temporal and physical space with an elastic power-geometry has allowed me to interpret it as a transitional space in relation to ACEX Lecture Theatre 1 (LT1). The incidental active learning interactions self-directed by students in this breakout space are also argued as similar to the self-directed hidden transitions and interactions encased within the formal LT1 space. These in-between hidden transitions within the LT1 space have therefore been identified as narrower transitional spaces in and of themselves. In this section I define different types of transitional space in which students are believed to possess a greater sense of agency to interact, reference and engage with in-situ transitions important for active learning.

5.4.1 On-ramp and off-ramp transitions

Whereas my ethnographic observation allowed occasional but detailed data collection, occupancy monitoring data provided continuous indication of occupancy and transition between the informal ACEX breakout space and timetabled sessions in the formal LT1 space. These occupancy logs provided broader cohort-level insight into how people were actually transitioning between the two spaces and were most insightful when corroborated with timetabling data, which indicated planned attendance and what students were supposed to be doing. These transitional spaces have been ethnographically determined as sites of 'incidental' active learning and handling of enquiry during postponed transitions.
Part (b) of figure 5.4 provides a graphical representation of weekday occupancy for ACEX LT1 and breakout space plotted against time to show the relative changes in occupancy at points of timetable transition. The annotated arrows on the occupancy graph indicate the relative ebbs and flows of occupancy between the LT1 and breakout space during these timetable transitions. These relative changes in occupancy occur as a result of the

architectural divide between the ACEX spaces which channels users into habitual routes of ingress and egress movement in response to timetabled expectations. These relative occupancy changes before and after timetabled sessions can be seen colour coded in figure 5.4 and allowed me to define *on-ramp* (red) and *off-ramp* (blue) transitions. These transitions ramp on to and ramp off of the timetabled space as represented in part (a) of figure 5.4 and are defined later in table 5.2.

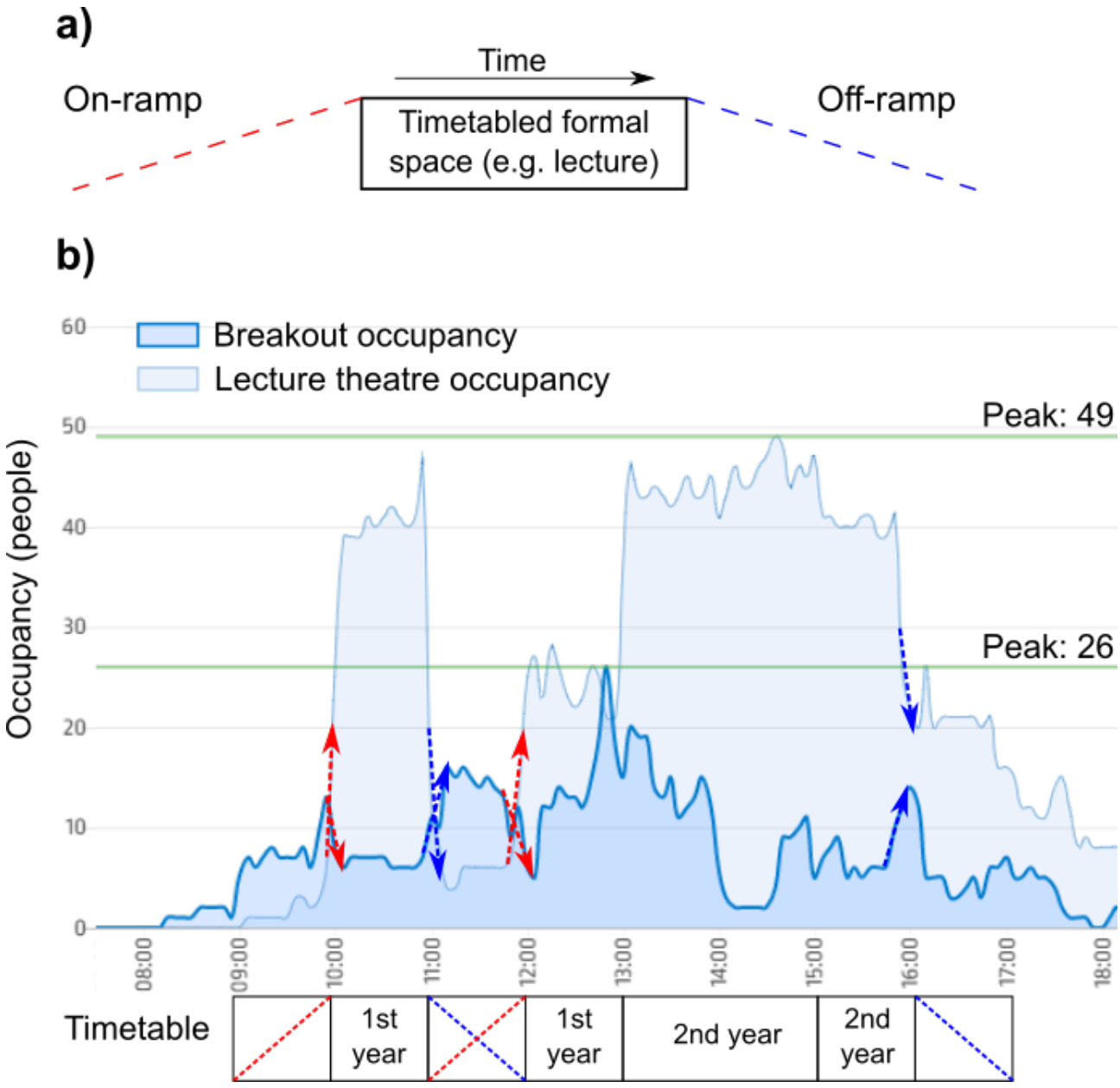


Figure 5.4: (a) Definition of on-ramp (red) and off-ramp (blue) transitional space in relation to timetabled space; (b) LT1 and breakout occupancy plotted against timetable indicating the relative changes in occupancy as students enter (on-ramp) and exit (off-ramp) LT1

'Off-ramp' transitions are a type of postponed transition which occur in the 15-20 minute

period of time and space immediately following timetabled sessions and present opportunities for students to interact and reference with the lecturer, each other or technology to tackle liminal states. These off-ramp spaces are typically associated with the adjacent informal spaces like the breakout space, but can also occur within LT1 soon after a lecture has ended, for example when I observed students making their way to the front of LT1 to ask the lecturer a question. However, my observations indicated that the nature of off-ramp enquiry in the ACEX breakout space and LT1 differed, given the breakout space seemed to be perceived as more 'democratised' by users as a result of it being a student-owned, social space. This was evident during one observation when a 2nd year student was observed casually asking their lecturer about covering for another lecturer on sabbatical during an off-ramp transition. 'On-ramp' transitions are the 15-20 minute period of time and space just prior to timetabled sessions, associated with students waiting for and anticipating the timetabled session. Whilst the 15-20 minute extent of these transitions was inferred from 'subjective' observation, I objectively confirmed this from my analysis of occupancy data. My observations supplemented relative occupancy trends like in figure 5.4 by helping me to confirm that groups of students were gathering in the ACEX breakout space in on-ramp and off-ramp periods to interact with peers about work and non-work related topics. On the same day that this occupancy profile was recorded, observation was made of 1st year students waiting and interacting either side of their 10am timetabled lecture session; the lecture session was also observed for data triangulation. During the on-ramp transition leading into the session, individuals and small groups of 2-4 students out of a total of 16 users were observed seated on the sofa benches on the left hand side of the breakout space, including one student which I monitored asking their group: "do we need to go to separation [lecture]?". Another student was observed in a separate conversation responding with: "it is due tomorrow". These conversations seemed to approximate planning and

affirming behaviours which appeared to support students in making brief but important connections between different activities and spaces within the broader degree curriculum through referencing with peers. These specific conversations were categorised as talking about work-related topics in the observed breakout activities in table 5.1. Following the 10am lecture session displayed in figure 5.4, a field interview was conducted with a student observed leaving LT1 during an off-ramp transition, observed initially using her phone in the corner booth of the breakout space before withdrawing her laptop to complete independent work. She confirmed in field interview that "Between two lectures I will do work, and then have labs", which meant using this space "everyday" when asked about her frequency of usage. This meaningful use of the breakout space during off-ramp transition was also observed with a group of students who remained in the breakout space following the 10am lecture session, supported by a stable breakout occupancy profile following 10am in figure 5.4. One explanation for this use of space could have been the anticipation of another 1st year lecture in LT1 later at midday. The analysis of this occupancy data in conjunction with my observation of activity implicates an important consideration, which is that students will engage variably with on-ramp and off-ramp transitions based on the configuration and attached expectations of the timetable.

Whilst observation and occupancy data in combination helped me to define off-ramp transitions in the ACEX setting, many students were observed gathering their belongings from LT1 and leaving the spatial vicinity with minimal interaction in these off-ramp transitions. It was difficult to interpret the intent behind these behaviours without confirmation in field interview and I was not inclined to interrupt students who exited LT1 and the breakout space swiftly. This lack of interaction and engagement with off-ramp transition could either mean that student liminality was latent (i.e. they did not have questions) or that they postponed tackling liminality beyond the 15-20 minute off-ramp

transitional period. It could equally be argued that some students were rushing off not only to 'escape' their liminal discomfort, but because they simply had another lecture scheduled elsewhere. The fixed power-geometry and didactic suppression of referencing in ACEX LT1 is posited to have resulted in off-ramp transitions which, when engaged with in the informal breakout space, provided a student-controlled space in which the collaborative socialisation of liminality was more possible. The crowded occupancy of the breakout space, particularly during the typical 12-13:00 lunch hour, may have disincentivised students from remaining in this space during off-ramp transition. Peaks in breakout space occupancy during the 12-13:00 lunch hour were able to be confirmed in my analysis of the broader occupancy data set, which mostly conformed to 'bell' curve occupancy profiles like in figures 5.2 and 5.4.

Medial space

The timetabled space nestled between on-ramp transitions before and off-ramp transitions after has been termed *medial* space, which is bounded temporally by the timetabled session and physically by the lecture theatre. Whilst definitions of on-ramp and off-ramp transitions emerged as significant in the ACEX breakout space, my ongoing ethnographic fieldwork allowed me to recognise the aforementioned hidden transitions and interactions within ACEX LT1 as equally significant forms of transitional space. This terminology therefore seeks to structure the different spatial and temporal phenomena I observed in the broader fringe (breakout) and narrower medial (LT1) transitional spaces and can be found summarised in table 5.2.

The medial space was also characterised as an important social transitional space, given the fixed power-geometry of LT1 was found to be not only controlled by the lecturer and their expectation, but by the extent to which students were 'compliant' in acting out expected, ritualistic behaviours. These medial transitional spaces were therefore the site of self-directed

Table 5.2: Definition of on-ramp, medial and off-ramp transitional spaces

Element	**Transitional space**		
	On-ramp	Medial	Off-ramp
Conceptual definition	Constrained period of time and space just prior to formal timetabled sessions typically associated with the adjacent informal space.	Bounded period of time and space confined to the formal timetabled session typically associated with the formal lecture theatre space.	Constrained period of time and space just after formal timetabled sessions typically associated with the adjacent informal space.
Physical transition	Marks transition from physical and temporal informal space to formal timetabled space.	Marks expectation to sit, listen and absorb information during didactic transmission session.	Marks transition from physical and temporal formal timetabled space to informal space.
Empirical indicators	Students waiting, planning for and anticipating timetabled session.	Transitions out of expected, ritualistic lecture behaviour to self-direct referencing for dealing with liminality.	Students reflecting on the timetabled session, enquiring with one another or the lecturer and orienting themselves to the next learning space.
Time length (minutes)	15-20	60-120	15-20

and teacher-directed transitions in power and ownership. Self-directed medial behaviours were thought to arise when students acquired a referencing need, such as an encounter with liminal misunderstanding. This empowered students to exercise agency to undergo in-situ transitions out of 'expected' passive listening of didactic transmission to engage with the transitional space and deal with their internal liminal state.

Blackett foyer transitions

To bolster my findings regarding student behaviours during on-ramp, medial and off-ramp transitions in ACEX, I continue to introduce data relating to the traditional Blackett Lecture Theatre 2 (LT2) and adjacent foyer space which had a very similar configuration to the ACEX spaces. In the Blackett foyer I observed a narrower set of behaviours than those in

ACEX in table 5.1. These were categorised as students using the lockers, using personal technology, waiting for sessions in LT2 or LT3 and using the tables to gather around for brief interaction. I also observed some interesting behaviours during off-ramp transitions in Blackett which ranged from a student walking from the back row of LT2 to ask the lecturer a question at the front, to students leaving LT2 and engaging in interaction either with the lecturer or with peers in the foyer space. In the latter case, I exited LT2 and observed three 3rd year students conversing in the foyer, shortly after which the lecturer left LT2 and approached one of these students who seemed to have been waiting. The particular lecturer then used the foyer tables to explain a concept using pen and paper to this student and in field interview, described the foyer as a "useful follow-up space" which confirmed my observation. When asked how he imagined students using this foyer space, he explained: "Mostly using it before and after class, talking and gossiping, which is fine". This suggests a level of awareness on the lecturer's part about the democratic function of this foyer space as a pedagogic extension of LT2 which is able to support on-ramp and off-ramp transitions. Whilst I revisit data collected for the Blackett foyer in later sections, its purpose and usage as a circulatory space connected to two lecture theatres (LT2 and LT3) meant it was used similarly to ACEX breakout by students during on-ramp and off-ramp transitions. The opposing lecture theatres feeding into this foyer and its proximity to amenities like elevator lifts and toilets (see figure 4.2) meant that like ACEX, it was frequented by different user groups and seemed to possess an elastic power-geometry. However, this Blackett foyer importantly differed to the ACEX breakout space given it possessed a narrower set of amenities and affordances to ACEX, such that users engaged differently with on-ramp and off-ramp transitions. Comparing these informal spaces has allowed me to understand the role of physical space in shaping how students engage with these transitions, such that I was able to feed into the redesign of the foyer space which I revisit in section 7.2.1.

5.4.2 Transitional space behaviours

The self-directed behaviours and interactions observed during on-ramp and off-ramp transitions seemed to share some similarity with the medial transitional space behaviours observed within the traditional ACEX LT1 space. Despite these fringe (breakout) and medial (LT1) transitional spaces differing in size and nature, the behavioural sets in each share similarity in their deviation from the expected formal behaviour which serve to orient students toward material and social references for dealing with liminal states. At the heart of reference behaviour seems to be a form of comparison which allows students to socialise their internal schema with others. These behaviours are not always rewarded by the expectation instituted by original design and formal curricular intention, hence being deemed 'hidden' and 'incidental' (Eisner, 1985). However, they are believed to support student self-regulation and transition in learning by mediating the formation of social groups, community and sense of belonging within cohorts.

Affirmation and confirmation

In its purist form, formal didactic transmission teaching operates under the assumption that what is taught and transmitted is absorbed and understood by the learner (Scribner and Cole, 1973). However, human learning is believed to be more complicated than that, and naturally presents instances where the learner needs to connect to previous knowledge funds and other microsystems in order to reach full understanding as intended. Rather than learning being a simplistic and linear process, it is normal for students to encounter problems or uncertainty that lead to disjunction and liminality. These disjunctions are also an expected product of pedagogic communication, given misinterpretation of the intended message between transmission and reception is probable; this is further complicated by the fact that different individuals learn at different rates and in different ways (Pollak, 2009).

These disjunctive threats to the individual's life world inherent to the education process present personal obstacles which cannot be overcome with an individual's previous knowledge and experience alone (Savin-Baden, 2007; Postholm, 2008). These instances necessitate external reference points and the construction of a learning space in which transition toward fresh understanding and perspective can take place.

The process of referencing one's internal schema with peers, lecturers and material references has been theorised and observed as one way in which students achieve learning. Students were observed affirming and confirming with peers in a number of cases, for example when two 1st year students finishing an ACEX lecture session immediately turned to one another in the breakout space saying: "did you understand...?", to which the other responded: "I got the...". In other observation cases, students seemed less explicit about the technical aspects of learning and rather sought affirmation for difficult emotion surrounding their learning experience, such as one student in the breakout space who said to another: "There is so much work", with the other affirming: "You aren't usually behind".

In seeking affirmation or confirmation, students appeared to be corroborating an internal belief, thought or emotion with another person, group or reference point. If the individual was affirmed, they seemed more likely to consolidate this as knowledge, yet if they were not affirmed through verbal or non-verbal communication, they remained critical and looked to other reference points to satisfy their liminal concern. This socialising mechanism seems central to active learning and the cultivation of a sense of belonging within a student cohort through lasting relationships (Ahn and Davis, 2020). Winnicott (1971) uses the concept of *mirroring* in adult education, claiming that an individual's mirroring in the face of the teacher, peers, subject itself and institution is important validation. This mirroring seems to work consciously and unconsciously given signs, symbols and spaces emit visual and textual stories that can either be validating or alienating depending on the capital of the individual

(Bourdieu, 1989; Sagan, 2011). Social affirmation and validation is a mechanism that has been evidenced in this study as taking place in on-ramp, medial and off-ramp transitional spaces where students fear less judgement and perceive lower risk than, for example, asking a question or sharing their liminal concern in front of the entire class (proven more likely to result in 'failed' transitions).

On the one hand, these affirming behaviours seem to serve a more educative function which assist student transition toward the attainment of goal-directed learning. On the other hand, these social affirmations, indicated by comments such as "There is so much work", help students to deal with the associated emotional aspects of challenging learning when there is greater uncertainty felt from being liminal or having part adjusted or confused schema which are socially moderated. It therefore seems important to help students to emotionally regulate and seek reassurance through linking their personal schema to direct and vicarious experience. Changes in the way students seek affirmation and confirmation throughout their development as undergraduate students has not been explored in any depth in this study, yet it is suspected that students acquire greater independence and a different set of referencing needs as they progress through their degree study.

Questioning and enquiry

Students were invited by lecturers to ask or answer class-level questions in all observed didactic transmission sessions in ACEX LT1. These invitations were found to be a common way of the lecturer punctuating transmission, yet were generally met with minimal response. The initiation of interaction by posing or inviting class questions seemed to preserve the power gap between the lecturer and students. The power-geometry and expectation surrounding this ritualistic behaviour has been posited to result in 'failed', hidden, off-ramp and postponed transitions in which students negotiate safer spaces within which they can

reference, enquire and ask questions relating to the lecture session. These safer transitional spaces, because of their positioning between spaces that have clear rules and expectations like LT1, possess an elastic power-geometry that is less affected by the inertia of the contingent spaces and which permits more authentic interaction and expression of liminality. In addition to the power-geometry of spaces and the pedagogic expectations negotiated and reproduced, the disposition of the individual, be it generative or disruptive (Bronfenbrenner and Morris, 2007), will also influence whether they take agency in asking questions.

Savin-Baden (2019) reminds us that '...the experience of getting stuck in learning, and the subsequent liminality, are essential to the notion of learning ecologies' (p. 46). The same author refers to the importance of knowledge co-construction, aligning with the social constructivist theory of learning (Vygotsky, 1980), emphasising the importance of the individual's interaction with people and their environment. These environmental objects have been referred to as reference points in this study, which students engage with to generate internal feedback via what Bronfenbrenner (1988) terms proximal processes. These processes require connection between internal and external microsystems and are believed to enable learning and the development of an individual's capabilities, dispositions and resource characteristics (Bronfenbrenner and Morris, 2007).

Social, cognitive and material objects not only represent reference points for construction of learning spaces, but also prompt states of disjunction by posing information that challenges the individual's internal world. Therefore, a good learning environment seems to simultaneously create useful disjunction in the learner and support students in acknowledging and articulating that disjunction as to orient them to the right reference points for interaction. Questioning has been observed as an important mechanism for allowing students to construct a learning space through interaction with social reference points. This interaction is complex and can either reduce or increase liminality, based on the nature of the

interaction. Social referencing is more active because it presents opportunity for a student to be challenged by difference in belief and perspective from another person. Having to reason and defend their position is one reason for the effectiveness of the active learning approach (Michel et al., 2009). For a student to enquire and open up dialogue, they are required to have a level of metacognitive knowledge that brings their problem or misunderstanding into awareness. Sharing this misunderstanding in the form of a question, according to the social constructivist view of learning, initiates a mutually beneficial dialogue as the student contributes to the shared knowledge of the dyad or group with which they interact, whilst internalising the products of the interaction for learning.

Questions that were not asked by students in front of the class spontaneously or during periods of formal invitation within medial space were believed to be postponed to off-ramp transitions, where a more personalised interaction with the lecturer was possible. The time constraint of the timetabled session in Blackett LT2 meant that off-ramp enquiry frequently transitioned from LT2 to the foyer or other informal spaces. The awareness of impending LT2 sessions was able to be confirmed in interview, including with a lecturer participant who when asked in interview how she thought students use the Blackett foyer space, explained: "Sometimes I have carried out conversation outside into that [foyer] space as I usher students from the front of LT2 because of the time restriction". A different didactic lecturer recognised the importance of informal spaces in the department when they stated: "Having something where they [students] have ownership would be nice". The foyer was found to be perceived as a 'democratic' informal space by lecturers in which enquiry and discussion could be handled more suitably during off-ramp transitions than in LT2.

In addition to these incidental student-lecturer interactions, peer-to-peer questioning was just as commonly observed in the fringe transitional spaces. In ACEX, two students were observed leaving their 1st year lecture and proceeded to sit on breakout space sofas opposite

the lecture theatre entrance, asking questions of one another such as: "The one thing I didn't get...?" and "How did he go from these three to these...?". This observed questioning and discussion were work-related activities that these students soon after confirmed in interview as something they carry out "between lectures" in the breakout out area. I monitored other brief periods of peer-to-peer questioning during off-ramp transitions, one of which involved an older student wearing a suit and a younger student, both leaving a 2nd year lecture to discuss "catalysts" for no longer than three minutes, before moving on. The reason for these peer-to-peer interactions may have been that some students preferred to share misunderstanding with friends than with the lecturer, or that the constrained nature of the LT1 off-ramp space meant students having to 'compete' and wait for lecturer attention. My observation of students queuing at the front of LT1 to speak to the lecturer following taught sessions supports the latter hypothesis.

Venting and complaining

In a similar vein to my observation of questioning, students were frequently observed venting and sharing complaints with one another. Other empirical work has shown that hearing affirmation from a recipient leads to an immediate increase in mood, whilst the act of complaining leads to an immediate decrease in mood (Wojciszke et al., 2009). These perceived moods may link to the actual social rewards and costs of each behaviour. The act of venting may therefore have a similar behavioural intention to questioning, that is the seeking of reassurance from others as a mirroring and coping mechanism during liminality. Nonetheless, the important distinction seems to be that whilst questioning seeks useful solutions to articulated problems, complaining could be a way of soliciting attention from confidantes for validation purposes. My observation of venting as more prevalent may be because it is a lower risk behaviour than direct enquiry, given it allows students to enter a

'safer' space in which they can share and express internal dilemma, but in a way that does not expect or invite a response and judgement from their recipient, like with questioning.

A representative example of complaint was when one 1st year student was observed saying to a peer sat beside them: "I'm going to fail my degree, it doesn't matter" prior to an ACEX lecture starting. Comments like these may help students establish trust with one another and form relationships and friendships that later support learning and transition; they may therefore have social utility, despite their perceived hindrance to learning. Complaint and venting was recorded just as frequently in the breakout space, such as by one undergraduate student passing through the space who I monitored saying: "I've given up on lectures at this point" to a small group of peers nearby. Sharing negative emotion and vulnerability seems to require and build trust (Coyle, 2018) by opening a shared space in which students appear to manage personal emotion and express internal liminality associated with learning and transition.

Complaints alternatively may represent avoidance behaviours where instead of practically tackling liminality, students postpone and avoid it, choosing to complain instead; this has been a strategy reported in other work (Savin-Baden, 2008). This is supported by the fact that most complaints monitored and observed related to course workload and the perceived competence of coping with university life. On the contrary, these venting behaviours may help orient students toward their next steps following an uncertain space such as a difficult lecture, supporting important transitions into and out of this formal space that result in shared planning and affirmation. Venting was observed in on-ramp spaces, including when a 1st year student entered the ACEX LT1 and said to their friend: "what did you get in your exam project?", followed by a complaint of: "I'm not in the mood for this at all". The reciprocation and confirmation of these complaints between peers may be an important mechanism for the formation of informal social groups, as one develops a better sense of

their role in the community and what they should and shouldn't be doing. Through multiple observations and field interviews, these groups have been evidenced to form and strengthen in transitional spaces, given they empower individual students to deal with cognitive and affective aspects of transition.

Personal technology usage

The seeking of affirmation, asking of questions and confession of complaint was believed to not only be confined to physical transitional spaces, but to blend into virtual spaces co-constructed using personal technology and the internet. Although this study did not explore the role of virtual space in transition, I was able to extensively document the situated usage of personal technology in the ACEX LT1 and breakout space. Out of a sample of 25 field interviewed participants, 36% reported using technology for non-work related purposes and 28% for work-related purposes in the ACEX breakout space (refer back to table 5.1). This use of mobile phones, tablets and laptops spanned on-ramp, medial and off-ramp periods in the breakout space.

The use of technology in LT1 medial space was just as frequent as in the breakout space. I previously associated this use of personal technology with an attenuation of concentration on the transmitted session which was most prevalent on average 30-40 minutes into the observed sessions in LT1. I also observed productive use of personal technology which seemed to aid the formal learning, including during one lecture session when a student was observed partially listening to the lecture and partially making written notes from something on his phone screen. Another example of purposeful use of technology for supporting formal learning included my observation of a student sitting close to the front of Blackett LT2 who used her phone to take a photograph of the lecturer's blackboard notes just before the lecturer rubbed off the written derivations.

Whilst my interpretation of intentions behind technology usage was inferred from observation, use of technology within formal medial space came to be understood as fulfilling two intentions on the part of the user: 1) a social behaviour that communicates to the rest of the class something about the individual and their internal state, with an implicit intention to conform to social norms and a ritualistic behaviour 2) a more personal behaviour that appeases an actual learning need, such as checking another set of lecture notes on a laptop or using a search engine on a mobile phone to clarify a misunderstanding about a concept. Disentangling these behavioural intentions is difficult and the likelihood is that observed technology usage was a combination of each.

Students were suspected to seek affirmation using the internet via personal technology. Recent studies have identified the internet and search engines like Google as spaces for profound confession and questioning in which users share private and publicly-contentious information (Stephens-Davidowitz and Pabon, 2017). Hence, although it cannot be delineated with certainty here as to why students were using mobile phones during lectures, it is possible that some were consulting the internet on their liminality and referencing with what is perceived as a 'safer', hidden and less socially disruptive space than for example, whispering to peers. It may have also been the case that some students were communicating with other students using platforms like WhatsApp or Facebook to construct virtual spaces in which they could exercise a greater sense of agency and ownership than in the suppressed physical formal space. This behaviour approximates a similar behavioural reward to students undergoing hidden transitions during lectures, as to negotiate virtual transitional spaces within which they have a greater sense of control and agency to reference their schema.

On a more personal level, students may be using social media and other internet spaces to achieve the same sense of validation and affirmation when internally liminal, as is the case with my observation of social venting and complaining. This virtual behaviour, whilst being

less risky and onerous than physical interactions, is less grounded in the physical context and may be less apt at helping students make important social connections that result in social capital and sense of place than in-situ interaction (Bourdieu, 1989; Temple, 2018). The role of personal technology and virtual transitional spaces in supporting or inhibiting transition has not been explored in any depth in this study, but could be the subject of future work.

5.4.3 Transitional space properties

I have introduced characteristic behaviours in the previous section associated with on-ramp, medial and off-ramp transitional spaces, in which students have been observed to openly share liminality and engage in more informal discussion with peers. This section builds on the previous sections by interpreting properties of transitional spaces indicative from this analysis of characteristic behaviours in relation to the timetabled and physical space. According to bioecological theory, transition not only enables technical learning but operates to revise our knowledge, habits, perception and behaviour (Bronfenbrenner and Ceci, 1994). These internal characteristics dictate the way an individual engages with reference points and thereby construct learning spaces for transition. In addition to these internal resource characteristic influences, transitional spaces possess important physical and temporal properties which influence learning behaviour; these findings allowed me to begin understanding the interaction between behaviours in and properties of transitional spaces.

Perception transitions

Important behavioural changes were documented and interpreted as students moved between the formal lecture theatre and adjacent informal space in both settings. Whilst these physical transitions implicated a change in physical space, it is likely that a change in power-geometry from 'fixed' in the formal medial space to more 'elastic' in the informal fringe space occurred,

giving way to greater freedom and student ownership. This research identifies a variety of student behaviours in transitional spaces, some related to overcoming internal liminality and others pertaining more to coping with the associated emotion of being fully or partially liminal. Understanding the root cause of these behavioural changes is complex, yet their relation to transitions in perception is suspected to play a role. This study assumes that humans perceive and define situations as a result of their previous experiences and thereby create and act out the consequences they expect. This links to my deeper exploration of student and lecturer perception and expectation later in the thesis.

I discovered that students not only underwent a transition in perception of the physical space as they moved between the formal and informal space during ramp transitions, but a transition in perception of the lecturer and their peers within those spaces. Whilst these momentary transitions in perception were difficult to capture, I inferred them from the aforementioned off-ramp transitional space behaviours and interactions. This was evident in the way one 2nd year student left a two hour session in ACEX LT1 to interact so casually with their lecturer in the breakout space, asking them about their covering for another lecturer on sabbatical. This friendly interaction suggests not only that the breakout space was perceived as more permissive, but that the student and lecturer perceived each other and their roles differently within that space. It can be inferred with some confidence that the physical transition between the ACEX formal lecture theatre and the informal breakout space reduced perceived barriers to interaction between students and their lecturer, resulting in a set of personalised exchanges that were distinct from those in LT1.

The general user perception held about the ACEX breakout space as a student-owned, social space supports these transitions in perception linked to physical transitions. For example, a 2nd year participant, observed flicking through paper notes in the corner booth of the ACEX breakout space, reported in field interview that they "...see this more as a social space than

a study space". This was echoed in the responses of a 4th year undergraduate and PhD participant that were observed talking and using laptops together in the breakout space who I then approached for interview. When asked how they usually use this breakout space, the PhD participant reported: "I was working initially and then my friend came and we have been socialising", and the other student reported that they: "...tend to socialise when I see friends in this space".

I compared perceptions of the ACEX breakout social space with perceptions of the Blackett foyer space by asking student participants to imagine how it could be changed to be more efficient for study. A 4th year participant answered rather pessimistically about the foyer: "Not really, doesn't need to be anything particularly special, serves a purpose as it is". This view was reflective of the static perception of this foyer among most participants who felt it served a trivial purpose. My observation of transitions in perception as students exited Blackett Lecture Theatre 2 (LT2) into the foyer seemed to be temporary, habitual and in rhythm with the expected on-ramp, medial and off-ramp transitions. These in-situ transitions in perception and expectation have been of interest in this study for answering the first research question. They have later been linked to broader 'ex-situ transitions' in perception and expectation relating to participation in the Blackett refurbished spaces and other learning spaces in chapter 7.

The contrast in power-geometry between ACEX LT1 and the breakout space resulted in a separate transitional space in which perception transitions occurred. This was a crucial finding regarding the properties of these on-ramp and off-ramp transitions, which were not only determined by the movement of people into and out of LT1 and the nature of that timetabled activity, but by the presence of other users and their activities in the breakout space. This transient activity inevitably resulted in continuous negotiations between different user groups which I was able to explore using interviews. The changing expectations of the

breakout space were apparent, for example, by the implicit awareness of users who would talk quietly when the space had low occupancy or project their voice when it was crowded. This caused perception and power-geometry to remain elastic and dynamic.

Timetable influence

The properties of transitional spaces were also found to be linked to the configuration of the ACEX LT1 timetable, which expected students to attend scheduled sessions in different physical spaces. This temporal organisation of activity was found to be a prominent influence on behaviour and intention within transitional spaces, including when students were observed rushing to and from lectures between other spaces. In ACEX field interviews, around 40% of participants, when asked about which previous space they had come from, revealed they had been in a timetabled lecture in ACEX LT1 or LT2, now residing in an off-ramp space. The remaining majority were in a 'prolonged' on-ramp space and explained they had labs or other course contact later in the day. A minority had either just come from the campus library or had other intentions such as eating lunch or relaxing in this breakout space. I corroborated this general reporting with specific field interview responses regarding how students usually used the ACEX breakout space, to which a 1st year student said: "Between two lectures I will do work, then have lunch before labs". This data supports the transitional nature of the ACEX breakout space, including its role in supporting both briefer on-ramp and off-ramp transitions into and out of LT1, and more 'prolonged' transitions into and out of distal campus spaces elsewhere.

Lecturers too reported that the timetable and its temporal constraints influenced the way they engage with physical off-ramp space for managing interactions and questioning with students. When asked how she thought students used the Blackett foyer space, one Physics lecturer responded in her field interview:

"As it is at the moment, just to chat briefly after the lecture. Sometimes I have carried out conversation outside into that space as I usher students from the front of the lecture theatre because of the time restriction".

The time restriction appears to be what informed this lecturer's decision to frequently leave the LT2 space and interact with students in the informal fringe space at the end of a session. The timetable arguably sets an expectation not only for student and lecturer presence in LT2 for taught sessions, but for transitions into and out of the LT2 space based on time and incoming cohorts. There are implicit negotiations between these different user groups which determine perception and expectation to transition.

In addition to these observation and field interview data, occupancy data was used to generate quantitative insight into how and for how long students were engaging with on-ramp and off-ramp transitions between the ACEX LT1 and breakout space. To achieve this, two different repeatable timetable configurations were identified using Celcat timetabling data for LT1 and the occupancy trends at points of timetable transition were recorded on all of the days conforming to these configurations. These generic and repeating timetable configurations have been defined as *type 1* and *type 2* and can be seen in figure 5.5. The types of transition associated with these configurations has also been labelled.

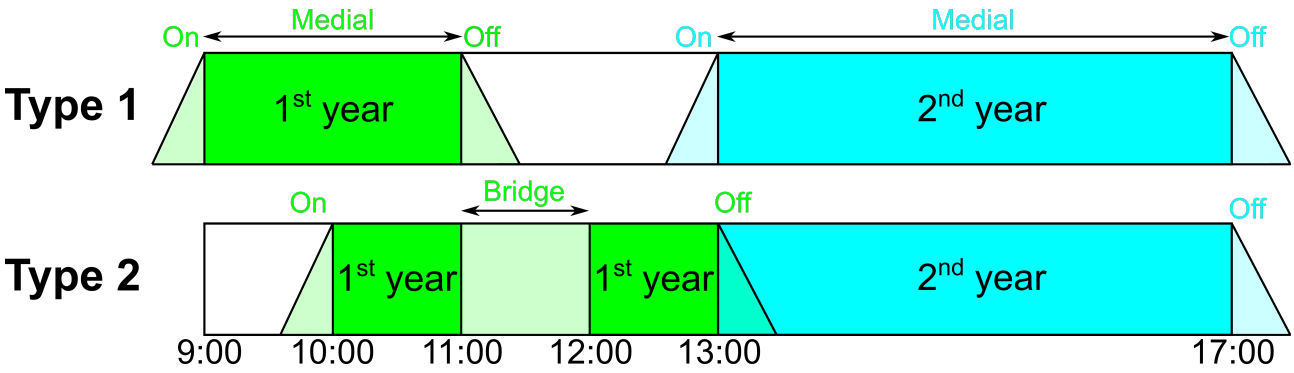


Figure 5.5: Definition of type 1 and type 2 timetable configurations for ACEX LT1 with time along the base, year cohorts attending and on-ramp, medial and off-ramp transitions labelled

Table 5.3 shows averages for the data captured for a total of 30 timetable transitions on 15 different days that conformed to type 1 or type 2 configurations (raw data in appendix 11).

In instances where a stable occupancy was recorded for longer than 5 minutes prior to or following a timetabled session, it was assumed that a group of students were engaging in *meaningful* on-ramp or off-ramp transition. The occupancy technology only recorded users who were present in the space for longer than a few minutes, so any students passing through and not meaningfully remaining were not recorded in the occupancy count. As students could not be identified or individually tracked between spaces, the relative differences in occupancy at the timetabled crossover periods were calculated to infer whether groups of the moving LT1 cohort remained in the breakout space or left beyond a 5 minute interval. This gives some level of confidence that these transitional changes in occupancy were the result of student groups moving between the formal LT1 and informal breakout space and engaging 'meaningfully' in transition for at least 5 minutes, rather than users leaving or entering the breakout space for different purposes; this cannot, however, be inferred as certain.

Table 5.3: Average values calculated for the percentage of students engaged in meaningful on-ramp and off-ramp transitions for type 1 and type 2 timetables (raw data in appendix 11)

Timetable	**Transition**	**Values (n)**	**Averages (%)**				
			Mean	Min	Median	Max	Range
1	On-ramp	9	20	8	18	40	32
1	Off-ramp	9	19	9	20	36	27
2	On-ramp	7	52	21	43	100	79
2	Off-ramp	5	43	16	41	67	51

Controlling for these timetable configurations allowed me to understand the influence of the timetable on student engagement with on-ramp and off-ramp transitions. Comparing the average percentage of students meaningfully engaging in off-ramp transitions between type 1 and 2 gives some indication as to whether students were more or less likely to use the breakout space in each configuration. Based on arithmetic mean in table 5.3, a higher amount of 43% of students on average meaningfully engaged with transition during the off-ramp transition following the 1st year lecture under the type 2 configuration, whereas only 19% of students on average meaningfully engaged in the off-ramp transition under the type

1 timetable. This is likely because for the type 2 configuration, 1st year students anticipated another lecture in the same lecture theatre one hour later, and so were more likely to remain in the breakout space during the off-ramp/on-ramp crossover period. I labelled this crossover period as a transitional *bridge* between the 1st year medial spaces in figure 5.5. This bridging space has been demonstrated to serve social and academic purposes based on ethnographic data. Type 1 on the other hand posed little incentive for 1st year students to remain in the breakout space following their 9-11am lecture. In the type 1 scenario, a number of students reported in field interview that they planned to go to the library, buy lunch or return to halls of residence during this off-ramp period, helping to confirm this behavioural trend.

The idea of bridging medial space can be used to similarly explain the average percentage of students meaningfully engaging in on-ramp transitions in each of the timetable types. For type 1 timetables, 20% of students on average engaged in the breakout space during their on-ramp transition prior to the 2nd year lecture, whilst a higher amount of 52% of 1st year students on average engaged in their on-ramp transition under type 2 conditions. This suggests not only that the type 2 configuration has led to more meaningful transitional engagement than type 1, but goes some way in explaining why 1st year students feel a greater sense of ownership in the breakout space, pointing to a hierarchy of power between undergraduate year groups which has been confirmed in field interview with students. The type 2 timetable provides 1st years with 2 hours of formal teaching contact and 1 hour of 'ownership' or 'occupation' within a bridging transitional space 11-12:00 (see figure 5.5). Understanding how these timetable configurations promote or inhibit incidental active learning within physical and temporal transitional spaces between timetabled sessions could be useful. According to these occupancy-driven findings, timetable design might be informed by the opportunity and connectivity of these transitional spaces, which evidently have the potential to 'bridge' formal timetabled activity.

Contrasting space affordances

The actual affordance of space, the context of the unfolding activity and the changing needs of the user seem to be of greater importance for actual usage than institutional designation of space (Harrop and Turpin, 2013). This chapter has thus far demonstrated how the contrast in power-geometry between the formal lecture theatre and adjacent informal space in both ACEX and Blackett, and the resulting transitional space between, empowers important transitions in student perception and behaviour. This is evidenced ethnographically, in combination with occupancy data, which together have helped me to confirm that the organisation of the timetable shape the properties of these transitional spaces and how students engage with them during on-ramp and off-ramp transitions.

In contrasting the range of transitional space behaviours in the ACEX breakout space and Blackett foyer space, it was found that a narrower set of behaviours were possible in Blackett because of the perceived and actual narrowness of affordance in the foyer space. In its pre-renovation format, this space contained student lockers, waist-level tables and a litter bin. For one 3rd year student that didn't own a locker in the Blackett foyer space, they reported that they "Wait between lectures and stuff - I don't have a locker". A 1st year student similarly perceived this bare foyer space with little enthusiasm or sense of ownership, reporting that they had "Never been here apart from waiting". Students observed using the Blackett foyer space in its original format were interacting very little, rarely observed doing independent work or eating food.

The range of possible activities and sense of ownership in this foyer space significantly differed to the better equipped ACEX breakout space (see table 5.1). The availability of functional furniture and other amenities transformed the ACEX breakout space from what could have been a throughway corridor used solely for waiting to enter and exit spaces like LT1, to a transitional space which was more adept at bridging medial space. Although

occupancy data was not available for the Blackett setting, the observed length of usage of the foyer space was on average less than the ACEX breakout space in which students felt more empowered to do independent or group work or eat lunch together. There was also, on the whole, less peer-to-peer enquiry about lecture material in the Blackett foyer space which more so processed physical transition between LT2, LT3, toilets, lifts and exits.

Although I have not used CHAT as a core theory in the thesis (see section 3.6.1), I have adapted the CHAT triangle (Engeström, 1987) in figure 5.6 to visually represent the generic differences in rules, power, community and tools as students transition between the formal lecture space and informal fringe space. This adapted CHAT diagram is equally applicable to both the ACEX and Blackett settings, and attempts to capture transitional changes in key elements which shape the power-geometry and behavioural expectation of each space. It is a useful schematic reminder that timetable transitions are not only about physical movements between formal and informal spaces, but that an important transitional space exists in-between which connects to and influences the adjoining activity systems (or microsystems). These transitional spaces have been demonstrated to implicate transitions in perception between the medial and fringe spaces.

Field interviews allowed me to confirm that all of the behaviours I observed during on-ramp and off-ramp transitions were underpinned by a primary user intention. In on-ramp space, students were present in the informal spaces because they were primarily waiting for timetabled lectures. In off-ramp space, student intention was more elastic and students were observed referencing with peers to plan and orient themselves toward informal spaces like the campus library. In some cases, I observed these underlying intentions being referenced against peer intention, including between two 2nd year students in an on-ramp transition in the ACEX breakout space 10 minutes before a 'Reaction Engineering' lecture. One student asked the other: "Are you going to Reaction Engineering?", to which the other

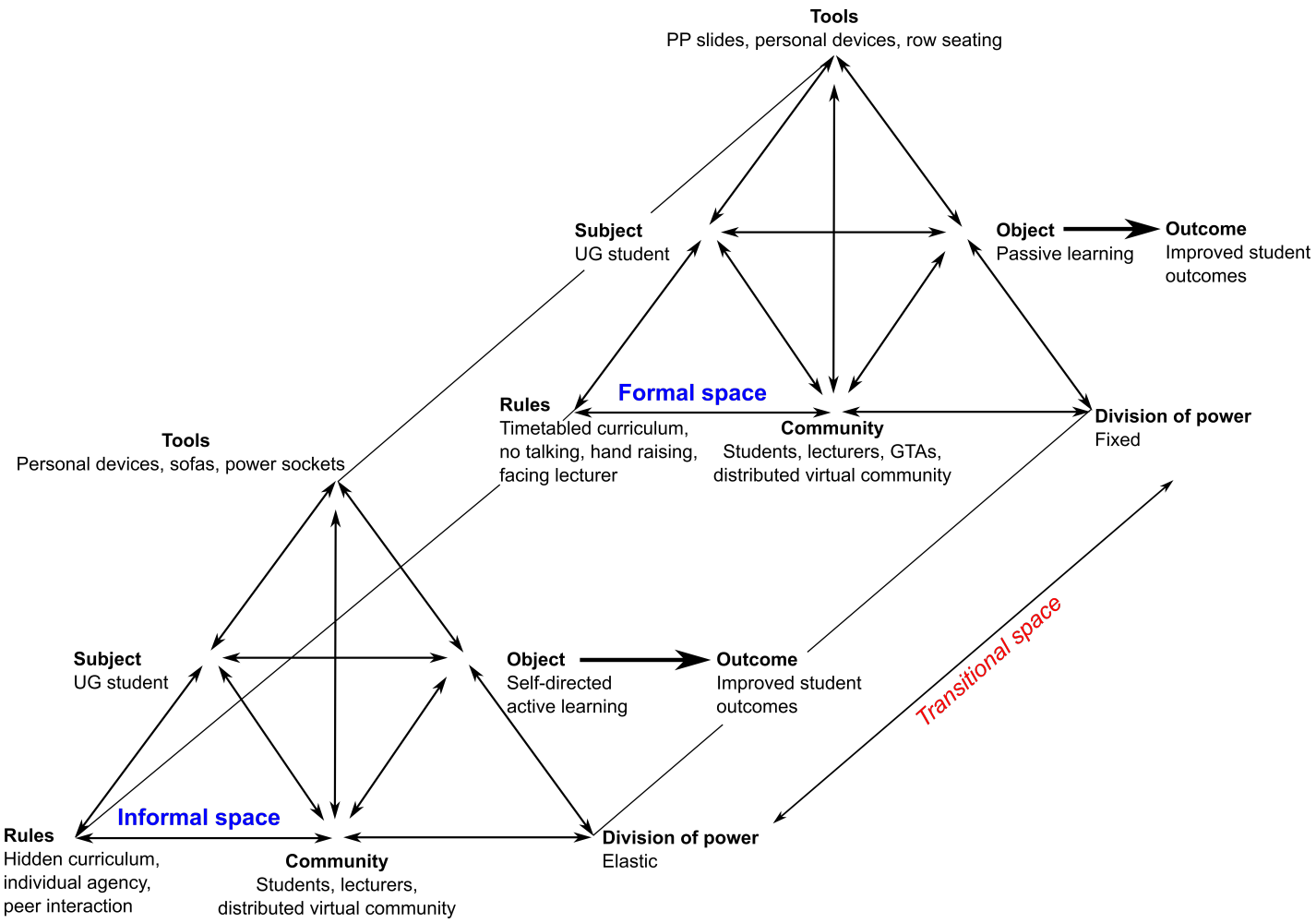


Figure 5.6: Adapted CHAT prism showing the transitions in expected rules, tools and power-geometry between the formal and informal space

answered: "I might do coursework". The affordances of the ACEX breakout space as a throughway/waiting space for dependent utilisation, as well as a social space for independent utilisation (Nassar and Hosam, 2014) such as relaxing on the furniture, seemed to cause it to afford different transitional behaviours to the Blackett foyer which was originally less well equipped for independent utilisation. Finding ways to cultivate opportunities for independent utilisation and incidental active learning in these fringe transitional spaces is further explored in chapter 7, given it seems to make significant difference to how students perceive and manage transitions between formal and informal learning spaces.

5.5 Chapter synopsis

This chapter has shone light on the first research question reintroduced in section 5.1:

> What are the nature of transitions in learning spaces?

This focus has led to my definition of on-ramp, medial and off-ramp transitional spaces (see table 5.2) which are the sites of referencing behaviour in which students were observed affirming, enquiring and complaining with one another. Given these transitional spaces seem to be a structural consequence of the timetable and architectural configuration, their properties have been shown to influence power-geometry, level of ownership and transitions necessary for incidental active learning. These findings are significant not only for achieving a holistic understanding of the nature of transitions in learning spaces, but for designing timetables and physical spaces for effective transition and active learning. Timetable designers might begin considering the time either side of formal sessions, whilst space designers might begin considering the use of fringe spaces adjacent to lecture theatres.
In chapter 6 I test this thinking by introducing data and findings relating to the Blackett refurbished LT2 space to understand how redesigning a traditional lecture theatre 'broadened' transitional space for in-situ transition and active learning.

Chapter 6

Redesigning for in-situ transition

6.1 Introduction

This chapter builds on the findings from chapter 5 regarding in-situ transitions in traditional learning spaces. Here I introduce ethnographic observation, field interview and in-depth interview data to explore how redesign of traditional Blackett Lecture Theatre 2 (LT2) influenced these in-situ transitions. Having defined on-ramp, medial and off-ramp transitions, a greater focus is developed in this chapter around medial transitions within timetabled LT2 sessions. Together with chapter 7, this chapter seeks to answer the second research question:

> How does the redesign of learning spaces influence transitions?

The refurbished Blackett LT2 and pre-renovation foyer space have been plotted as separate microsystems in figure 6.1. This model illustrates the relationship between strategic-driven redesign of LT2 in the exosystem and in-situ transitions in the microsystem and mesosystem necessary for active learning. Student and lecturer transitions in perception and referencing seemed to result from this broadening of transitional space, such that expectation for active learning could be more easily renegotiated. This was confirmed in in-depth interviews with participants for whose pseudonyms can be familiarised in table 4.5.

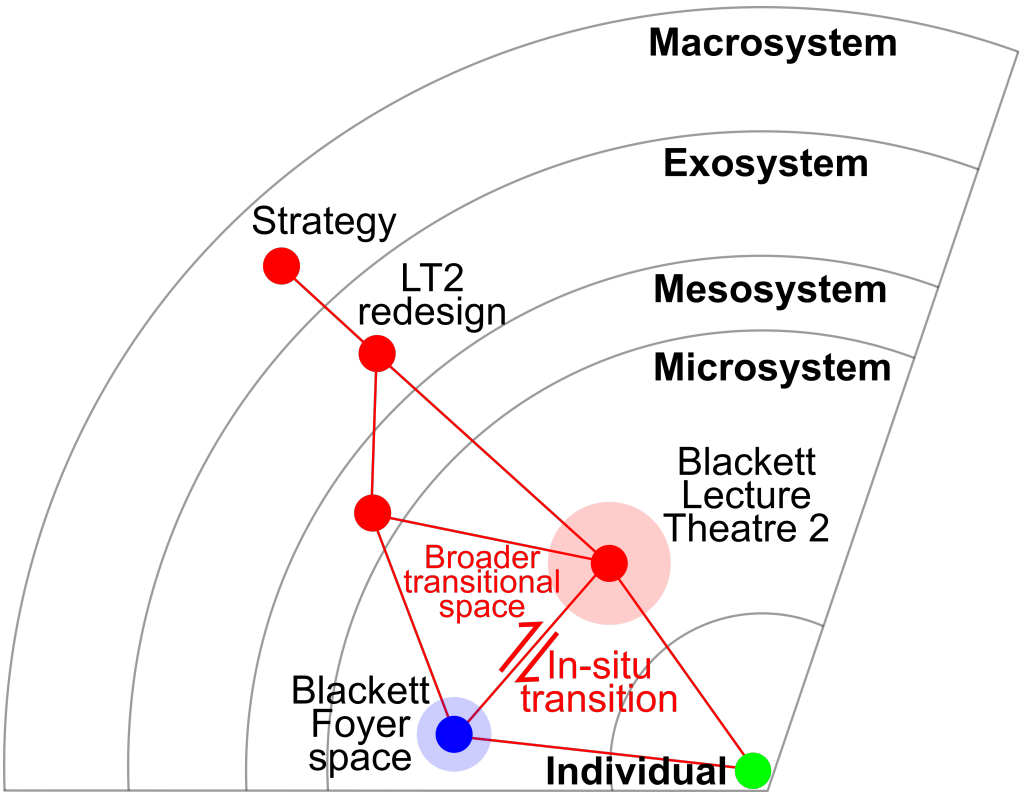


Figure 6.1: Refurbished Blackett LT2 and pre-renovation foyer space plotted as microsystems on the ecological systems model showing broader transitional space resulting from strategic-driven redesign

6.2 Blackett Lecture Theatre 2: medial transitions

As part of a College-driven space refurbishment programme, the traditional Blackett Lecture Theatre 2 (LT2) space was converted from a traditional lecture theatre to a more interactive auditorium. This £1 million investment involved an architectural restructure of the row-by-row seating into connect-booth seating. Booths seat up to 5 people, are embedded within the raked format and are connected by walkways from the front of the space. A photo of the refurbished LT2 space can be referred back to in figure 4.5 and more detail about the refurbishment changes in section 4.2.1.

This space was selected within a wider suite of campus space refurbishments, driven by the College's Learning and Teaching strategy, which sought to provide more flexible environments for teaching and learning. As a researcher interested in the relationship between transition and space, I was made privy to these refurbishment plans prior to carrying out my Blackett

pre-renovation observations. My attendance at the LT2 design board meetings provided me with an awareness of the design intent and philosophy, which allowed me to better interpret and contrast learning behaviour and in-situ transitions before and after the refurbishment. More than this, my findings from ACEX and pre-renovation Blackett informed a number of conversations with architects, building managers and other members of the LT2 design board about how this design philosophy might seek to 'broaden' medial transitional space to better enable transitions for effective active learning. This broadening is about a physical expansion of transitional space, whilst also changing student and lecturer awareness of and involvement with that space. By feeding some of my earlier findings from the first phase of ethnographic fieldwork into the LT2 redesign process, I was better able to conduct post-occupancy evaluation of learning behaviour and in-situ transition. I was also able to return to earlier findings to confirm or deny their validity in a similar context.

6.2.1 Seminar activity transitions

I adopted a consistent methodology across each phase in which I would observe timetabled sessions in LT2 and sometimes follow these up with field interviews in the adjacent foyer space. I chose to focus most of my post-renovation LT2 observations on the 'Year 1 UG seminar' series, given this module embraced the interactive format of the LT2 space by using a problem-based approach to encourage more active forms of learning. Seminar groups of 1st year students were pre-assigned, consisted of 4-5 members and were each allocated a booth in LT2 that they used throughout the duration of the academic term.

My post-renovation observations allowed me to categorise the characteristic type and sequence of transitions between activities in these interactive seminar sessions. My observations of other interactive modules like the 4th year 'Research Interfaces' module helped me to confirm these activity transitions within medial spaces. I summarise these

activity transitions in figure 6.2, which shows the pairings of activity, the associated transition type inferred as necessary between each activity and the physical space design feature needed for that transition to take place effectively. Whilst the in-situ involvement of seminar coordinators was paramount for enabling these transitions, the transitions were recorded and interpreted from the perspective of the student (which is important for answering the research questions). Recording this transitional potential between activities required skillful observation and was at times difficult given the finite time between each activity and the nuanced changes in behaviour.

I have also represented these LT2 activity transitions diagrammatically in figure 6.3 which numerically corresponds to figure 6.2. These formal activities in themselves are formal learning spaces, yet between them exist transitional spaces which not only process change from one activity to another, but colour the nature of adjoining activity. The transfer of information and knowledge, as seen in figure 6.3, is only possible because of the transitional spaces which support learners in making crucial microsystem connections through proximal processes (Bronfenbrenner and Morris, 2007). The diversity of learning activities (and thereby transitions) evidenced in figure 6.2 was increased relative to traditional didactic transmission sessions in which transitions to self-directed or class-level interaction could be better described as 'failed' or hidden.

Figures 6.2 and figure 6.3 provide examples of characteristic in-situ, medial activity transitions which permit flows in attention, information and interaction between different actors and their activities. However, these figures risk being an over-simplification, firstly given that in reality students transition between multiple references simultaneously and less sequentially than is implied. Secondly, in their work into temporality and *chronotopes*, Esposito et al. (2013) remind us: 'Unlike novels, in which chronotopes indicate moves from one scene to another one, in a learning process participants negotiate their own identities as

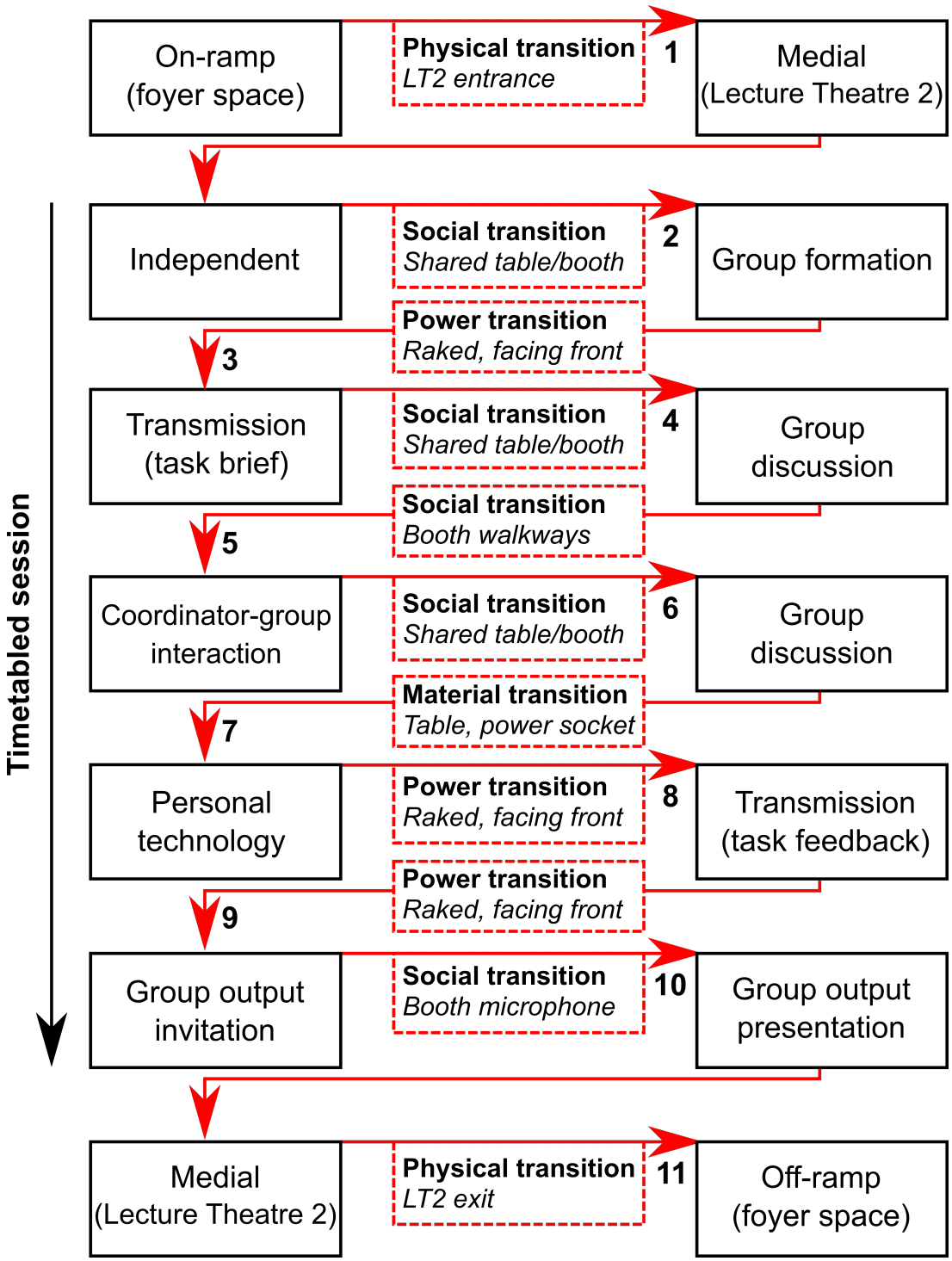


Figure 6.2: Characteristic pairs of activities and associated transitions observed throughout seminar sessions in LT2 with enabling design feature italicised. Transition numbers correspond to numbered transitions in figure 6.3.

authors arising from symbolic moves across different time-space configurations' (p. 18). This is where bioecological thinking usefully positions LT2 students within interrelated nested systems which through the chronosystem, enable not only in-situ transitions but connection to temporal and ex-situ spaces which together enable learning.

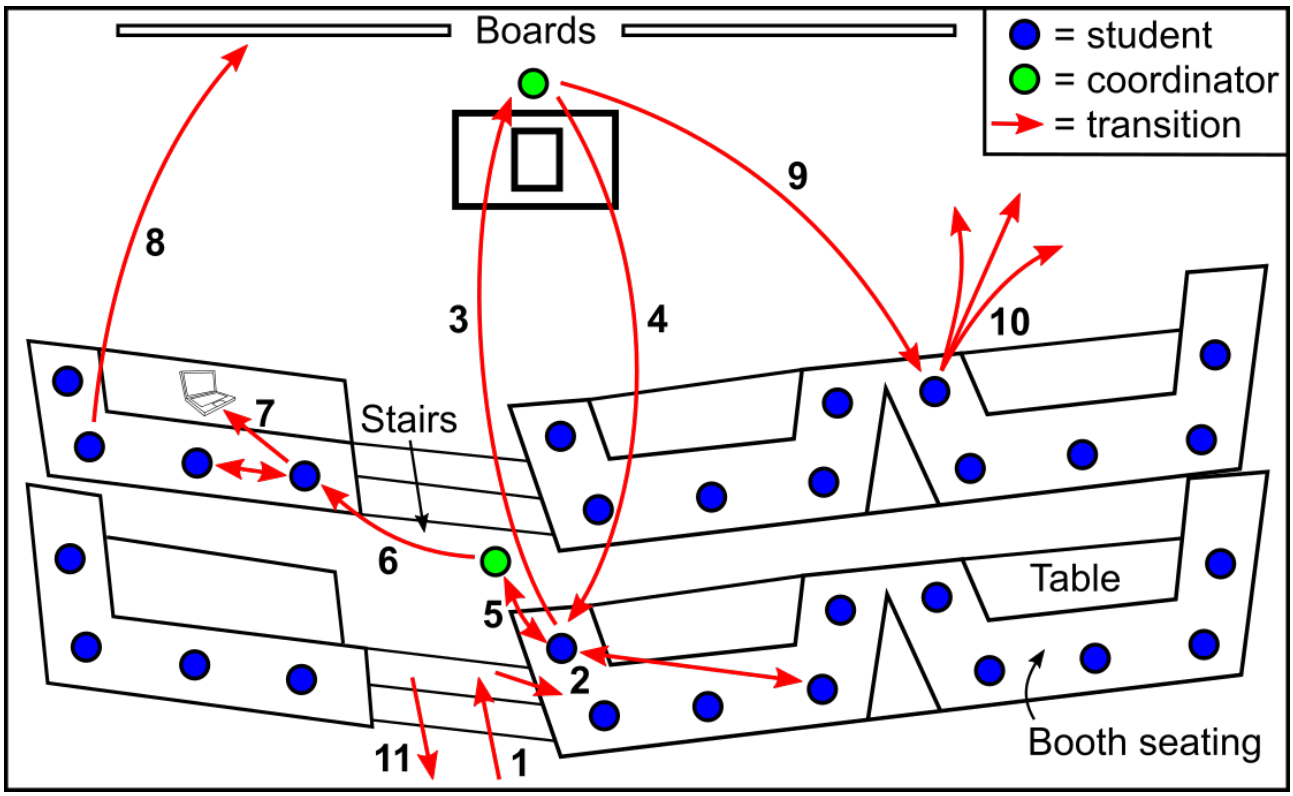


Figure 6.3: Floor plan of the front section of the refurbished LT2 space showing characteristic transitions between seminar activities and/or actors. Numbers correspond to numbered transitions in figure 6.2.

These observed activity transitions were further explored in interviews with both seminar students and coordinators to confirm the type and nature of the most significant activity transitions. A seminar leader in field interview was asked if the new design made it easier for them and students to transition between different types of teaching activities, to which they responded:

> "Transition requires them [students] to go from talking to listening. I haven't found this difficult to manage. Some students don't want to stop talking - I see this positively as they are eager to discuss".

The inclination of students to continue talking, even into didactic transmission activities where attention back on the lecturer was commanded, is deemed positive from this lecturer's perspective and is indicative of the strong affinity for peer-to-peer interaction in seminars. This response implies that a student transition away from expected, rehearsed didactic

activity had taken place, and that seminar coordinators were required to reestablish cues and signals that helped them to facilitate teacher-directed transitions necessary for a new ritualistic learning behaviour. My observations further confirmed that transitions into group work and discussion were seemingly natural and effortless for students, whereas the transitions from group work back to didactic transmission were less smooth, with lecturers having to clap hands or shout out to regain student attention. These 'lagged' transitions were sometimes found to last as long as 10 seconds before the lecturer fully regained student attention, including in one observation where they instructed "finish off conversations soon". To gain perspective on this student engagement in group interaction, students were asked in in-depth interview if they found it any easier to get into group work in LT2 than other spaces. This question sought to provide insight into the perceived smoothness of transitions into and out of group work. One 1st year student, Alex, responded to this question by stating the undoubted ease to transition into and out of group work, choosing to compare it to his experience in traditional Blackett Lecture Theatre 1 (LT1), answering:

> "Without a doubt, but again, it's quite hard to compare because in LT1 you're never encouraged to do group work as such, you are just maybe encouraged to talk to the person next to you, whereas in LT2 the entire focus is group work".

Following their attendance at seminars for at least one academic term, Alex had begun to perceive LT2 and these seminar sessions as more centred around interaction than his didactic transmission sessions in traditional lecture theatres. This transition in perception seemed to be a combination of session intent and the changed nature of the space in relation to other spaces they were accustomed to.

6.2.2 Post-renovation medial behaviours

The documentation of characteristic activities and transitions typified in the interactive seminar sessions in Lecture Theatre 2 (LT2) allowed me to begin contrasting behaviour before and after the refurbishment of this lecture space. The behavioural phenomena introduced in this section represent the most obvious behavioural differences observed and reported by participants in response to the architectural redesign of LT2.

Ease of group interaction

I carried out ethnographic observations of both didactic and interactive lecture sessions in the refurbished LT2 space to understand the influence of the new space on active learning behaviour. Ten of these observations were of the 'Year 1 UG seminars', a further 5 of the interactive 'Research interfaces' and the remaining 5 of didactic transmission sessions.
The level of student engagement in group discussion was the first striking observation made within one of the initial seminar sessions. This initial session observation later proved to be representative of typical interactive behaviour in the majority of seminar sessions, with some variation depending on the individual session plan. The depth of engagement in group discussion was also evident from facilitators having to approach and interrupt groups to enquire if they had any questions. The arrangement of student groups in booths where members could physically turn to one another and more easily construct a sense of shared space than the pre-renovation space seemed to play a major role in this ease of interaction and transition between passive listening and discussion-based activities. The raked, connect-booth design may have also contributed to the ease of group interaction by providing a sense of physical separation between groups (see figure 6.3 for booth layout). This sense of demarcated booth space was absent in the traditional LT2 space.
The engagement in booth group discussion meant that seminar leaders were frequently

observed having to clap hands or shout out in an effort to regain student attention for didactic segments of teaching between these discussion periods. These transitions in power from student back to lecturer seemed initially more difficult than in the pre-renovation lecture sessions where lecturers continually retained control of interaction and the behaviour was more rehearsed and expected. This indicates that within the refurbished space, a new expectation and set of rules had to be negotiated between session coordinators and students. This indicates a less fixed power-geometry resulting from the change in physical layout. It also indicates that by converting the physical configuration of the space into something with inbuilt interactive intentionality, and by changing the expectation of activity with a different pedagogic intent, that students were more easily able to interact with one another and discuss their learning. This was recognised by one seminar leader, Joe, who reported on his insight from a cohort survey in his in-depth interview:

> "I have to say looking at the seminar survey, err that we did in term 1, the number one err thing that came out of that was how much the students liked the group working...because they are just talking to each other, and, and that's, I mean that's a big success for the seminar sessions but also for the space because that's coming from this positive environment that they are in".

Joe not only perceived student interaction positively based on his own preconceptions, but seemed to partly measure 'success' based on what students liked. This level of student engagement in seminar group discussion, whilst being a function of the new booth design and change in pedagogic intent, is believed to have also been related to seminar sessions comprising 1% of the overall module credit, which may have encouraged higher attendance and engagement than otherwise; this credit influence on behaviour is discussed in section 6.2.5.

An ease of interaction was observed to a lesser extent in didactic transmission sessions taught

within the refurbished LT2 space, as a result of a different pedagogic intent and expectation of activity. However, hidden transitions and interaction within booths were still observed in these traditional didactic lectures, in spite of the fact that no explicit expectation for peer-to-peer interaction was made. In one observation example, two 4th year students turned to one another in the same booth and uttered something with a smile; in acknowledging this, the lecturer said to them: "Can you guys see the text OK?". One student responded to the lecturer with a comment about the equation derivation which stumped the lecturer, given they took some time to figure out an answer to their question. The confidence of these students in referencing with one another and then 'challenging' the lecturer seemed rare in the pre-renovation LT2 observations and may be indicative of the new space empowering a change in expectation and transition toward more peer-empowered, active learning behaviours. It is as if the constraints attached to the old space had been lifted, and students were initially less subservient to 'traditional' rules.

These peer-to-peer interactions were reminiscent of hidden transitions characterised in the traditional lecture settings. However, the affinities between students within the refurbished LT2 booths seemed stronger than in the row-by-row configuration, evident from the observation of a separate didactic session when one 4th year student entered the lecture session slightly late and joined another student in the same booth, forcing them to acknowledge one another non-verbally. This obligatory acknowledgement and interaction suggests a sense of shared booth space within a wider impersonal lecture space which reinforces individual and/or group agency. This could begin to explain the ease of interaction observed among booth members and their confidence to be more critical, as exhibited by students in the earlier example. These findings collectively suggest that lecturer expectation for student interaction with peers versus obedient silence seemed up for renegotiation following the LT2 refurbishment.

Vetting questions and sharing enquiry

Belonging to a physically demarcated booth space in which one can easily interact with fellow students seemed to allow students to share and vet their questions in a safer space than in the traditional lecture theatre. This personal booth space seemed to present less fear of judgement than sharing questions and enquiry in front of the entire class and better supported the natural tendencies of students to engage with what was termed 'hidden transitions' in the suppressed traditional lecture space. The socialisation of knowledge gaps and liminal misunderstanding not only serves to advance cognitive understanding, but is critical for helping students affirm their associated liminal emotion.

It was observed most evidently in seminars that once a student shared and vetted personal questions with their group, they seemed to be more empowered and assured in knowing whether to escalate that question to session coordinators or alternative reference points. It was less commonly observed in seminar sessions that students in groups would raise their hand to attract coordinators for questions. Rather, coordinators were more often observed having to make effort to proactively approach and check in with groups. Only at points where groups reached a collective liminal state, would they seem to feel consultation with a more knowledgeable coordinator 'passing by' was warranted. This switching from peer-driven questioning to coordinator-driven checking-in could represent a transition in the social expectation renegotiated within this refurbished space. Sessions were designed to appeal to this expectation, so that the coordinators introduced problems at the start of the session and held the solutions, providing them with the information and power to guide groups which struggled. In one case, this openness to coordinator enquiry was witnessed where a student was overhead confessing to a coordinator passing by: "you need to teach me", as if surrendering to the fact that he and his group did not understand the task.

In didactic transmission contexts, less data was collected than for the interactive sessions,

but the observations made provide insight into the differences in behaviour pre- and post-renovation. In one didactic session, the number of questions asked to the lecturer was observed as higher than average than in traditional contexts. One student corrected a lecturer mistake on the board, whilst another soon after raised their hand unprompted to which the lecturer permitted their question. These riskier enquiring behaviours and deviations from traditional expectation were less commonly observed in the traditional lecture settings. Booths also seemed to encourage students to sit together with friends during didactic lectures, a stark contrast to similarly sized didactic lectures in the pre-renovation LT2 space where students were observed spaced apart in an individualistic fashion. The physical layout of a booth seemed to either oblige students to sit together or pressured them not to sit apart, unlike a lecture theatre row where isolation seemed more expected.

The subtle vetting of questions among students was also reported by didactic lecturers when asked in interview about the frequency of questions posed by their students. The response of one didactic lecturer, Mark, in in-depth interview suggested a higher frequency than what he was accustomed to, noting: "I think slightly more [questions] in the LT2 compared to my other lecture theatre experience". In a similar vein, when asked in field interview if he had noticed any change in student behaviour in the refurbished space, a separate didactic lecturer said: "Maybe too early on in the course, students nodding a bit more with this refurbished space", showing they had noticed an increase in non-verbal student engagement. These findings suggest that those 'hidden transitions' observed as suppressed reference interactions in the traditional lecture settings seemed to be more permissible and even expected by students and lecturers in the refurbished LT2 space. These peer-to-peer interactions almost became a pre-requisite interaction to class-level questioning, given the booth layout allowed students to socialise with peers and thereby better articulate to themselves and others the relevance of their liminal misunderstanding. The interactions empowered by the physical and

social booth space seems to have broadened the LT2 medial transitional space for sharing and interaction, even in didactic transmission contexts.

In seminars, these booth interactions could be observed with greater transparency given students belonged to pre-assigned groups and the sharing of misunderstanding with peers became normalised. When Joe was asked if he had noticed a change in the amount of student questions, he intuitively responded "...maybe it's the wrong question to say are students more willing to ask questions from the academics, because they are just talking to each other". Student perception of questioning behaviour was concomitant with this seminar leader's perspective, indicating a lesser frequency of interaction with coordinators than expected. One 1st year student, Felipe, represented this view as he was expecting there to be increased reliance on the coordinators in seminar sessions, predicting that: "I thought that everyone was going to have questions you know". However, he later revised his expectation after attending seminar sessions, explaining: "...it seems completely different, I think it seems like there is always 2 or 3 [coordinators] free, and actually they have to come check on us". Therefore, whilst students felt more empowered and assured in elevating questions to coordinators, due to their ability to undergo a vetting process with their group, they became more independent and adept at relying on peers as reference points than the lecturer alone. Further efforts were made to empower students to respond in front of the seminar class, including the use of a cushioned, cube microphone that could be thrown between different booth groups to amplify student voice. In one seminar observation where no student responded to a lecturer question at the end of a didactic transmission segment, the leader was observed throwing the microphone at random to a booth. Beyond its practical function of amplifying voice, this microphone might be symbolic of transitioning power, responsibility and agency from lecturer to students. This reflects the teacher-directed nature of class-level enquiry in seminars and is reflected in the diagrammatic transitions in figures 6.3 and 6.2.

Sharing risk

Risk is a concept that broadly includes loss, significance of loss and uncertainty, and has been applied in the education literature in relation to student learning and teacher practice (Ponticell, 2003). Risk-averse or risk-taking behaviour is important to consider, given they go hand in hand with barriers to innovation, change and transition. The ease of group interaction evident from interactive and didactic session observation in LT2, and the resulting empowerment of students to enquire with one another, meant that students were better able to form trustful bonds and friendships with members of their booth. This was particularly the case in seminars where students were expected to interact and work together in groups to solve task problems, with the expectation to report back outputs to the class or electronically submit documents to the session leader.

The development of shared trust and vulnerability, including via the normalising of sharing liminality, led to an increase in the sharing of risk, as students felt more empowered to risk 'failure' or a perceived loss of reputation among trusted peers. This sharing of risk was observed in different forms, for example when one student asked a question in front of the seminar class, which he seemed very doubtful of, after which he looked to other members of his group for a sense of reassurance. Based on this behaviour, there may also be a perceived 'risk' of students appearing too keen or smart, and being seen to put themselves ahead of their peer group and class. For some students, the cost of making others look bad may even exert a greater perceived risk than getting a class question wrong.

The booth space seemed to allow students to more easily interact, form trustful bonds and share different risks, as to reference and alter their perception of those risks. This was confirmed in in-depth interview with a 4th year student, Maria, who contrasted her experience of group work in refurbished LT2 with that in traditional Lecture Theatre 3 (LT3) located opposite:

> "I think it's just because when we are in LT3, they ask you a question, everyone says their initial thoughts, but then it's actually quite hard to keep anything going because you can only see sort of 2 or 3 other people, you can't really hear exactly what the person on the other end is saying, unless they are like shouting, and also because you've got, you're in close proximity to other groups".

According to Maria's well articulated experience, the physical limitation of a traditional, row-by-row lecture theatre seemed to hinder group communication, stifle the continuity of interaction and reduce this student's ability to construct a shared space with her group in LT3. This barrier to interaction seemed to present barriers to group sharing and understanding of risk.

Joe's perspective from in-depth interview helped to confirm how students shared risk differently in his seminar sessions and with whom. He aptly explained: "I think its easier for students to take risks with their group than it is to take a risk talking to either a TA or particularly a seminar leader or when the whole class is listening", continuing: "...essentially it's a kind of low, low level of embarrassment if you say something wrong in front of your peers". This perception of a reference hierarchy based on perceived risk, combined with student awareness of module credit and how their behaviour may influence reputation and assessment outcomes, caused students to share risk primarily within their booth groups, unless for example approached by a coordinator or thrown the cube microphone. Riskier interactions within LT2 booth groups were possible because of the transition in power-geometry and broadening of transitional space; students not only had more agency to share liminal misunderstandings and risk, but perceived a potential benefit and 'prestige' to behaving in such a manner. This led to transitions in student perceptions of one another, which fundamentally altered referencing behaviour; this is explored later in section 6.2.3.

Space ownership

Remodelling the physical architecture of LT2 and changing pedagogic intent through modules like the seminar series broadened medial transitional space, which seemed to give students a greater sense of ownership to discuss and share their learning than in the traditional lecture settings. A key design feature that is believed to have enabled this sense of ownership is the booth spaces. Over time, these physical booths enabled the cementing of social group space and lasting relationships. This was particularly the case in modules like the seminar series where groups sat in the same booths throughout the academic term. Unlike the ACEX breakout space which was also found to have a high sense of student ownership and be the site of incidental active learning behaviour, the purposeful and expected active learning behaviour in LT2 became situated at the level of shared booths and had greater group ownership than individual student ownership.

My observation of student interaction with the material LT2 space resembled some of the behaviours indicative of ownership in the ACEX breakout space. In the ACEX breakout space, two students from a group of eight were observed moving stools from one side of the space to where the rest of their group were positioned to discuss a "project". Similarly in one of the seminar sessions in LT2, a coordinator approached a group and suggested: "you should probably discuss it as a whole group", which empowered one student to stand up from his booth seat, stand in front of the booth and begin discussion with his group. A clear expectation for group interaction had been set and verbalised by the session leader, which empowered students to use the space agentically both within the time/context of this observed event, as well as beyond it.

In a different LT2 observation example, a number of students were able to be more experimental about how they interacted with the physical space, for example in one instance when a student was observed standing at the head of his booth, proposing ideas and

gesticulating, after which he said to another member: "I haven't a clue mate, not going to lie...". This flexible material interaction in and around booths indicates a level of comfort and ownership which gave students a greater perceived individual and/or group agency to fulfill their own/group's learning needs. This agentic behaviour required transition out of traditionally expected norms and was most evident during one practical seminar observation when student groups were given whiteboards, rulers and bouncy balls to carry out a physics experiment. The way students used this equipment and the LT2 space was unconventional compared to previous seminars, for example crawling on the floor or using the walkways as additional space. This 'playful' use of space and deviation from expected usage is partly a manifestation of the elastic power-geometry and broadened transitional space. Seminar intent and lecturer expectation were also factors that framed the perceived reward of this broader range of material interaction and behaviour.

A strong sense of student ownership of personal booth space also appeared to extend in space and time to ownership of the entire LT2 space during informal non-timetabled hours, as evidenced by Mark, a didactic lecturer who remarked in in-depth interview:

> "...what I have seen is that outside of lecturing, the students seem so comfortable with the space that they go back there when there is no lecturing in progress so they can sit at the booths and use the space as a quiet space".

Mark continued with the caveat that: "...I haven't seen students do that in other lecture theatres because its more set up for listening rather than sitting down and working in". The comfort and ownership felt in this remodelled LT2 space therefore assisted transitions into and out of the informal, non-timetabled learning spaces, according to this didactic lecturer's perception and experience. This was confirmed by Maria, a 4th year student, when I asked her in which ways she had used LT2 as the first question in her in-depth interview, to which she responded:

> "...I had a lot of my lectures in there this year, so I used it obviously for that, and then I'd study in it as well, kind of in between lectures, particularly on Tuesdays, I had like one lecture then an hour gap, then another lecture then an hour gap, so I'd just stay in and work in there as there is nothing else going on".

Similar to the occupancy analysis of the ACEX timetable configuration (see table 5.5) which concluded that periods in between timetabled medial spaces 'bridge' formal spaces by encouraging meaningful transition in proximal informal spaces, Maria perceived sufficient ownership and affordance in LT2 to use it for independent study between her timetabled activities. This level of informal student ownership is striking compared to the traditional lecture spaces which were found to be more often vacant out of hours. This informal use of the LT2 space was also likely encouraged by the Physics department timetabling 'study time' between taught sessions. The refurbishment seems to have re-framed the LT2 space into a formal interactive space with broadened transitional potential, both within and between timetabled medial spaces.

Task and non-task transitions

The behaviours observed and interpreted in LT2 were possible because students and lecturers could more easily transition between different spaces and activities (see figure 6.3). Two broad categories of behaviour were identified within group discussion periods of interactive sessions: task focused and non-task focused interactions. These seemed akin to transitions between 'work' and 'non-work' related conversation recorded in the ACEX breakout space (see table 5.1). The non-task interactions were sometimes observed within the transitional spaces between activities recorded in figure 6.2, for instance when a lecturer had finished introducing a task and groups began to reassemble and orient themselves toward the task problem. In other instances of non-task interaction, students would transition into and out

of task-focused activity within the allocated group discussion space itself. One seminar group was observed laughing between more serious task-focused conversation, a behaviour that was more easily disguised within the seminar atmosphere than in the quieter traditional didactic setting. In a separate seminar session, I monitored a conversation in one group which centred around what time in the week the members preferred to "party".

This casual, task-deviated behaviour shares a similar signature with some of the 'hidden' informal behaviours observed in medial lecture space. The significance of this non-task interaction is debatable, but may have been booth groups scaffolding social bonds and trust for sharing of risk. Alternatively, this casual behaviour may be explained as the signalling of a state of individual or collective liminality implicated by the task to those in the social milieu, as to invite social acceptance or reassurance, such as from a coordinator. In other cases, groups were exhibiting this informal behaviour having finished the task, which was confirmed in in-depth interview with Felipe, a 1st year student who said: "...we always finish the [task] fast, so we also get to have a laugh afterwards". He perceived this freedom and engagement with non-task interaction as positive to an extent, explaining the caveat as: "...having your friends so close is a double edged sword" as he could get a "...bit distracted " and "...resort to memes". There may have been a group 'reward' associated with completing the task quickly/effectively which motivated more efficient interaction.

Felipe also interestingly attributed his proclivity for non-task interaction to how "bad" the lecturer was for a particular seminar session. Placing the responsibility (blame) for their learning (or lack of) on the lecturer rather than themselves seems to be a remnant of didactic transmission teaching where the lecturer performs and the students passively spectate.

For this student, the lecturer in some sessions may have been actually bad, but their own perception of this and transition in responsibility led to their choice to engage in non-task interaction with their group; the student's behaviour may have been a subtle signalling of

their perception of bad lecturing back to the teacher. Transitions between task and non-task focus are therefore linked to student risk and responsibility. Lecturer responsibility for student engagement in task and non-task interactions was indicated by Joe, a seminar leader who linked student engagement to task structure and timing in his in-depth interview: "...one of the issues that we probably didn't get quite right was the amount of material to try to cover in the time available". A renegotiation had clearly occurred between lecturer and students which placed greater responsibility for learning with students.

Non-task interaction was also observed in seminar breaks when this sort of behaviour was permitted. However, students retained a high booth retention during seminar breaks, for example during one observation when the lecturer called a break 50 minutes into the session, and only 5-10 students left the room, with the rest remaining in their booth chatting informally; some of these students were observed using the break time to continue working on the task. The continuation of group interaction during the transition between task-allocated time and session break time demonstrates the degree of social comfort established within these LT2 booth spaces. It also perhaps demonstrates a renewed expectation and responsibility to stay with one's group, compared to traditional spaces where learning sits with the individual.

These non-task focused interactions overall seem to represent behavioural signatures for transitional spaces between expected and self-directed activities. LT2 provided a broader transitional space for this transition, such that students could share and deal with the increased difficulty and cognitive load demanded by problem-based, active learning. This links back to and triangulates with the prevalence of venting, complaining and affirming behaviours documented in fringe transitional spaces in section 5.4.2. These task to non-task transitions may therefore be necessary spaces for dealing with cognitive and affective liminal states resulting from difficult learning.

6.2.3 Transitions in perception

For the behavioural transitions documented thus far in this chapter to be possible, it is believed that a series of in-situ transitions in student and lecturer perception needed to take place. Perception, which is defined as an internal phenomena which gives rise to embodied reason (Lakoff and Johnson, 1999), was methodologically explored using field and in-depth interviews.

Perceptions of Lecture Theatre 2

Remodelling LT2 seemed to result in transitions in the preconceived perceptions of teaching space, as reported extensively by lecturer participants in field interviews. One seminar leader, when asked if their perceptions of the lecture space had changed since first hearing of its remodelling and then subsequently teaching in it, said: "Something about the informality of the seats, being able to lounge - it feels less like a classroom". Words like 'lounge' carry positive connotation and seem to suggest that this lecturer perceived the space positively in relation to their interactive teaching experience; this also seemed to indicate a mutual comfort and safety within the space.

In in-depth interview, all participants were purposefully asked what they thought of LT2, as to openly invite response about their perception of the space. Maria, a 4th year student, responded:

> "I really like that it doesn't sort of have really long desks that are in every other lecture theatre, they have more like group kind of things, ermm, which is just nicer, I think, I mean our [didactic transmission] lectures don't have massive discussion in, ermm, but if they did I can feel like that would be a really good setup because it is quite difficult when you're in rows to talk to people".

Although Maria acknowledged that traditional lectures have little discussion, she voluntarily

commended the setup of LT2 by comparing its ability to accommodate interaction with other row-by-row lecture theatres. As a result of these new features, a traditional didactic lecturer Mark was asked if his expectation of learning had changed since using LT2, explaining:

> "I'd like to use more the, the spectrum of displays that's available in LT2, so I might adjust my balance between blackboard and screens and, err, some tutorial style questions where I roam from booth to booth, ermm and help each booth out, and LT2 is really good for that".

Having roaming access to booths has evidently encouraged Mark, who I observed as very traditional in his 'chalk and talk' approach before and after the LT2 refurbishment, to engage with the new LT2 affordances like the walkways between booths, for active segments of teaching in future.

To interpret this data, it is evident from previous data relating to two traditional, raked lecture theatres (ACEX LT1 and Blackett LT2) that space cemented the perception and expectation of both students and lecturers with regards to how they should ritualistically behave and interact. If space has this capacity to cement perception and behaviour, then it too has the capacity to change it, as evident from these interview quotes representative of wider transitions in the perception of the LT2 space.

Perceptions of lecturers

Transitions in perception were further explored in in-depth interviews, and were found to be more pervasive than the perception of the refurbished space alone. These changes in space perception were accompanied by transitions in student perception of the lecturer also. In being asked if they noticed a change in how they interact with their lecturer, one 1st year student, Felipe, explained how his original perception of the lecturer had shifted since attending seminars:

> "...since then I thought lecturers were like a higher being or whatever, and this guy was just coming from table to table, coming to check on us individually with a smile...you can ask him stupid questions".

This compelling transition from perceiving the lecturer as a 'higher being' to someone who is approachable seemed to empower Felipe to not only ask 'stupid questions' that he would have otherwise avoided asking, but to interact differently with the lecturer in the transitions to informal spaces:

> "I can email him, I can email a lot of other people, you know, because I was not going to office hours because I'm a bit afraid".

A transition in Felipe's perception of his lecturer therefore resulted in a decrease in his fear of perceived judgement, and an increase in his perceived agency to interact with the lecturer inside and outside of the timetabled session based on his learning needs. This indicated a transition in the student's responsibility for their own learning and a broadening of potential transitional space connected to the timetabled formal space. A different 1st year student, Alex, shared a similar sentiment when asked if his interaction with the seminar lecturer had changed, remarking:

> "Yes, I think that the lecturers can be more approachable in that space. I mean, rather than having to go after, after a lecture or go to the office hours I think when the lecturer is there and you can actually approach them and ask them, they get to know you, it makes it probably a bit less intimidating than asking them after".

The perception that the timetabled seminar became a 'less intimidating' opportunity for students to enquire with misunderstanding than solely during off-ramp and postponed transitions suggests a broadening of transitional space compared to the pre-renovation

LT2 space. This change in student perception of lecturers was also recognised by lecturers themselves, evident when they were asked in interview if they noticed a change in student interaction with them, to which one seminar leader Joe answered:

> "...my goal from the beginning, and I've written this down somewhere, was that we would not be kind of authority figures err handing down information to them and handing down answers, err but they would be there working things out for themselves...get them to see you as a, as a helper".

This lecturer's intent and resulting expectation of students 'working things out for themselves' explains the increase in responsibility reported by students and their treatment of lecturers differently. The refurbished space seems to have empowered this seminar leader to achieve his goal of transitioning student perception of him toward a more facilitating 'helper' role; student perceptions of lecturers have helped to confirm this.

Perceptions of students

Whilst lecturers became acutely aware of how they were perceived by students, they also tended to undergo their own transition in perception of student interaction. One interactive lecturer in field interview explained:

> "Going from talking at the front to group work is much easier. More tricky transitioning from transmission back to group. I perceive it positively if students are engrossed in discussion".

This response reconciles the challenges of recapturing student attention following group discussion with a positive perception held about deep student engagement in group discussion. Interestingly, when asked in field interview how he felt about teaching in LT2, a 'more traditional' didactic lecturer similarly approved of this peer-to-peer interaction in

booths: “I didn’t mind students talking in bays which may help to keep them engaged”, despite it challenging his traditional transmission-based style of teaching.

The challenge experienced by seminar leaders in managing student transitions in perception and expectation of learning interaction was mitigated by explicitly stating expected behaviours to students. In one seminar observation, the leader was observed first saying to an individual group: “You should probably discuss it as a whole group”, after which they said to the whole class: “You can discuss with your friends”, to which a noisier classroom atmosphere resulted. The need to explicitly state new expectations was confirmed by Joe, one of the seminar leaders in in-depth interview, who remarked: “...some students don’t realise that they are allowed to ask questions”, which made him “...realise that there are things that you have to spell out that you wouldn’t expect to spell out”. This reluctance for student interaction with lecturers may have been because students opted to divert any questions and concerns to their seminar group instead of escalating them to coordinators and risking loss of credit. In response to this reluctance, lecturers recognised a need to empower students, which as Joe went on to perceptively note, requires one to “...get students realising that they have something, something useful to say to each other”.

By making new expectations explicit to students, lecturers were thereby empowering changes in student perception not only of themselves as lecturers, but arguably encouraging transition in student self-perception such that they would take on a different learner role with greater agency and responsibility to share ‘something useful’ and actively learn.

Among changes in perception of the space, activity, lecturer and self, perhaps one of the more prominent transitions in perception was experienced between students. Having repeated opportunity to work in a booth group with peers shifted how students perceived one another. One 1st year student, Felipe, when asked if he felt his seminars in LT2 had changed his perception of peers, gave one representative example of this:

> "...this guy [peer] that I really never spoken to before, but like just spoken to briefly and now I just confirmed he is like a really good guy".

Felipe went on to share in interview that more generally he had "...made a lot of friends I talk to even now" and that these peers were "not competitors anymore". This data is educationally significant given the previous perception of peers solely as 'competitors', whilst providing a driving force for independent learning, risks pressuring students into isolation. This isolation has been shown to hinder self-regulation and well being in adolescent students (Muhammad et al., 2014; Akçayır and Akçayır, 2018) as students are positioned 'against the world' and struggle to construct a high sense of self-efficacy. In contrast, peers positioned as potential collaborators in shared learning, like through these transitions in perception in LT2, allows learning via both direct and vicarious experience.

These transitions in peer perception seem to result from repeated opportunities in seminars for students to interact with one another in different seminar contexts and form relationships with fellow students, enabling them to prove or disprove original and sometimes negative perceptions held about peers. This is in stark contrast to traditional lectures where a limited range of social transitions were possible. The perceived role of peers therefore transitioned from 'competitors' toward sources of help and useful discussion, supporting in-situ transitions toward more collaborative learning behaviour and mindset.

These general perception transitions resulting from the refurbished LT2, whilst sharing some similarity with perception transitions in section 5.4.3, should be distinguished from those associated with in-situ transient transitions in perception between physical spaces. These more general and longer-term transitions in perception are found later to influence interaction and behaviour outside of these in-situ microsystem spaces, resulting in ex-situ transitions linked to other microsystems explored in chapter 7.

6.2.4 Transitions in referencing

The documented set of perception and behavioural transitions activated by the refurbishment of Lecture Theatre 2 (LT2) appeared to have changed the way students tended to reference in their learning. In this section I explore these transitions in referencing behaviour.

A flexible space

Changes in the collective perceptions of students and lecturers (social references) and of material resources in the physical space itself (material references) led students to perceive learning in LT2 differently to lectures in other spaces. A 1st year student approached for field interview in an on-ramp transition prior to their seminar, when asked if their learning felt different in LT2 compared to other traditional lecture theatres, responded: "Different because in LT1 it is more passive lecture style. Both have merits and are quite different". This distinction made between their interactive seminar-based learning and didactic learning in more traditional spaces like Blackett LT1, however, did not limit LT2 to interactive learning alone. Lecturers on the whole found LT2 suitable for didactic transmission, including one lecturer in field interview: "Yes, because it cannot only be used for traditional teaching but other forms too". This view was shared by a 1st year Biology student field interviewed in an off-ramp transition following one of his weekly revision session in LT2, who similarly reported LT2 flexibility: "Lot of group communication, it is better for this. Would probably not make much difference to lectures".

These reported perceptions of the space's affordances suggest that despite compromises being made in refurbishing the raked lecture theatre, such as a loss in space capacity, the conversion of this space did not implicate a huge loss in perceived function for traditional learning and teaching. The only indication of any such regression were minor gripes shared about the space's technology or aspects of design. One example of this was when a 1st year

student explained in field interview that: “The tables are not conducive to group work, causing divisions since students at flanks cannot talk to one another”. Complaints like these could have also represented proxy signals of distrust, such that participants were unwilling to complain about anything significant, yet still wanted to signal their position as sceptical about LT2. Whilst these specific gripes may have inhibited the effectiveness of specific referencing behaviours, the flexibility of the space seems to have broadened the mode of referencing overall.

The flexibility of LT2, through a perceived and actual increase in referencing possibility, better facilitated the activity transitions summarised in figure 6.2. Whilst educators and designers can furnish a learning space like LT2 to increase the likelihood of certain learning behaviours, students in many cases were found to take agency in negotiating ‘hidden’ transitional spaces (see section 5.3.3). Given these self-directed spaces were found to be important for students to interact, reflect and reference, individuals continually revised their perception, expectation and behaviour in response to these interactions. These self-directed interactions constitute proximal processes which shape the development of an individual’s disposition which, if exposed to the right conditions, can become more in sync with collaborative learning and behaviour (Bronfenbrenner, 1979). The flexibility of the LT2 space provided greater allowance, through a broadening of transitional space, for these social interactions and negotiations between students and other members of the learning community. My documentation of changes in referencing behaviour suggests that students became more accustomed to in-situ active learning in LT2.

Referencing transitions

Expected referencing transitions routinely observed in pre-renovation Blackett LT2 didactic transmission lectures included students either consulting proximate material such as printed

lecture notes and the PowerPoint slides, or more rarely asking the lecturer class-level questions (often leading to 'failed' transitions). This was found to be normalised, ritualistic behaviour in all observed traditional didactic sessions where students were expected to sit, listen and absorb transmitted information. In addition to these expected ritualistic behaviours, however, students also took agency in engaging in hidden transitions, including subtle consultation with peers and personal technology. These behaviours were deemed hidden because of the suppression of referencing and rules of the classroom. My attendance at the LT2 design board meetings made me aware of the design intention to empower students to reference with a greater range of resources, and to thereby liberate the previous referencing suppression. For this student liberation to be supported, lecturers as figures of authority too must have undergone transitions in expectation to permit these transitions in referencing behaviour.

The educator as a more experienced person might be better placed for guiding students that are stuck and liminal, yet are arguably less adept than peers at relating to the challenges and associated emotions of the learning journey. The enriching of referencing in LT2 can be linked to the Zone of Available Assistance (ZAA) which considers the ecology of resources available to a learner in a specific context (Luckin, 2008). These resources are termed *references* in this study (see section 3.5.1) to reflect the comparative and relational nature of learning when an individual interacts with and internalises the material and social resources in their environment, as forms of available assistance. However, the presence of these references or resources in a learning space alone is not enough; the physical, social and power conditions of a space must empower active transition between reference engagement. The redesign of LT2 not only transitioned its perceived affordances, but when combined with the pedagogic design and intent of interactive seminars, normalised peer-to-peer referencing as a new expected, ritualistic behaviour. This peer-to-peer referencing was predominantly

confined to seminar booth groups which were pre-assigned and which were expected to produce task outputs for a small amount of module credit. In a small number of cases, cross-booth interaction between different seminar groups was observed, including during one observation when the member of a group shouted forwards to another group saying: "Hey mate, how do you do that?" enquiring about how to use a Jupyter platform as part of the task. In response, the student handed forward their electronic tablet and the student in the booth in front helped them set it up correctly. Besides this exceptional cross-booth interaction, the booth design instilled a sense of personal group space in which students could more easily share liminality and vulnerability within the group. The natural inclination and expectation of students to direct their interaction with external reference points therefore changed in LT2, compared to traditional settings, posing new opportunities for active learning and connections between microsystems.

Reference routes

Reference routes denote the characteristic sequence of cognitive, social and material references which students engage with following liminal misunderstanding. Student proclivity and expectation to reference changes according to the in-situ power-geometry and conditions of the space. In the refurbished LT2 space, students seemed to be more willing to engage in references that were typically deemed higher risk/higher reward in traditional formal spaces, including engagement with fellow peers. The change in expectation in LT2, particularly in the seminar sessions, seemed to alter student perception of this perceived risk and reward, and consequently transitioned the characteristic referencing behaviour.

The characteristic reference route taken by a student in any given context varies according to a complex set of interrelated factors. Whilst this complexity cannot be fully captured diagrammatically, the characteristic reference routes observed and reported 'on average'

within traditional ACEX LT1 and refurbished Blackett LT2 can be seen in figure 6.4. These adapted CHAT frameworks could be deemed an over-simplification, given for example students were observed simultaneously consulting material course notes and engaging in group discussion. The overall prevalence of transition to social references like peers and seminar coordinators, particularly in response to initial misunderstanding and/or need to progress through the seminar task, was found to be increased in LT2 compared to the traditional lecture spaces. In ACEX LT1, students seemed exposed to a material-rich (or socially-poor) environment which guided these reference routes. Contrarily, the Blackett refurbished LT2 space, particularly in interactive contexts, presented a socially-rich environment with less perceived barriers to interaction. The richness or scarcity of reference points in these spaces was partly governed by the presence of 'tools' like material notes, and negotiated according to the 'rules' of activity; the 'division of power' between members of the 'community' determines the relative power of the 'subject' and other interactants.

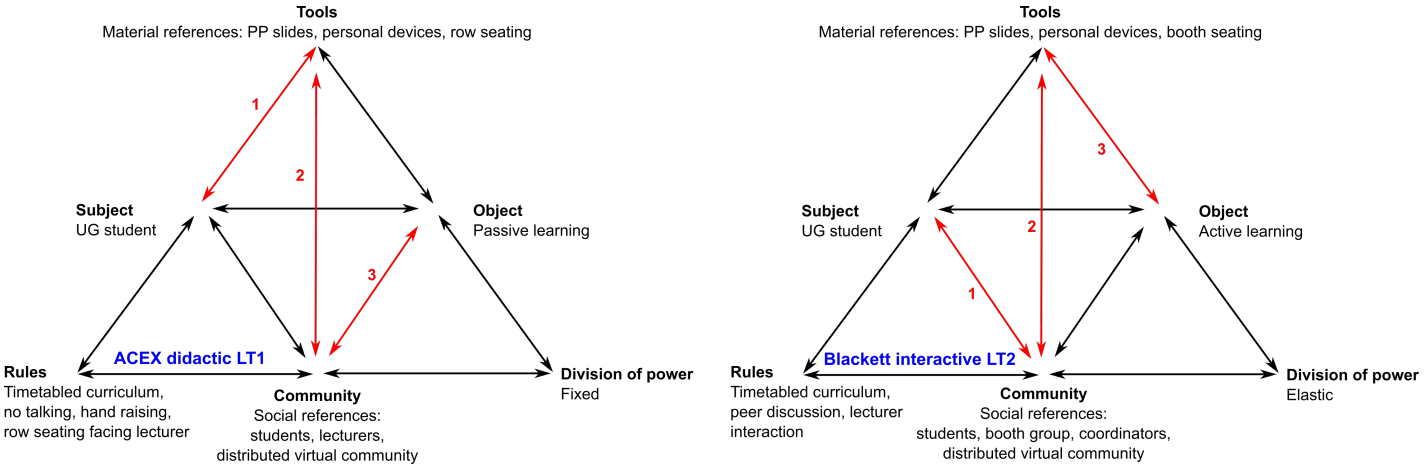


Figure 6.4: Adapted CHAT triangles showing the characteristic order of transitions between students and material/social references in ACEX LT1 (left) and Blackett LT2 (right)

Whilst these CHAT diagrams present the characteristic reference routes observed and confirmed in interview for a particular space by students and lecturers, they do not apply to all moments observed in all sessions. For the refurbished Blackett LT2 space, one particularly perceptive 1st year student, Felipe, explained in his in-depth interview how his referencing

habits had changed in LT2 to reflect the route seen in figure 6.4. Felipe explained his ordering of consultation as:

> "...I usually ask my, my friends, then the internet but the internet usually has no answers because you know how hard finding physics questions on the internet is, then usually ask the seminar leader, or the first, or the TA [Teaching Assistant], we don't really discriminate between them".

Felipe's response helped me to understand how each reference was part of a progression of transitions. The normalisation of peer interaction in LT2 enabled seminar groups to generate and articulate a 'hypothesis' that could be shared with a TA as a question, inviting a more efficient and assured interaction than spontaneous questions asked in traditional spaces. The process of group-directed hypothesis generation, deliberation and then testing with a more experienced TA or lecturer approximates a more active learning process. This learning approach and resulting set of skills is also more applicable in other contexts like research which aligns more with learning from discovery. The traditional lecture spaces were better set up for passive learning, whereas refurbished LT2 better enabled reference routes more akin to active learning. Felipe was able to elaborate on how different spaces influenced his referencing proclivity, including in Blackett traditional LT1: "I just whisper it to the guy next to me and that's it, and if I don't get the answer I search on the internet because I'm a bit too embarrassed to ask".

To further explore reference routes pursued in a different interactive learning context to the seminars, 4th year 'Research Interfaces' sessions were observed. These sessions sought to teach softer professional skills to students who were pre-assigned to groups and allocated to booths similar to the seminars. This module was also assigned credit and assessed with a 85% coursework and 15% practical component. One of the module leaders, Ruth, expressed an expectation for predominant student interaction when she was asked who students

were mostly directing their questions to: "...its not so much them asking us questions, its more us asking them questions and getting their response to that". Ruth had little expectation of students reaching out to her with questions, but rather expected students to consult each other in their groups. This seems to have led to a transition in the role and expectation of the lecturer, necessitated by a need to circulate and intervene in student group discussions. This links back to the transition in student expectation to learn via group-directed hypothesis generation, deliberation and testing with a more experienced educator in LT2. It also suggests that the reference routes established in the refurbished LT2 space approximated active learning by discovery more so than independent, passive learning characteristic in the traditional learning spaces.

In didactic transmission lectures taught in the refurbished LT2 space, the reference routes were observed as similar to the pre-renovation setting, however, some important variation was observed and reported. Maria, a 4th year student participant of Research Interfaces confirmed a greater comfort in referencing with peers in both interactive and didactic sessions, when she explained who she mostly directed her questions to:

> "...I ask my friends first. So if we are, and that's kind of with regards to if we are doing like a group work thing or even like just in one of the Plasmonics lectures where you're not technically working together, if there is something I don't understand and I'm not at the front I'll ask my group members first".

Maria interestingly reported peer interaction at points of misunderstanding in her didactic (Plasmonics) lectures. Furthermore, she interestingly described these peers as 'group members' even in this transmission lecture context, which supports the earlier documentation of student-student perception transitions. This transition in student behaviour and referencing appeared to also spark an evolution in lecturer expectation. Mark, a didactic lecturer, when asked in in-depth interview what he thought of LT2, answered:

> "...when I'm lecturing I can see a bit of whispering in the booths and err and sometimes I'm for that, especially if its about the material, err sometimes it can be a little bit disruptive, err so I, I have seen the students ask questions to each other and talk about it, I also try to give them time to do that in the lecture and I think the booths really facilitate that".

Whilst Mark expressed mixed feelings about an increase in these 'disruptive' interactions between students in booths during his didactic teaching, it seems evident from his interview response that he is now finding ways to provide more time and space to accommodate such interaction. Therefore, the transitions negotiated in student referencing behaviours reported in both interactive and didactic transmission sessions may have contributed to a transition in lecturer expectation of what constitutes useful learning behaviour, even for those like Mark who swore by the most traditional transmission approaches.

6.2.5 Influences on referencing

Having introduced transitions in the referencing routes and behaviours of students in LT2, this section seeks to interpret why these transitions in characteristic referencing may have occurred. Following on from the belief that effective referencing leads to effective transition and active learning, it is important to consider what prompts and influences the way an individual will reference and transition; this links theoretically back to the 'influences on transition' in table 3.1.

Preceding activity and intent

For transition to occur, the preexistence of one or more 'spaces' is required in which an individual moves physically, socially or cognitively from one space to another. Therefore, it is possible for transition to represent a process where the subsequent space is yet to be

constructed and is a product of the transition itself. This explains why students reference in their learning, in that they are presented with a single or set of disjunctive spaces which prompt a liminal state, after which they transition to another space to avoid, postpone or engage with the liminality (Savin-Baden, 2008). Transition is therefore 'messy' and difficult to atomise because it requires contemporaneous connections to different microsystem spaces, and varies according to the personal learning ecology of the individual. Whilst an individual's intent to reference might be 'genuine', it may also serve to appease a ritualistic expectation because of the 'spotlight effect', that is when people behave to be accepted in the eyes of others in the social milieu (Gilovich et al., 2002). Reference routes must be explored within a broader sequence of transitions and activities, whereby learning achieved from one activity must precede, influence and provide an internal substrate for learning in the next activity (see figure 6.2).

The nature of learning as a temporal sequence of reference engagement means that it is heavily guided by the intent of the seminar session. Student agency also plays a significant role in how they reference. For example, a student that has been assigned a task problem and initially discussed this in their group, through generating a hypothesis with their peers and exhausting possible solutions with that reference, will internally and socially acknowledge that alternative references must be pursued to confirm/deny the hypothesis. In this scenario, the console of a more experienced coordinator might be sought after. Inherent to transition is therefore an articulation of the reference needs to the student in that learning scenario and moment, at which point a rich set of reference points should be accessible if in-situ transition is to effectively achieved. The refurbished LT2 space has been evidenced as better configured than the traditional lecture space for both students and lecturers to physically and sensorily orient their attention to a richer set of reference points in interactive periods (see figure 6.3). Being a member of a 4-5 person booth group also meant that a greater number of social

interactions were possible in interactive sessions, unlike in traditional settings where students were restricted to 'hidden' interaction with one person either side. This increased potential for social referencing among 5 students in LT2 booths and a single coordinator is visualised in figure 6.5, which shows the potential social spaces constructed between different member combinations.

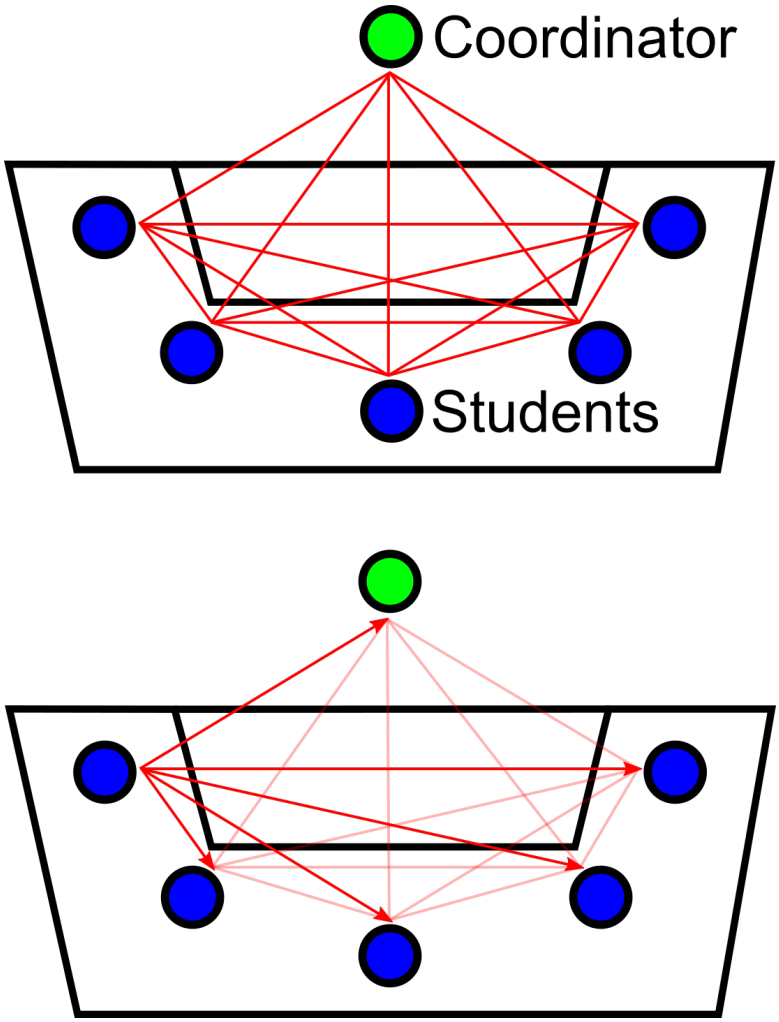


Figure 6.5: Top LT2 seating booth shows all potential reference interactions/transitions between a group of 5 students and a coordinator with bottom booth showing those connections available to an individual student

By empowering students to share risk and build trust within booth groups, the 'stronger' members were observed helping and teaching 'weaker' members, such that all members were empowered to contribute and better understand their role within the group. This was reflected by several students in interview, including Alex a 1st year seminar student:

> "...you want to ask people in your group and, you know, see what they think of the problem, also allows you to kind of gauge maybe how difficult the question is relative to your peers so you kind of understand where you are, but I mean if everybody is struggling, OK fine I sort of know where I am, but if everybody else kind of knows the question very easily, and they say, actually it came up in lecture 2 or something and you hadn't seen that lecture, then you kind of know, because that's quite useful to students who can reference where the material came up in lecture content or something in a way that TAs just can't".

Alex's response suggests that by referencing with peers in seminars, he was able to become more self-aware of his own understanding by 'gauging' difficulty and thereby orienting himself toward the appropriate reference and transition. This seemed part of the aforementioned discovery process of generating an individual and/or group-moderated hypothesis and following this up with appropriate reference action, such as consulting a TA. Critically and in addition to this previous finding, however, Alex also stated how fellow students were better positioned than seminar coordinators to help him navigate the broader curriculum, including important connections back to concepts in previous formal activities like 'lecture 2'. This invaluable peer perspective has been better leveraged in LT2 seminars to support students in making important connections between microsystems which are easily overlooked, yet paramount for effective learning and application of knowledge in contexts ex-situ to where it is constructed.

Refurbishing LT2 broadened the narrow medial transitional space of traditional LT2 in which transitions were hidden or postponed to off-ramp transitions. This broadening transitioned the incidental and navigational interactions documented in the fringe space to within the medial space, where students had more power to orient themselves to the next referential interaction.

Module credit and time

Year 1 UG seminars constituted 1% of the module credit, with 75% of that credit for uploading group materials, and the remaining 25% being performance-based where students were required to submit outputs on the department's learning management system.
The session design meant that students were expected to discuss with members of their pre-assigned booth group to reach a certain output to a problem task within a certain time frame. Having a shared task meant that students were required to discuss more so than in traditional settings, and the assignment of a small amount of summative assessment credit to this activity seemed to further motivate students to collaborate with their group. Decoupling the organic proclivity for peer discussion, from student efforts to cultivate a certain image for achieving module credit is an important challenge here. I explored this relationship in interview, including with one seminar student, Alex, who described assessment credit as having little influence on his proclivity to reference with peers:

> "...when you're given problems to discuss I think you do naturally just discuss them, even if the problems weren't assessed, whereas when you're in [Blackett] lecture theatre 1, you are often next to people you don't know that well, see trying to discuss problems would be quite intimidating you know, people would rather just sit there and think about it themselves".

What seemed more influential than credit was Alex's familiarity with his peers and the relationship he formed with them through repeated group work in the LT2 seminars. A different 1st year student, Felipe, offered a contrasting perspective, reporting that the credit assigned to the seminar module influenced how he wanted to be perceived by the coordinators and why he primarily interacted with his group. Felipe explained this when I asked who he directed questions to during seminars:

> "...we just don't want to ask the seminar leader straight up because we are really like a bit, because we know we're being assessed you know, we don't, we don't really want to make a fool of ourselves".

Student awareness of assessment and the resulting motivation to maintain a certain image among the seminar leaders seemed to preserve a distance between the student groups and coordinators, thereby cementing peer-to-peer reference routes. Credit in this respect seems to have served a pedagogic utility by incentivising students to be more active in their groups, as opposed to passively deferring to seminar leaders as a default reference route.

Interviews with seminar leaders helped me to gather an additional perspective that could be triangulated with that of students. This management of perception between seminar coordinators and students, as tainted by the use of assessment credit, was recognised by Joe, one insightful seminar leader who explained:

> "...you are the guardian of credit, that affects your, your relationship with the students, and the more of the students err have in, have in their heads that you're this guardian, err the more they are going to treat you differently...to kind of tick the box to get the credit".

This student perception of coordinators and resulting relationship led Joe to reflect on the influence of assessment credit and time allocation on student referencing behaviour to decide that: "...next year if we do the same then it will be with no credit, and my guess is there will be, you know we will have the same thing and it won't cause many problems". This combination of design intent and use of assessment credit clearly contributed to the overall transition in referencing behaviour. When asked if his experience as a seminar leader had changed his expectation of student interaction in other spaces, Joe usefully compared his ability to encourage classroom interaction in a traditional lecture theatre with the refurbished LT2 space, remarking:

> "...these problem solving classes, it was pretty easy to circulate around, but the atmosphere was really different, erm so it was yeh it was very much students weren't really expecting to be talking to one another".

Therefore, it seems that because of the difference in physical space and session design between LT2 and other spaces that Joe had taught in, students in the traditional space were only referencing and interacting with peers when they had problems, whereas during seminars, peer discussion was expected and more integral to the active learning process. Module credit seems to have moulded how students chose to appear to be referencing in seminars. The time allocated to group-based task interaction determined how students referenced in order to successfully complete the task within the limited time. Module credit might be thought of as a tool to cultivate group formation, however, student group formation was found to present challenges and opportunities.

Subgroup formation

In interactive sessions, I frequently observed booth groups divide into 'subgroups'. This seemed to influence the way in which individual students were inclined to reference (or not) with fellow group members. One initial explanation was the relative positioning of a student within their booth. For example, when group members were positioned on the outer flanks of a booth, they seemed less engaged in discussion than members at the centre, and appeared to find it more difficult to have a voice (see figure 6.5). This flank phenomena was first evident in observation, and was confirmed with Huan, a 1st year student in in-depth interview:

> "So if you come by the last outer group you would be sitting on the edge like way way way at the edge, and someone who will be writing stuff on the other side, you have no hope of seeing, and that will just shut anyone out of the following discussions in terms of, you know, psychology".

Another possible reason for this subgroup formation was believed to be a practical division of labour. In one seminar example, I observed a group segregated with two students at one flank end informally talking and laughing, a student at the centre of the booth sharing notes with the group on his notepad and a student on the opposite flank sat with a coordinator who seemed to be receiving help; following the coordinator interaction, the flank student proceeded to share information with the whole group. In this scenario, each member was engaged with a different reference point simultaneously and the purpose of each interaction appeared to differ between each subgroup. According to Alex, a 1st year seminar participant, this division of labour seemed almost necessary during LT2 group work:

> "...you really do have to talk to your group and you have to communicate and you have to find effective ways of making a decision and allocating work to different people so that you can do things in the allocated time".

These group to subgroup transitions seemed necessitated by the completion of the group task. Less able members of seminar groups referenced with more proficient members, leading to an overall increase in group learning gain which was enriched by the neurodiversity of the group (Pollak, 2009). Learning via this peer-to-peer teaching also allowed stronger students to affirm their own understanding. This mutual learning benefit seemed to enable a triangulation that strengthened an individual's perception of what was right and wrong, allowing them to more competently direct their referencing efforts.

In a number of cases, however, group division seemed to indicate the breakdown of group communication. In one seminar observation, a student on their laptop shouted to a member on the opposite side of the booth who was drawing on his group's whiteboard: "Are you happy with this for...?", at first receiving no response. He asked another question for confirmation, to which the fellow student still remained unresponsive. There could be a number reasons for this unresponsiveness, yet this observation demonstrates the struggle

for some individuals to 'have a voice' in their group. Having to settle differences with members and cooperate throughout the academic term arguably led to the development of collaboration skills for seminar students. Based on my observations, these communication breakdowns did not seem common across student seminar groups, and in the rare instances they occurred, coordinators were able to intervene to offer assistance.

6.3 Chapter synopsis

This chapter started to address the second research question reintroduced in section 6.1:

> How does the redesign of learning spaces influence transitions?

By continuing to observe a mixture of interactive and didactic transmission sessions in refurbished LT2, I came to understand the influence of the redesign on medial transitions necessary for active group learning. The addition of booths connected by walkways seemed to change the 'social distance' between students and educators who could more effectively transition between activities (see figure 6.3); it has therefore been argued that this redesign 'broadened' physical and conceptual transitional space. This seemed to permit a more elastic power-geometry, which enabled educators to better transition power to students who had greater individual and/or group agency to alter reference routes from passive listening and 'failed' transitions in the traditional pre-renovation space, to group-directed hypothesis generation, deliberation and testing with a more experienced educator in the refurbished space. These documented transitions in reference route should be of interest to anyone interested in encouraging active, discovery-based or research-based learning.

In chapter 7 I take these findings relating to in-situ transitions in the refurbished LT2 space and introduce findings relating to the refurbished Blackett foyer space to further explore the influence of these space refurbishments on ex-situ transitions.

Chapter 7

Exploring ex-situ transition

7.1 Introduction

This chapter introduces observation, field and in-depth interview data for the post-renovation Blackett spaces (see table 4.4) to understand how the in-situ transitions, necessary for active learning in Lecture Theatre 2 (LT2), connected to *ex-situ* transitions from participation in other non-observable spaces. The first half of this chapter focuses on in-depth interview findings for the refurbished foyer, with the second half exploring how the Blackett 'transitional zone' (refurbished LT2 and foyer spaces together) influenced in-situ and ex-situ transitions in student and lecturer perception, expectation, behaviour and agency. Together with chapter 6, this chapter continues to address the second research question:

> How does the redesign of learning spaces influence transitions?

The refurbished Blackett spaces have been plotted as microsystems in figure 7.1. Foyer refurbishment led to a further broadening of physical, conceptual and design transitional space. Resulting transitions seemed influenced by a 'critical mass' of meaningful participation in this 'transitional zone', which contributed to a 'ripple effect' phenomenon in which the 'agentic threshold' for active learning became more broadly attainable.

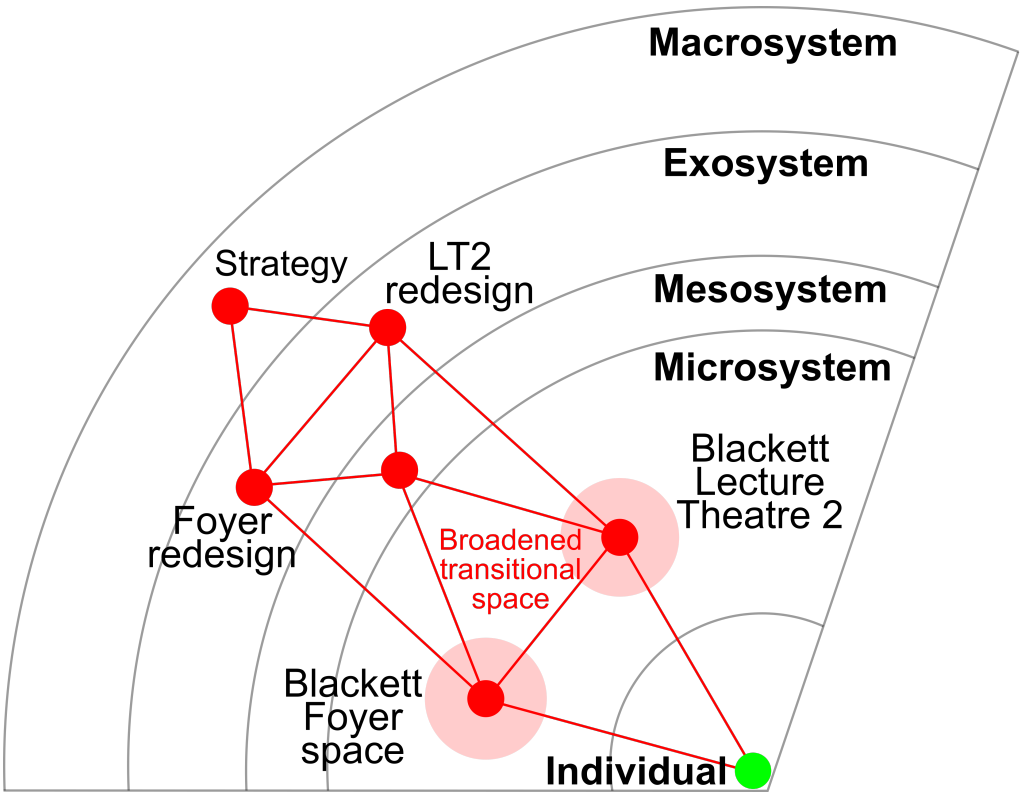


Figure 7.1: Refurbished Blackett LT2 and foyer spaces plotted as microsystems on the ecological systems model with broadened transitional space resulting from redesign

7.2 Harnessing transitional space

In chapter 6, I demonstrated how strategic-driven redesign of Blackett LT2 led to in-situ transitions in the perception and behaviour of students and lecturers using that space. Given LT2 is an activity system (Engeström, 1987) or microsystem (Bronfenbrenner, 1979) located within a broader ecosystem, it interconnects with actors and other microsystems in the mesosystem and chronosystem. In-situ transitions observed in LT2 are therefore posited to 'ripple' into non-observable spaces via ex-situ transitions. Transitional spaces between LT2 and other microsystems, like the foyer, have been identified as supportive of these transitions and negotiations. Converting LT2 into a more interactive auditorium broadened this transitional space, which further broadened following the refurbishment of the adjacent foyer. Systems thinking suggests that changes within these transitional spaces feed back into the entire system (Pendleton-Jullian, 2019). Harnessing their potential therefore deserves greater attention for supporting active learning and culture change.

7.2.1 Blackett foyer: fringe transitions

All of my observations of refurbished Lecture Theatre 2 (LT2) included observations of transitions into and out of the adjacent foyer space in its pre-renovation format, much like my approach in the ACEX setting. These data enabled me to define on-ramp and off-ramp transitions at the fringe of the formal LT2 space.

My findings about medial and fringe transitions relating to LT2 and the foyer positioned me ideally to engage with a StudentShapers project, working with a team consisting of a 4th year student and members of staff from the Physics department and College, to translate this study's research philosophy into a remodelled foyer; further information about this redesign project can be referred to in section 4.2.2. Although the redesign was not a planned aspect of this PhD research, it represented a novel integration of my findings with a participatory design approach (Casanova et al., 2018) which engaged the end users of these Blackett spaces. By adding the right type of furniture and thereby increasing the comfort and affordance of this space, the intention through redesign was to encourage better active learning and interaction during on-ramp and off-ramp transition into and out of timetabled sessions in the neighbouring LT2 and LT3 formal spaces (see floor plan in figure 4.2).

The redesign of this foyer space has helped me to better understand how in-situ transitions observed in LT2 might 'ripple out' via ex-situ transitions into other spaces. The staggered refurbishment of LT2 and the foyer therefore allowed me to distinguish the impact of these space changes on transition. I was able to most rigorously explore participant perception of these space changes in my in-depth interviews, which began shortly after the advent of the COVID-19 pandemic. It is noteworthy that both the Blackett LT2 and foyer refurbishment pre-dated and were not responses to the COVID-19 pandemic. Nonetheless, this study's findings might have potential value in the institution's response to COVID-19 and socially distanced blended learning.

Space for learning?

In field interviews both pre- and post-refurbishment of LT2, I asked undergraduate students before and after their timetabled sessions about how they might change the neighbouring foyer space to be more conducive for learning. This yielded relatively unperceptive responses, given the general student perception of this foyer as a 'waiting area containing lockers' remained static, which seemed to inhibit imagination about its remodelling. This static student perception had likely been cemented by a ritualistic expectation and usage, which I repeatedly observed as brief waiting behaviour during on-ramp transition and swift exit during off-ramp transition. A handful of exceptions included students chatting for longer than a few minutes or using the lockers.

The limited view shared by most students in field interview, that this foyer space served as nothing more than a waiting area, matched the dominant behaviour I observed. This was reflected by a 3rd year student observed using the tables to access his bag before being approached for field interview, who explained: "Not great for studying with traffic, but the tables seem pointless". His rejection of this space as anything more than one for processing traffic between lecture theatres was echoed by a 4th year student observed using his locker who felt that the space "...didn't need to be anything particularly special, serves a purpose as it is". Another 4th year student answered with similar pessimism:

> "Don't think this space could be used for study, but if you walk through parts of Skempton or Aero [departments] where there is seating, it could be similar, social space makes more sense".

This student did express recognition for the capacity of this space to be improved as a 'social space', similar to how students perceived the ACEX breakout space (see section 5.2.1). Overall, students identified more with what Nassar and Hosam (2014) refer to as *dependent* utilisation of the foyer space, which is waiting outside of or entering/exiting the adjacent

lecture theatres. The elements that potentially would enable *independent* utilisation, such as introduction of furniture for interaction and activity, were more secondary and overlooked.

To contrast with this narrow student perspective of the foyer as a potential space for learning, other students made practical suggestions about how it could be improved for independent utilisation beyond its function as a waiting area. This desire for change seemed to be in response to a frustration about its shortcomings, echoed by a 4th year student's description of this space looking "...quite boring" and "...depressing". To remedy this, another 4th year student made a simple suggestion to add "More comfortable seats and lower tables", whereas a 3rd year participant in a separate interview argued for "...better use of the tables as it is currently just a waiting area". One explanation for why many students had little stake or interest in this foyer space, despite frequenting it, is offered in the analysis of a 1st year Biology student who was interviewed after his revision session in refurbished LT2. Although this student was not a member of the department and arguably had less sense of ownership of this space, he remarked:

> "I don't know how I would use this space because if I wanted to do more work it would be in library or halls. It seems important for people who have lockers but not for me".

The low perceived value of this foyer space for independent and group study might be because students compare and benchmark it with more desirable study spaces like the campus 'library'. A lack of any meaningful suggestion about how this foyer space could be made better suited for study was therefore to be expected, even though some participants recognised an untapped potential.

This limited outlook was also expressed by lecturers to a lesser extent, who were similarly asked in field interview how they might change this foyer space to make it more conducive for learning. Some lecturers provided more creative suggestions, but were again limited

in their ability to make meaningful comments. A leader of the LT2 seminar series made some practical suggestions such as: "Long tables with plenty of working space", yet highlighted what he saw as significant limitations, including: "No natural light is an issue" and "Basement feel is psychologically restricting". Whilst these limitations are indisputable and other more preferable spaces are recognised by participants elsewhere on campus, the utility of this foyer space for supporting important transitions was not able to be explored in these constrained field interview interactions. This was likely because both students and lecturers were not empowered or equipped to successfully imagine and articulate a remodelled space during such a short interaction, and struggled to foresee the space's potential beyond their own historic usage. For this space's re-imagining to be possible, participants ultimately needed to undergo transitions in their traditional roles and perception to roles that were akin to design partnership.

Transitions through partnership

The limited student and lecturer perception of this foyer space was, perhaps, influenced by the highly structured field interview interaction, which inhibited participant creativity to fully explore possibilities of the foyer as a transitional space. These interviews rather allowed participants to reflect on their previous usage of this foyer space and in a restricted way, project forward about how they could foresee changes to this space in future. With this in mind, and with my previous realisation that in-situ transitions in student perception in LT2 led to transitions in student role from passive to active learner, it seemed necessary that for meaningful input into the redesign of this space to be achieved, that individuals needed to be better equipped and more empowered to redesign this space.

My findings regarding on-ramp, medial and off-ramp transition between LT2 and the foyer space allowed me to inform the design philosophy of this bare foyer space in partnership

with the StudentShapers team. Redesign intended on broadening fringe transitional space for more effective timetable to non-timetable transition and incidental active learning.

Transitions in *role* were recognised as necessary for student and staff partners to perceive themselves as capable of modifying the very environment in which they had learned and taught in; a role is defined as the ideas and principles that guide what a person should do and how they should behave in a given situation (Hewitt, 1976). In essence, the individuals recruited through the StudentShapers scheme had to be empowered to transition from their usual role as passive or active learners and teachers to what Martens et al. (2019) refer to as *design partners*. Figure 7.2 provides a simplified hierarchy of these different learner roles to illustrate the need for a set of transitions between each. This diagram is valid in relation to the partnership-driven redesign of the foyer space, yet is also relevant in relation to the roles that students are expected to adopt between passive recipients of information and active partners in their learning.

The chronological progression from passive to active learner to design partner implied in figure 7.2 is better depicted as a set of fluid transitions between each role based on the needs of the learning context. Furthermore, these transitions through partnership are not 'independent' role transitions, but occur in a co-constructed space where expectations are negotiated by student and teacher. Hence, student transitions to design partner requires a reciprocal transition in role with those they partner with and who they are educated by; mirrored transitions in educator role from authoritarian transmitter of knowledge to active facilitator to design partner are necessary. Given empowerment and perceived agency increases up the diagram, such that a 'safer' space for risk-taking and deviation from expected activity is negotiable, a broadening of a 'design transitional space' might be said to occur.

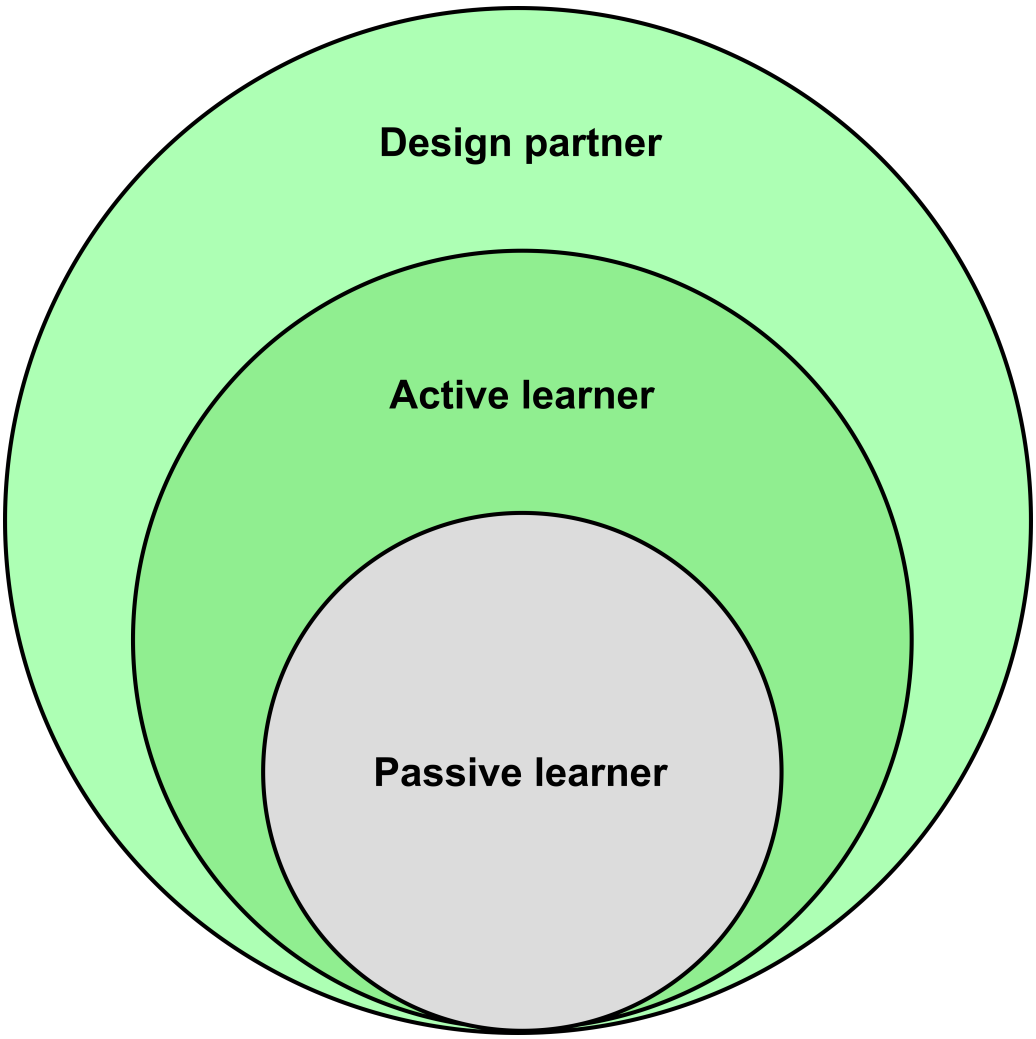


Figure 7.2: Diagram adapted from Martens et al. (2019) to show transitions between the potential learner roles of students

Changing on-ramp and off-ramp affordances

Once a StudentShaper team had been convened and each member was equipped and empowered to act as design partners, the Blackett foyer space was able to be re-imagined and re-designed through a participatory design process involving end user consultation in the Physics department. By implementing high tables and stools, writing surfaces and comfortable sofa seats at the periphery, space affordance and usage transitioned. The redesigned foyer space along with these key features is shown in figure 7.3.

Behaviour observed during actual usage of this refurbished foyer space was discrepant with the broadly pessimistic student perception documented prior to its refurbishment in field interviews. A stronger student affinity to the space is first visually evident in the photograph



Figure 7.3: 3D render showing the key features of the redesigned Blackett foyer space including high stools/tables and variable writing surfaces

in figure 7.4 which illustrates typical activity in my 4 observations of the refurbished foyer space. The difference in usage was first striking to me when a group of 1st year students using the space during an on-ramp transition prior to their seminar session in LT2 were sat talking on the sofas. Of the 15 students counted in total during this on-ramp transition, the remaining students were sat on the high stools, some using their mobile phones alone or in groups. Not only was this observation of space and peer-to-peer interaction drastically different to the pre-renovation space, but so too was the on-ramp occupancy levels and distribution of users. As this on-ramp group prepared for entry into LT2, the 1st year group exiting LT2 into an off-ramp transition paid some attention to the foyer space, yet left more immediately. It was hard to decipher whether a hidden negotiation of ownership between the on-ramp and off-ramp group occurred during this transitional 'crossover' period.



Figure 7.4: Photograph of the refurbished foyer space showing independent and active learning activity (source: Imperial image library)

Felipe's response to if he expected to engage differently with on-ramp transitions since the foyer space refurbishment helped me to clarify this:

> "...what I feel there is a problem with, and it should maybe be addressed in the future is the fact that sometimes it can get a bit too crowded when people are leaving the lecture theatre, you know what I mean, like, when there is like a whole crowd leaving, and there is everyone like standing around them".

The crossover traffic caused by the encounters between the on-ramp and off-ramp groups in this 'crowded' foyer space was understandably off-putting for Felipe, which corroborated with my observation of most users leaving the foyer space immediately after session.

The informal chatting monitored in my first observation of the refurbished foyer space was

more purposeful and learning-related than in my pre-renovation observations. This was exemplified when two students entered and placed their notebooks on a table, exchanging: "...if we do problem sheet 1 now, we can do problem sheet 2 next week". During a separate observation, my exit from LT2 around midday coincided with a 1st year student also leaving LT2 who, unprompted, began a conversation with me, enthusiastically complementing the new furniture in the foyer space. This was the first interaction of its kind among any of my non-participant observations to date i.e. a student approaching me to initiate informal conversation, perhaps indicating a change in social norms renegotiated within the refurbished space(s). The relatively minor economic cost of renovating this fringe foyer space seemed to increase capacity/expectation for interactive social behaviour which rippled from LT2.

1st year seminar students were arguably less hostage to this foyer's historical status/usage than later year students. To confirm this, I observed two later year undergraduate students in my final observation entering the space with their lunch. Their conversation seated at one of the high tables meandered between a reflection of "...how things used to be" and comical reference to"...lets do something else against social convention", as if they perceived this recent space refurbishment as challenging 'social convention'. This comical interaction suggests that by finding themselves in a remodelled space that communicated a different inbuilt intentionality to what they historically expected, these students were renegotiating their own perception and expectation. The renewed physical space seemed to offer a renewed transitional space more permissible of 'riskier' behaviour. During a separate observation, I noticed the movable glass writing surfaces had been displaced to the edges of the space near the sofas, demonstrating a transition in material interaction and sense of ownership among users. This student-directed modification of this space likely intended on establishing stake in and better affordance for independent and collaborative learning.

Space for transition?

Through redesign, the foyer space became a better 'analogue' for documenting in-situ transitions in active learning behaviour connected to the refurbished LT2 space. A single field interview was able to be conducted with a student in the refurbished foyer space. When asked if she used the space differently to before it was renovated, this 4th year student responded: "Yes, we never came down here and worked as there was nowhere to sit before". Although she was using the space independently, she referred to herself as 'we' in this response, indicating that this transition in perception of the space was perhaps shared by her peers. Her expectation of future usage was also transitional: "On Tuesdays, I have a lecture and an hour gap then another lecture. I will use it to get work done during that gap as it isn't that far to go". The proximity of this foyer to LT2, in combination with its renewed affordances and the timetable providing 'an hour gap' between her LT2 sessions, caused the foyer space to become an alternative study space option to vacant lecture theatres in periods between timetabled contact. This links back to the occupancy analysis for ACEX data summarised in table 5.3, which identified these timetable gaps as 'bridges' between the timetabled medial spaces which encourage meaningful use of the informal fringe spaces. In-depth interviews allowed me to engage in a reflection with more participants who had varying experience with the refurbished foyer space. The response of a 1st year student, Alex, to if he noticed any change in foyer usage since the refurbishment, explained one major factor that guided his and other student's use of this foyer as an alternative to informal spaces like 'halls accommodation':

> "...older students using that space, and you know I saw one of my Physics parents [departmental buddy] sitting on a computer with someone, doing the work, and I know I think older students seem to use it more than undergraduates, probably because they don't have the accommodation that's as near to the university".

Alex's use of hierarchical terminology like 'parents' indicates his perception of older students (which are likely part of the departmental buddy scheme) as peer mentors, who perhaps feel more entitled to this space than earlier year undergraduates. Huan, another 1st year student, echoed a reluctance to use the refurbished foyer space for different reasons, given he explained:

> "...it's not very welcoming to me as a student, because firstly, the whole place seems like a basement, because you have kind of very low ceilings and I'm not sure if it's mercury lamps, but it is the kind of fluorescent lamps which gets very, very cool, cool temperature light".

These perceived spatial shortcomings meant that Huan's perception of the foyer remained fixed as he went on to conclude: "...unfortunately it seems like a last minute refurbishment to just add a bit more room for people to sit and perhaps write stuff on the table". Huan's unchanged perception may simply be a function of the space being perceived cautiously in the earlier stages prior to meaningful usage and sense of ownership, such that a social/group expectation had not yet been constructed; the advent of COVID-19 and my termination of observations made this unfolding usage impossible to further explore in-situ.

The negative sentiment shared by this particular participant does not, however, seem representative of the general perception. During my first observation in the refurbished foyer space, two students observed entering the space and placing their belongings on one of the tables exchanged a conversation that indicated a different set of perceptions. One remarked to the other: "I don't believe they completed this space in one weekend", followed by: "I'm glad to see they are actually spending their money wisely after 3 years". This conversation indicates these students seemed complementary of the space, their department ('they') and the process/strategy that created it. This more enthusiastic usage and perception of 4th year students, compared to 1st years, may even be a result of a member of the final

year cohort partnering in the StudentShapers design team and through consultation, negotiating a greater sense of foyer space ownership among his 4th year peers. Furthermore, the conversation and behaviour of these older students suggests that this refurbished foyer space as adjacent in space and time to LT2 not only became a better vehicle for transition into and out of the formal lecture theatre(s), but a student-owned space with an elastic power-geometry where in-situ transitions in LT2 could be further negotiated, amplified and progressed.

Ahead of Mark, a didactic transmission lecturer in LT2, sharing his perception of the refurbished foyer space, he made reference to his 'make-do' use of the pre-renovation foyer space for handling off-ramp enquiry. His revised perception was shared:

> "I think its great, I like the blackboards, the pictures are nice, I can really see how both the undergraduate student community making the most of that during term time and indeed our graduate student community utilising that out of term time during the summers and so on".

Mark seemed to welcome a space where he could better handle off-ramp enquiry with his undergraduate students. He also commended and recognised the flexible capacity of this foyer space for graduate student activity out of term time. Another lecturer participant, Joe, who adopted more of an active learning approach to teaching shared how he perceived remodelling the refurbished foyer space as a:

> "...I think its worth trying because that's the time when they are still thinking about things and so, the best, the best time, and yeh slightly more level playing field compared with them coming down the steps to talk to you at the front in your space [LT2], then if you're going into their space [foyer] then that's probably a better way".

Joe referred to the lecture space as 'his space' and the foyer as a 'student space' with a 'more level playing field', positioning off-ramp interaction in this space as preferable to hurried interactions held in LT2. This triangulates with the general student perception of the ACEX breakout space as a student-owned, social space in which off-ramp interactions were commonplace. After a different interactive lecturer, Ruth, expressed her frustration of "...running over time" when handling student questions at the end of session, which seems like a reality of all timetabled activity, she similarly commended the prospect of a better equipped transitional foyer for handling off-ramp enquiry: "...it's more likely that they will actually get the answer rather than having to then follow up with you. The wait might mean that they drop off and don't follow up". The latter part of Ruth's response suggests that she was aware of the susceptibility to 'postponed' transitions which can result from space and time constraints. She usefully linked the 'wait' after timetabled sessions to an increased chance of students 'dropping off' and not 'following up', such that the absence of appropriate transitional space, like this refurbished foyer, can lead most students to neglect liminality and miss out on rich in-situ learning.

The adjacent foyer space seemed to provide a space in which students had a greater sense of agency and ownership than, for example, a trip to the teacher's space like their personal office; the foyer therefore seemed to level the playing field between the student and educator. The foyer also provided a more 'comfortable' space for Ruth to handle interactions with her students. The transitional space not only has pragmatic benefits for assisting timetable transitions by incentivising cohorts to not overrun in LT2 and instead take off-ramp interactions outside, but also seems to empower a continuation of rich learning interaction beyond LT2. This 'rippling' of interaction between each space reinforced expectations for active learning.

Referencing as bi-directional contribution

Given the collective evidence for in-situ transitions in perception in response to the Blackett LT2 and foyer space refurbishments, it is believed that transitions in learner role and referencing behaviour occurred as a result. It can be instinctive to conceptualise referencing as a comparative process in which an individual merely 'consumes' information from their material and social environment. Nonetheless, interview responses with students indicated a shift from this consumer role to one of a contributor role, where referencing became perceived as 'bi-directional' and reciprocal. This transition in referencing became evident in seminar group discussions in LT2, which benefited not only the referencing student, but the learning of all involved participants within a 'shared' booth space. This reciprocity is less inherent to material reference engagement, including the physical spaces and artefacts which students interact with. However, this study has demonstrated that with the right tools and empowerment, student partnership can transition the role of learners from passive recipients of a transmitted curriculum toward design partners who have agency over a negotiated curriculum and learning environment (Martens et al., 2019). These transitions in role and referencing behaviour mark a significant ontological transition, whereby students and their environment are treated as a closely coupled developmental system (Ingold, 2000).

One way I explored transitions in student perception of referencing behaviour was by asking participants if their experience of group work in LT2 had changed how they approached group work in other spaces. Felipe, a 1st year student, explained:

> "I've learned new things about myself, as in like, I might not be the best one at physics in the group, but I am definitely the one who is better at organising or coming up with ideas".

For Felipe, his repeated seminar group work led to a better understanding of his own strengths in relation to the group. Alex, another 1st year student, similarly responded:

> "I'd say it's gotten me more used to group work probably yes, I mean I haven't experienced much in other spaces but I say I'd feel, probably a bit more confident, if I was put in small group like that again to put ideas forward".

Not only did both students develop a greater awareness of their strengths and role in their seminar group, but the 'confidence' Alex developed to 'put ideas forward' indicated that he changed his perception of his own contribution within his seminar group. These transitions in perception of referencing behaviour are indicative of a greater self-awareness within these LT2 group learning contexts, as well as in ex-situ contexts outside of LT2. Both participants suggested that the seminars in LT2 empowered them to more effectively assume and accept a role within other group learning contexts. This increase in self-awareness was likely facilitated by students having greater opportunity to reference with their seminar group. This calibration of one's schema and emotions may support transitions in agency and self-efficacy, which Mruk (2006) defines as the extent to which one feels worthy of respect from others and competent to face the challenges that lie ahead. Arguably, better understanding one's role, strengths and weaknesses relative to the social group would transition one's perception of their own worthiness and competence if they are more assured of where they fit in; this also may lead to more generative dispositions (Bronfenbrenner, 1988). Furthermore, Jindal-Snape (2009) notes that exposure to a new environment and concepts, and the formation or loss of new relationships inherent to education transition can leave students feeling vulnerable. Quality relationships with others, including those reported in LT2, are suspected to ripple into ex-situ physical and temporal spaces inhabited by participants and seem crucial for regulating self-efficacy and well being during 'vulnerable' transition. The social connections made more possible since the foyer renovation strengthened the formation of these relationships first seeded in LT2.

Seeding connection

The expectation to interact in LT2 transitioned and 'rippled' from the formal space into the adjacent foyer space during off-ramp transitions. There was evidence in the refurbished foyer that by increasing the affordance of this space, students were better able to connect with one another and more effectively engage with off-ramp transition. This supported navigation of the uncertainty associated with transition from formal to informal learning space, which has been associated with a decrease in student self-regulation within flipped classroom contexts (Akçayır and Akçayır, 2018). By providing renewed affordances for students to connect, the previous expectation for a fruitless end to the timetabled session and transition to independent behaviour seemed to be up for renegotiation. Students now had more 'reason' to co-construct spaces for connection, which resembled those documented in the ACEX breakout space, 'disguised' as venting and complaining about the LT2 seminars.

Whilst venting about seminar pitfalls might seem counter-productive on the surface, they lead to student-owned medial and fringe transitional spaces. The introduction of appropriate furniture and amenities into this foyer space led students to more often co-construct these group spaces in which aspects of learning were also discussed. There had been an important transition from secluded off-ramp behaviour (pre-renovation) to social off-ramp behaviour (post-renovation). Creating spaces with inbuilt expectation for connection and transition seem crucial for assisting students with managing these repeated transitions into uncertainty. Coyle (2018) refers to: 'Collisions - defined as serendipitous personal encounters - are, he believes, the lifeblood of any organization, the key driver of creativity, community, and cohesion' (p. 66). It seems it is not only important to maximise potential 'collisions', but to provide the right conditions for useful collisions to take place. Off-ramp transitions from passive or active timetabled sessions into the fringe space, if properly designed, present ideal conditions for incidental (or 'serendipitous') active learning.

The seeding of these connections in fringe transitional spaces like the refurbished Blackett foyer, which have been proven to possess elastic power-geometries, can also lead to fruitful interactions between, for example, students and lecturers who are able to engage in more personal dialogue than in the formal lecture theatre. According to Mark's perception in his in-depth interview, these off-ramp interactions are useful:

> "...for general advice on what types of research projects, opportunities with the College for research, err, even interacted with students from the other lecture theatre, who err, who learned about me from their friends and colleagues attending the course I taught".

Well equipped spaces like this foyer space therefore have an extended capacity for connection and cross-pollination of different user groups who use proximal spaces like the adjacent lecture theatres. These potential 'collisions' between different users, who were rarely observed 'colliding' in the pre-renovation foyer, seemed to have acquired reason and even expectation to interact as part of a larger community. Student foyer usage for independent or group study in-between timetable medial periods may cement a sense of ownership of the space, and thereby increase student perceived agency to interact with lecturers during other periods like off-ramp transition. Furthermore, the increased affordance of this space, in combination with the interactive learning approach adopted in LT2, may increase a student's probability of 'colliding' with fellow students or academics. These collisions result in important social transitions into, for example, future research collaboration of value to the department and student. This refurbished foyer therefore capitalised on the natural routes of ingress and egress taken by members of the learning community into and out of adjacent formal spaces, to encourage 'collisions' among users. It also supported ex-transitions into non-observed formal and informal spaces which are now explored.

7.3 Ex-situ transitions

The coupled refurbishment of the Blackett Lecture Theatre 2 (LT2) and adjacent foyer space resulted in what I have coined a 'transitional zone'. This spatial area presented increased opportunity for learning and transition, including but not restricted to in-situ transition between the two spaces. This transitional zone has been evidenced as increasing active learning activity relative to its pre-renovation state. It also usefully allowed me as an ethnographer to observe more meaningful in-situ transition between the formal and informal spaces, and to thereby understand how redesign of physical space broadens transitional space for active learning (linked to the second research question).

Bioecological theory suggests that learning, and therefore transition, are not time- or space-bound phenomena. The observable and reportable in-situ transitions, including in relation to perception and referencing behaviour, are seeded during activity in spaces (microsystems) like the refurbished foyer and LT2 space. By virtue of timetables dictating student and lecturer use of other physical and temporal spaces, the in-situ transitions observed in the Blackett 'transitional zone' rippled into more distal spaces via *ex-situ* transitions in the mesosystem which either 'regress' or 'progress' the direction of the original in-situ transitions.

Encouraging participants in in-depth interviews to reflect on how their perception and behaviour had changed across space and time (see transcript in appendix 12), I introduce in the rest of this chapter transitions in role, expectation and agency linked to ex-situ transitions. Whilst in-situ transitions are context-dependent and emerge in the in-situ spaces observed, ex-situ transitions are believed to be the mechanisms for broader transitions in departmental behaviour, identity and culture. These ex-situ transitions approximate proximal processes which operate in the mesosystem and chronosystem (Bronfenbrenner, 1988) and investigating them has been important for answering the research questions.

7.3.1 Role transitions

Figures 4.7 and 7.4 represent before and after versions of the Blackett foyer space. The transition between these before and after versions of physical space resulted from the institution's strategy-driven capital investment into space. It can be harder to appreciate the before and after transitions in human role and behaviour that accompany these spatial transitions; after all, one appropriates the other (Lefebvre and Nicholson-Smith, 1991). The transitions in perception covered in section 6.2.3, and the transitions in role recognised as necessary for movement between students as passive to active learners to design partners, were further explored in in-depth interview. One way of determining if transitions in role had occurred in response to these refurbished spaces was by asking participants if their behaviour or expectation had since changed in other learning spaces. The response of a 4th year student, Maria, demonstrated her awareness:

> "I don't know if necessarily it [LT2] will bring the change itself...what I'd hope is that as you get younger lecturers coming in, and kind of, its more widely accepted now that the traditional lecturing style isn't necessarily the best way of learning, that's definitely the case in secondary schools and stuff where people are coming in and talking to you about, actually like listening you only take in 30% or whatever it is, whereas doing stuff you take in like 90%".

Maria's relative experience as a final year student revealed itself firstly in her acknowledgement of space as an insufficient change agent alone, and secondly in her recognition of her own agency as a student in negotiating transitions in lecturer role; these lecturer transitions seek to be more compatible with her own role and expectation as an active learner. This supports the reciprocal nature of role transitions, and for some students and lecturers, stems from their awareness of the shortcomings of traditional transmission lectures. This suggests that student role transitions like those summarised earlier in figure 7.2 are not independent

transitions, but occur through negotiation between students, their environment and others within it who appease the expectation of one another.

The response of the seminar leader Joe in his in-depth interview triangulated with this student's view of educator role in LT2:

> "...our role of walking around err is bigger than helping people with the technical content of the session and answering their questions, so our err, our role is partly vetting the environment for learning, so its not just about the space, the environment is not just about the space".

Joe led the undergraduate seminar series and could be deemed a 'champion' of the active learning approach following his participation in the university's PG Cert programme. Nonetheless, Joe's intent to move away from being perceived as what he termed a "guardian of credit" toward a "helper" seemed challenged by the intent of some students, preoccupied with achieving maximal module credit and a lecturer perception of them that furthered this goal (see section 6.2.5). However, by empowering students through the right investment into these refurbished spaces, Maria's interview response suggests that some students seemed to feel they could positively influence lecturer expectation to be more aligned with active teaching. Students had therefore undergone transitions in their role and responsibility as learners to become important sources of change to learning and teaching. When empowered as design partners, as with the refurbishment of the Blackett foyer space, it has been evidenced that students who are granted greater responsibility will enact even greater agency. The broadening of transitional space as a result of a change in pedagogic affordance seemed to support more fluid transition between roles based on the needs and expectation of the learner, educator and context. Hence, it seems that both students and lecturers developed not only their spatial literacy (Fisher, 2004), but also their *transitioning literacy* following their experience in the Blackett transitional zone.

7.3.2 Transitions in expectation

Transitions in role and perception necessary for students to become active learners and for lecturers to become more active educators, occur not in isolation but as a result of a set of negotiated transitions. This negotiation occurs within a 'co-constructed' space, made more possible as a result of broadened transitional space and elastic power-geometry, within which expectations are constructed.

Imms and Kvan (2021) note how the increasing investment in innovative learning environments (ILEs) will only translate into positive outcomes for students if teachers actually integrate learner-centred pedagogies and digital technologies into these spaces. When expectations are established for educators to engage in ILEs, they are more willing to tolerate uncertainty, take risks and explore new approaches. Therefore, flexible and innovative learning spaces only possess so much 'independent' power, and will only facilitate more innovative learning if educators subscribe to the guiding principles of the space. It could be argued that the educator must perceive active learning as an effective approach in refurbished or traditional spaces if active learning is to be achieved. Nonetheless, to expect active learning is one thing, to translate this expectation into actionable pedagogy requires agency, a change in role and a risk-taking attitude (Le Fevre, 2014). If managed poorly, this translation can lead to educator perceptions of risk and uncertainty (Twyford et al., 2017). Given risk-taking is not an objective reality confined to the individual (Rosa, 1998), the cultural appetite for risk is important to consider when attempting to empower educators and students to exploit the potential of refurbished learning spaces like LT2. This suggests that the desired transitions to active teaching practice require both strategic reward originating in the macrosystem, sharing of best practice and negotiation among a community of practitioners in the exosystem, and transitions in student and educator expectation/behaviour in the mesosystem and microsystems.

Exceeding lecturer expectation

In field interview, all lecturer participants who had some level of experience in the refurbished LT2 space were asked if they had concerns prior to the refurbishment, if they foresaw opportunities and if their perceptions had changed since teaching in the space (see appendix 6 for interview questions). This was a quick and effective way of tracking how lecturer's initially expected the space to turn out, how they went on to perceive it after using it and what they later expected from their practice in future. When asked about their concerns, there was a mixture of optimism, indifference and apprehension, given some lecturers were unsure whether the space would meet their pedagogic requirements. This apprehension was represented by the response of one of the main seminar leaders when asked about his initial concerns:

> "Broadly positive about it. If not perfect, it would be better for interactive teaching than the old space. I was apprehensive it would work as it should".

This lecturer's hopes that the space would 'work as it should' aligned with his expectation and intent to teach actively in it. Having taught in the space, it was clear that his expectation had been exceeded when he reported:

> "Been impressed by the effect of the architecture and design on the room, it just works. Students happy to talk to each other and interact which would not happen in a traditional lecture theatre or smaller classroom".

This lecturer positively contrasted his experience in the refurbished space to his historic efforts to achieve active learning in 'traditional lecture theatres' and 'smaller classrooms'. A different lecturer involved with the seminars was more concerned about LT2 losing function as a didactic lecture theatre: "...main concerns was how it would work as a lecture theatre still. Silly discussions about whiteboards and blackboards. It worked out better than I

thought". Based on these responses, the post-occupancy perception positively exceeded the expectation prior to the space being refurbished. The expectation of each lecturer can then be more broadly categorised into those participants that expected to teach didactically and those that expected to teach actively.

Regardless of the initial expectation held by lecturers, the initial apprehension followed by general contentment with LT2 indicates an 'exceeding' of expectation among all lecturer participants. Having facilitated active learning in LT2 and contrasted this with their previous experience of using 'riskier' active approaches in traditional spaces, participants seemed to express an important transition in their perceived agency to fulfill their teaching goals; that is, having now experienced LT2, they seemed to overcome many of their preexisting anxieties, which seemed to elevate their general self-efficacy. Exposure to the LT2 space both during the design process and after the space's completion guided some lecturers in their decisions about how to teach based on what they now perceived as the space's pedagogic affordances. The seminar lecturer who had concerns about LT2 functioning as a lecture theatre and who already expected to use it for active learning, explained:

> "My opinion of what it could do changed gradually through the design process. The format of seminars followed the design of the space - it wasn't until I saw the space that I got a proper idea of what it is capable of and how the sessions should run".

The idea that the space's affordances at first guided the perceived possibilities for teaching and learning was echoed by a didactic lecturer who similarly noted: "Came in yesterday with material prepared. I was sussing out the space trying to figure out the best way to present it". Since transition of affordance through redesign, educators seemed more empowered to trial new approaches. What then became interesting was any change in intent or behaviour reported in other learning spaces as a result of ex-situ transitions.

Expectation of learning in other spaces

To gain insight beyond the field interview phase, participants were asked in in-depth interview if their experience in LT2 had changed their expectation of learning in other (ex-situ) spaces. This helped me to understand whether participant in-situ experience in the refurbished LT2 space led to engagement with broader, ex-situ transitions in their perception, expectation and/or learning behaviour outside of LT2. For Felipe, a 1st year student, he responded:

> "I feel like LT2 does a really good job of making solid groups like actually I've made friends from the groups...makes it harder for people to go away or kind of like also forces people to work. Yeh, basically like I expect the quality to be as good as LT2 now".

LT2 seemed to have raised Felipe's expectation benchmark for group learning, much like another 1st year student, Alex, who shared that:

> "...the main asset of Lecture Theatre 2 is the group element, it hasn't necessarily changed my expectation of how I should learn, I think, in a sense, learning is quite an independent thing if you want to really master something, but it's changed my expectation of how I might interact with my peers in the university".

Whilst Alex maintained an individualistic perception of learning physics, he did report a change in his expectation of peer interaction in other spaces. A more pervasive ex-situ transition in expectation of interacting with 'peers in the university' had occurred for most students like Alex. This links back to the documented transitions in peer-to-peer perception and the transition from competitiveness toward collaborative learning.

From the lecturer perspective, Ruth had taught a final year course interactively in LT2 and shared her expectation of learning in other spaces:

> "...I think if I was doing something that required them [students] to learn new material, but learn new material in a way that was more interactive then I think I would be dead keen to use LT2...because you could also get them working as a, as a team again to try and test each other's learning, as well as me trying to test it".

Similar to the student participants, Ruth seemed to tie the success of student group interaction to the LT2 context and space itself, expressing little enthusiasm for testing similar pedagogic approaches in other spaces like traditional lecture theatres. Her perception also links to her enthusiasm to take agency in carrying out interactive learning, partly because Ruth (among others) seemed to perceive poor space as a limiting factor in her pedagogy. It must be noted that for a participant to recognise their own transitions in active learning or teaching requires a high level of reflection. Joe, a different interactive lecturer who had reported his historic efforts to facilitate active learning in traditional spaces, seemed more able to articulate such a reflection:

> "I would say that my expectations have changed across the course of this year and that's partly down to some of my thinking in the PG Cert I've been doing, but I think that's informed by what I've been seeing in the seminars as well so I think the two things together have probably changed my expectations".

An important combination of Joe's intent to actively teach, as motivated from his professional development as an educator, and his experience in the LT2 space caused a progressive transition in his expectation of learning. Joe's earlier reference to 'vetting the environment for learning' shows that his experience in LT2 seemed to have improved what Fisher (2004) calls his 'spatial literacy' (p. 37). Participant responses seemed to indicate a raising of expectation for active learning and functionality of space, as well as a transition in expectation of learning interaction in ex-situ spaces.

Expectation of interaction in other spaces

When asked if her expectation of student interaction had changed in other traditional spaces like lectures, the interactive lecturer Ruth went on to explain:

> "We were allocated [traditional] Lecture Theatre 3, for an activity that needs a fair bit of space but it's to do with space constraints so what I would ask to do with the timetable the next year, which I think will be feasible, is instead of having the whole cohort doing that session at the same time in LT3, I'd break them in half and have them doing it half and half in LT2 because its much better".

Ruth's responses suggest that having taught in LT2, her expectation and enthusiasm for active learning had since been raised as a result of the quality/functionality of space, since she preferred using LT2 for interactive learning to traditional lecture theatres like LT3 opposite. For a 1st year student, Felipe, his response to the same question about any change in expectation of interaction in ex-situ spaces initially suggested little change:

> "Well, as I said I keep it separate, so yeh, I wouldn't really expect to whisper to someone in the lecture because I know that everybody is used to it in LT2, that may be a bit disrespectful or rude to that person".

As with many of the participants, Felipe strongly distinguished his interaction in LT2 seminars to his interaction (or lack of) in traditional lectures due to context-dependency and session intent. With further prompt later in interview, however, he mentioned his changing perception of and relationship with his peers:

> "I actually think in Imperial if you ask questions you're regarded as stupid, you know, especially to your peers...there is always this underlying competition you know".

The important reference made by Felipe to a culture of 'underlying competition' among his cohort caused me to ask him if he now expected a different style of interaction with his peers since learning in LT2: "Yeh well like definitely, the friends I've made in LT2, they are not competitors anymore, you know I don't see them as competitors". A different 1st year student participant, Huan, similarly atomised his learning interaction in LT2 as separate to other spaces and contexts, reporting that it had little effect on his expectation of interaction in other spaces like lectures:

> "So I'm very used to learning things by myself first, and the value I see in group work is when you're working on a project together...the seminar sessions are kind of a boosted session where you quickly go through a topic and search a lot stuff and you quickly, or rather briefly communicate and at the end you get some insight".

Huan recognised the diversity of referencing and the different style of learning possible in LT2 seminars, yet seemed to stick by an individualistic approach to learning in ex-situ contexts. This independent view of learning and strong sense of individual agency supports the hypothesis that students don't necessarily expect a different style of learning following their experience in LT2, but do expect a different style of interaction. This goes hand in hand with assuming a different learner role based on the transitions in perception of peers from potential 'competitors' to 'helpers'. These expectation changes seemed pervasive and applicable to learning inside (in-situ) and outside (ex-situ) of LT2.

7.3.3 Transitions in agency

The in-situ and ex-situ transitions in expectation cannot be asserted as having translated directly into transitions in learning behaviour. These expectations are believed to be moderated by the perceived agency of students and lecturers.

Lecturer perceived agency

Findings introduced thus far indicate that renovating space may only play a partial role in enabling transitions in student and lecturer expectation of active learning interaction. Refurbishing LT2 shifted perceptions and encouraged lecturers to revise their preconceived notions about learning and teaching, partly in response to student-directed referencing transitions, which seemed to result from negotiations in expectation. This seemed to transition the perceived agency of lecturers who thereby began to consider whether to introduce active segments into their future teaching. Soon after their initial teaching in the refurbished LT2 space, an interactive lecturer who previously had keen interest in encouraging active learning but who struggled to foster it in traditional spaces, explained in a field interview that he was: "Now thinking about introducing some group-based discussion into transmission sessions as I now see the benefit of breaking it up". This educator seemed to have become more experimental, open to risk and agentic in using interactive approaches in other spaces and contexts. LT2 seemed to have lowered the perceived 'activation energy' to achieve effective active learning by elevating the perceived agency of lecturers. Another lecturer in field interview who taught the LT2 seminars and who was not interviewed during the in-depth phase, when asked to compare his experience in LT2 with other spaces such as flat-floor classrooms, remarked:

> "It is not only because of the student interaction, but because the students are more willing to talk to me as the lecturer. This space will change the culture of the students in first year, they will be able to talk in other settings".

This lecturer seemed adamant that students would now interact differently and that ex-situ transition at the level of cohort culture would result. The perception of students being 'so relaxed' in LT2 influenced how this lecturer thought about approaching his teaching practice in future: "I was already doing this before, but now I have this space, I can design lesson

plans and activities according to the space". Therefore, for an educator who already had a higher than average perceived agency to use "...interactive methods in a traditional raked lecture" prior to the LT2 refurbishment, his experience in LT2 had boosted his confidence even further. A different seminar leader who was field interviewed added to this:

> "I will be more likely to do flipped classrooms as it [LT2] provides me with confidence in group discussions working. I would maybe do this in different spaces but I would not have had the same confidence".

This participant showed some willingness and intent to use interactive methods in different spaces, yet because he reported lower agency and self-efficacy in these other spaces, seemed to express overwhelming preference for using these methods in LT2.

For lecturer participants that lacked this pre-existing intent to teach more interactively, it was interesting to explore if their perceived agency had transitioned since using LT2. To test this, educators who conformed to more traditional didactic transmission approaches were interviewed. For one participant in this category, he did not note any changes in fostering more student interaction, but did note some planned changes to his practice:

> "Indeed, up until this lecture [in LT2], I didn't consider a combination of slides, visualiser, and boards. Previously I just presented blackboard and slides, but I may now adjust how they can be used".

This participant had greater agency to experiment with new reference points ('slides, visualiser, and boards') presented by LT2, and perceived merit in transitioning between these to encourage more active forms of learning and interaction. He was therefore willing to take greater agency to use it in a broader range of modes than beforehand, either because of the intrinsic utility to learning or because of a perceived 'prestige' set by the institutional investment to undertaking the pedagogic venture.

Agentic threshold

Transitions in perceived agency were empowered by lecturers and students co-constructing space to explore interactive approaches within the refurbished Blackett 'transitional zone'. This zone presented an elastic power-geometry more permissive of sharing and managing the associated risks of transitions in role and behaviour. These risks represent transitions into and out of traditionally expected activity, which in turn require the availability of transitional space for the re-negotiation of expectations. By broadening transitional space, the coupled refurbishment of the LT2 and adjacent foyer space changed not only the power dynamic among students and lecturers, but their perception of and engagement with the risks necessary for remoulding ritualistic activity. It has been evidenced to differing degrees that the expectation of interaction in learning transitioned for all interviewed participants since their experience of teaching or learning in LT2. This change in shared expectation seems to have changed the perceived agency of students and lecturers, such that the *agentic threshold* for engagement with active learning in-situ and ex-situ became more attainable. All participants were asked a conclusive set of questions in in-depth interviews that produced insightful responses, given they were purposeful questions that built on the 'primed' reflection developed throughout the interview. Both students and lecturers were asked if they thought their experience in LT2 had changed how they learn and teach, to give a more concrete sense of whether there had been any change in perceived agency for active learning. Joe, a seminar leader participant, helped to place the influence of LT2 into perspective when answering this question:

> "...yeh I think without that [LT2] it would be a lot more difficult to get a foothold for active learning in the department. So yeh its really useful for that, so I'm sure I talked to you about this before, there is some kind of critical mass that you need to get to with active learning sort of activities".

Joe's important reference to a 'critical mass' and a department-wide attainment of the agentic threshold for active learning, according to his reflection, would be achieved when the department:

> "...get to a point where students just accept among themselves that this is good...then the reps will create pressure to do more of it, and that will trickle into academics' approach to whether they are willing to try that".

Joe's response highlighted the power possessed by students and academic representatives ('reps') in negotiating these more active forms of learning. Joe ultimately tied the attainment of an agentic threshold to the point at which students accept that active learning is preferential to traditional approaches. The transitions underwent by students seem to almost be an enabler and pre-requisite of a shift in the agentic threshold attained by lecturers like Joe who feel 'pressured' or empowered to adjust their pedagogic approach.

Given the powerful role played by students in adjusting the agentic threshold, students were on the whole able to acknowledge some changes in how they approached their learning since using LT2. For one 1st year participant, Alex, he seemed to express quite strong feelings about the impact of LT2:

> "If it wasn't for LT2, it would only be tutorials and lectures and there wouldn't really be an element of working with other people that was encouraged so I think it definitely has changed how I would engage with people now, yes, I think if I just did the lectures and everything I wouldn't be as inclined".

This sense that active learning became normalised since using LT2 lowered the perceived and actual agentic threshold for students to interact in general. The space seemed imperative to assisting the formation of groups, which was shared in the response of a 4th year participant, Maria:

> "...I think that what it [LT2] did was to make people to discuss problems, whether that was in a group scenario or whether it was kind of like whispering questions to each other during lecture, it was in both cases it was easier than in like the big lecture theatres".

Maria as a more 'experienced' student participant summarises here the true impact of LT2 on the proclivity of students to discuss problems in both 'group scenarios' and hidden transitions during didactic lectures. This 'ease' of interaction corroborates with my observations, and seems to equate to a lower agentic threshold to engage in active learning behaviour in-situ and ex-situ to LT2.

The notion of an agentic threshold and what one participant called a 'critical mass' of participation links well to what Campbell (2020) refers to as a "...stepping stone' innovative learning space, to encourage teachers and learners to engage with non-traditional ways of teaching and learning' (p. 200). It has been evidenced that providing the right redesigned space provides broader transitional space for empowering individuals to take risk in transitioning into and out of traditional expected activity. These in-situ transitions 'ripple' into other learning spaces, and become pervasive at the level of departmental culture, as a result of their connection to ex-situ transitions. LT2 could be argued to represent a 'stepping stone' space that has infiltrated the approach to learning and interaction now taken by lecturers and students in other spaces. A 'transitional zone' comprising the refurbished foyer and LT2 space together, in combination with curriculum reform and educator development, have contributed to shifting the agentic threshold required for students and lecturers to engage in more active learning behaviour.

7.3.4 Transitions in behaviour

Following my exploration of transitions in expectation and agency, participants were well positioned in in-depth interview to share if they had noticed any change in their own behaviour and/or in the behaviour of fellow students/lecturers in other (ex-situ) spaces. Ruth, an interactive lecturer who expected her final year students to "...do a lot of soft skills at the start in the lecture theatre and then...go every week to meet with a particular member of staff who guides them through writing a research proposal", was well positioned to comment on if any change in student behaviour outside of LT2 was noticeable:

> "I would say that having had the exposure and the soft skills, going around to talk to them and got to know them a bit, it was then probably easier to do the next part, in terms of talking to them as a group in my office for example".

LT2 may have accommodated stronger social bonds within student groups and a more understanding relationship between the course leaders and their groups, leading to different interaction in ex-situ spaces like Ruth's 'office'; this ultimately resulted in better quality learning and research proposals. To help decouple the role of the space in this behavioural transition, Maria, a student who attended Ruth's course attributed these behavioural differences not only to LT2, but to the pedagogic intent and agency of the lecturer:

> "...she [Ruth] would ask more questions that we were actually supposed to answer, but I think that was more down to her lecturing style rather than the actual room, as in, when we had similar lectures in LT3, I didn't notice a massive difference between how people interact with her in there as opposed to LT2".

Maria's response emphasises that the potential for learning and interaction is not solely constrained or enabled by a space like LT2, but more to do with how empowered and 'confident' educators are to agentically enact their pedagogic intent. Alex's experience

of lecturer behaviour in LT2 seminars helped to build on this idea that activity in a fit-for-purpose space can affect a general transition in perception and behaviour:

> "I'd say that lecturers really quite like Lecture Theatre 2, I think the lecturers like engaging with students and seeing, seeing how they think because it helps them to understand how will they comprehend the lecture content, so I think it does help the lecturers they definitely do actively seek out students".

This 'seeking out' of students by lecturers was perceived positively by all participants as it enabled a more dialogistic form of feedback. This was able to be confirmed with the penultimate question in all in-depth interviews when I asked all participants if they thought students were now more likely to discuss their learning with others in general. Ruth's suggested that the space "...looking nice and shiny and new" may have had a novelty effect on behavioural transitions, yet she concluded that "...having that layout is also definitely beneficial, so I think some of it will persevere". In spite of the risk of a potential expiry of enthusiasm for these new education approaches, the influence of a new space and/or the perceived impact of institutional investment made it clear to students and lecturers that there were efforts being made to improve the learning environment. Alex provided a useful reflection about how LT2 seminars had 'shifted his thinking' and now made him now about how he was learning:

> "I was thinking about, about whether it would be better for example just to take the seminars a step further and actually replace the tutorials with problem solving classes because that way you kind of are more encouraged do problem sheets and engage, actually yeh I would say it has definitely shifted my thinking from believing that tutorials and small groups were the best way to actually, to actually more interaction with peers and problem solving groups".

Alex seemed to have reflected upon the design and impact of his formal learning. Alex also indicated that he was now more critical of how to approach his own learning in future. These interview responses strongly indicate transitions in agency, behaviour and a more active awareness of one's formal and informal learning, which corroborated with my observations of students being more agentic and active in their learning.

Transitions in online behaviour

The remote in-depth interview phase of this study coincided with the onset of the first COVID-19 UK lockdown. This meant that my own transition to remote working was contemporaneous with the transition of most formal course activities (like LT2 seminars) to online format. The transition from LT2-based to online-based seminar group learning was a narrow window in which I asked all in-depth interview participants if they noticed any change in approach or behaviour between their experience in LT2 and online, most notably in relation to the seminar series. This presented a unique way of testing the 'ex-situ' (lasting) impact of transitions in learning behaviour associated with LT2 activity. The seminar leader at the forefront of managing the transition from LT2 to online seminars, Joe, explained when answering this question:

> "...I think it's the success, the success of the activities in LT2 have made us confident...we have a kind of clear view of what we'd like to do and having seen how well things worked".

Using LT2 as a testing ground for different approaches and activities seemed to empower a 'confidence' and agency in Joe to be more purposeful in the way he then approached interactive learning in online seminars. When questioned about his expectation of student interaction in the online space more broadly, his response indicated both pessimism and optimism about its capacity:

> "I think the thing with the whiteboards was a real success [in LT2] and I think, I think that probably won't work as well on the Teams whiteboard...but in a way its more democratising, in the Teams thing, because they can draw on it all at once".

This notion of the online space being more 'democratising' was an interesting choice of words because it implied that the balance of risk and power had changed in the online space, and that there had almost been a pedagogic emancipation of both students and lecturers. This sentiment was echoed in the response of one of the seminar students, Alex, who despite finding online learning prohibitive due to "technological hitches", contrasted his experience between the LT2 and online space when he explained:

> "...you can kind of see everybody equally and actually it's funny that, that equality of interaction with everybody is definitely noticeable online as opposed to in seminars".

The aforementioned subgroup formation explored in section 6.2.5 which led to barriers to interaction for certain individuals in LT2 seemed to have been mitigated in the online space by virtue of negotiating a more 'democratic' group space where 'equality of interaction' was possible. Nonetheless, another seminar participant, Huan, explained his frustration with not being able to share information with his group as easily:

> "...I will say the only hindrance of the online format would be to kind of find a proper software replacement for the whiteboard, and most of us don't have touchscreens, or anything like that so writing on a whiteboard is a bit different".

The space for transactional knowledge-based learning seemed to be easily transferable into this online space, yet the ability of students to interact and reference their understanding and emotions in the online peer environment, became more difficult than in LT2. The

implications of this for student agency, self-efficacy and feelings of isolation deserve further attention. Managing many of the material and social reference transitions necessary for effective active learning and switching between different activities seemed to be smoother and easier in LT2 than in the online space. Alex was able to explain the challenging practicalities of these reference transitions in online seminars, describing the allocation of time as insufficient:

> "...sometimes you've been given 5 minutes to do a question, which involves leaving the group, putting it on hold, going into the breakout group, trying to then coordinate some kind of group response to this question and discussion, everybody separately, then coming to some kind of conclusion and going, you know, 5 minutes is just not enough".

Alex did later mention that "...at least you know the people you're in a group with because you worked with them in a group in person previously", highlighting how his previous opportunity to form relationships with his group members in LT2 supported the transition into the online (ex-situ) space. These findings position LT2 as an important site of group formation in which individuals are better able to negotiate a shared space for in-situ and ex-situ learning than spaces which present more physical and social barriers to effective referencing and interaction, such as traditional lecture theatres or online spaces. Students are likely less inclined to share liminality and vulnerability associated with learning if they have not previously established social bonds, familiarity and trust with peers. LT2 evidently supported group formation, which supported ex-situ transitions into the online active learning space.

7.3.5 Regressive and progressive transition

This chapter has provided empirical evidence for how the Blackett 'transitional zone' (refurbished LT2 and adjacent foyer space) supported in-situ and ex-situ transitions in student and lecturer perception, expectation, agency and behaviour. These transitions were not merely a function of the physical space redesign, given session intent, assessment credit and perceived 'prestige' also guided how students and lecturers engaged with transition. Within the context of the institution's desired shift to active learning, the direction of transition might be defined as *regressive* or *progressive*, based on whether transition is away from or toward strategic/design intent. The redesign of the Blackett spaces (microsystems) led to a different set of connections in the mesosystem mediated via transitional space. Activity in the refurbished microsystems, which might be thought of as 'stepping stones' within a network of physical and virtual learning spaces, led to ex-situ transitions where changes 'rippled' out from LT2 and the foyer to other spaces, including the online space. A 'critical mass' of student and educator participation in the transitional zone increased the chances of cementing these changes in perception, expectation and behaviour to progress transitions in departmental and institutional culture in the macrosystem.

When asked at the end of their in-depth interviews if they thought the changes incurred by the refurbishment of these spaces were generally positive or negative, all participants shared a positive perception. However, a number of both regressive and progressive transitions were documented throughout data collection, where participants clutched to old approaches and/or embraced the risk of new approaches. In the longer-term, these finer transitions have amounted to an overall direction of transition toward favourable or unfavourable perceptions of active learning. Given transition and learning are not linear processes, they are more akin to a *rhizomatic tunnel* which has multiple entrances and exits (Savin-Baden, 2019). This complexity is captured by the ecotone metaphor introduced in section 2.5.4 and the

idea that the learning environment might be thought of as an estuary which is subject to competing tidal forces and tensions; these tidal forces represent the dominant direction of transition (linked to intent and power-geometry in the space). Students and/or educators either move with the tide, or exercise agency against it, the outcome of which leads to progressive or regressive transitions in the context of active learning; I revisit this ecotone idea in the discussion chapter in section 8.2.2. Refurbishing the transitional zone broadened the potential ecotone for students and lecturers to re-negotiate the agentic threshold for active learning.

7.4 Chapter synopsis

This chapter continued to address the second research question reintroduced in section 7.1:

> How does the redesign of learning spaces influence transitions?

I used in-depth interviews to explore with students and lecturers how the partnership-driven redesign of the adjacent foyer space influenced on-ramp, medial and off-ramp transitions linked to LT2. The formation of what I conceive of as a 'transitional zone' seemed to have significant implications for in-situ and ex-situ transitions in perception, expectation, behaviour and agency. Although these findings varied between different cohorts and educators using the refurbished spaces, they seem generally relevant for anyone looking to (re)design, manage and/or use campus learning spaces to strategically achieve active learning. Whilst educators may receive training for how to use these refurbished spaces to achieve their pedagogic aims, the attainment of the 'agentic threshold' seems equally reliant upon students expecting and enacting active learning approaches.

In chapter 8 I take the main findings from this and chapters 5 and 6 and assimilate them into a discussion and set of conclusions.

Chapter 8

Discussion and conclusions

8.1 Introduction

This study has explored the nature of transitions between and within formal and informal learning spaces in two different STEM departmental contexts. I have argued that these transitional spaces are important sites of incidental active learning, referencing behaviour and transitions between activities within didactic transmission contexts (e.g. ACEX Lecture Theatre 1). Given the institution's strategic appetite to adopt more active learning approaches, my earlier findings in traditional learning spaces were incorporated into the redesign of both Blackett Lecture Theatre 2 and the adjacent foyer space to facilitate better transition for active learning. A post-occupancy evaluation of these refurbished spaces, together referred to as a 'transitional zone', generated new findings which have shone light on how redesigning space influences transitions (linked to the second research question). This chapter assimilates the findings introduced in chapters 5, 6 and 7 into a discussion which is contextualised within the literature in chapter 2 and evolving sector context.

8.2 Transitions: connecting microsystems

In setting out to understand the nature of transitions in learning spaces, specifically within and between formal and informal spaces in the ACEX and Blackett settings, I have defined a number of in-situ transitions inherent to learning which can be found summarised in table 8.1. These in-situ transitions operate over shorter timescales and serve to connect microsystems comprising the student's physical, social and cognitive learning experience. The table also summarises a number of ex-situ transitions needed for active learning which operate in different ecological systems like the exosystem and macrosystem.

Table 8.1: Summary of transition types defined in this study

Chapter	Transition type	Transition sub-type	System	Nature
5	Medial transitions	'Failed' Hidden Postponed	Microsystem	In-situ
	Timetable transitions	On-ramp Off-ramp	Mesosystem	
6	Space transitions	Physical Social Cognitive		
	Activity transitions	Power Task Non-task Referencing		
	Pedagogic transitions	Passive Active		
7	Ex-situ transitions	Role Perception Expectation Agency Behaviour		Ex-situ
	Design transitions	Architectural Curricular Timetable	Exosystem	
	Strategy transitions	Regressive Progressive	Macrosystem	

In-situ transitions were explored using ethnographic observations and field interviews combined with automated occupancy monitoring data. These in-situ transitions occurred in medial and fringe transitional spaces, as a result of the structure of physical and timetabled learning space. The fixed power-geometry and ritualistic expectation to not interact

during didactic lecture transmission meant that students self-directed hidden transitions within the medial space and/or postponed any session-related liminal misunderstanding (Savin-Baden, 2008). Students were consequently observed referencing and affirming with one another during on-ramp and off-ramp transitions, where a more elastic power-geometry was negotiable to socialise affective emotion related to difficult learning and liminality. These fringe transitions outside the lecture theatre and medial transitions within connect important active learning activities, whilst themselves being a site of incidental active learning. Hence, despite these transitional spaces constituting a small subset of potential transitional spaces in learning, they represent 'analogues' for where students make important social and cognitive connections between microsystems (Elgin, 2013) and a window into the 'hidden' cultural codes which influence sense of belonging and attitudes to learning (Popenici and Brew, 2013). Furthermore, these transitional spaces are always sociopolitical (linked to their power-geometry) and in tension, such that students adopt *tactics* to establish a place that is their own and to subvert the *strategies* imposed upon them (De Certeau, 1984).

Purposefully feeding into the redesign and evaluation of Blackett LT2 and the adjacent foyer helped me to better understand the influence of physical space on the transitions in table 8.1. However, whilst these transitions connect bounded spaces and activities, their nature is such that they seem to overlap and/or blend the connecting spaces to create an entirely separate transitional space which has similarities and differences with both. The adjacent formal and informal spaces studied in this thesis are in tension and competition, the nature of which is determined by the expectations and intentions of each individual; their nature and granularity may therefore be experienced differently by different user groups. This encourages reflection about the fundamental nature and importance of these transitions for effective active learning.

8.2.1 Transitions: nicety or necessity?

The ACEX breakout space performed a core function of processing movement of people into and out of timetabled activity in the adjacent Lecture Theatre 1 (LT1). This *dependent* utilisation relates to the surrounding functions of a 'transition space' and is distinguished from *independent* utilisation which relates to additional elements within the space itself (such as furniture) (Nassar and Hosam, 2014). I discovered that the dependent utilisation of students engaging with on-ramp or off-ramp transitions in this breakout space was linked to an underlying expectation to attend timetabled lectures in LT1. The additional affordances of the breakout space (like various forms of seating) provided students with more reason or 'need' to meaningfully engage in this transitional space. Whilst repeating ACEX LT1 timetabled sessions (see figure 5.5) were the product of the department's pragmatic organisation of people in space with attached expectations (O'Brien et al., 2017), they provided students with a temporal structure within which ritualistic on-ramp, medial and off-ramp transitions empowered brief interaction and lasting relationships (Bronfenbrenner, 2001). These transitional spaces were more meaningfully engaged with in the better equipped ACEX breakout space than in the pre-renovation Blackett foyer space mostly because of the difference in affordance; this was confirmed following the purposeful redesign of the foyer. To address the section title question, physical on-ramp and off-ramp transitions seem to be a 'necessity' for in-person timetabled learning, whereas the redesign of supporting infrastructure like timetables and physical space are more of a 'nicety' which can harness transitional space to support active learning. Given the sector-wide transition toward blended and flipped classroom approaches (Edwards and Clinton, 2019), students are increasingly contending with a heightened self-directed, informal workload. Although students have more agency over how, when and where to engage in what is traditionally deemed the formal, educator-controlled space, this style of online lecture engagement risks

depriving students of places they can call their own (Hurdley, 2010). Given the strong 'framing' (architectural separation) between physical learning spaces like ACEX LT1 and the breakout space has been shown to reinforce transitions in power and ownership between the educator space and student space (Leijon, 2016), the 'attendance' of online lectures may increasingly deprive students of transitional spaces in which authentic sharing of emotion and learning can occur (Lave and Wenger, 1991). Since this sharing of emotion is important for supporting learning and well being (Disch et al., 2000), adolescent students may become increasingly isolated and struggle to self-regulate (Alghraibeh and Juieed, 2018). This thesis has not extensively explored the implications of transitional spaces for motivation, well being or belonging, yet further research is clearly needed to confirm or deny the claim that 'Well-designed social spaces are likely to increase students' motivation' (JISC, 2006, p. 28). To bolster these claims, a survey administered to just over 1000 undergraduate students about their online learning experience during the COVID-19 pandemic found that the number of students 'very satisfied' with their course dropped from 51% before the pandemic to 19% after moving fully online (Means and Neisler, 2020). The greatest challenges reported by students with this online experience were themed as 'staying motivated', '...missing the presence of the instructor and peers while they learned' and '...discussing course content with peers' (p. 10). It is difficult to attribute this student dissatisfaction, especially given students had a different expectation of their university experience prior to the pandemic reality, yet my findings would indicate this discontentment might be attributable to the loss of transitional spaces in which students are able to reference with peers going through a similar physical learning experience. Whilst the increasing desire for student 'contact hours' risks reducing investment into infrastructure which seeks to support transition and increase the quality (rather than quantity) of those contact hours, there is an additional need to consider the loss of transitional space associated with the shift to online and blended learning.

8.2.2 Revisiting ecotones

I introduced the ecological concept of *ecotones* in section 2.5.4, defined as:

> '...areas of disturbance and change, catalysed by the differences in the two ecosystems, and they are often zones of conflict as well' (Pendleton-Jullian, 2019, p. 113).

Ecotones include environments like estuaries in the natural world which represent a third entity with their own conditions and species (Smith et al., 1997). Estuaries emerge at the boundary between saline and freshwater ecosystems (learning spaces), and are subject to both river and tidal forces (the dominant direction of intent and transition), which influences the diversity of species (educators and students). Pendleton-Jullian (2019) argues that the ecotone concept is a potentially powerful metaphor and model for designing 21st century education and learning environments. The ecotone concept was not centrally adopted in this study because unlike on-ramp, medial and off-ramp transitions, ecotones less aptly capture the demarcation of physical and temporal learning space dictated by architecture and timetables. Conceptually, however, ecotones encourage us to question the physical and temporal extent of on-ramp and off-ramp transitions i.e. is the transition defined solely by its boundaries, or does it capture the whole transition in behaviour and power-geometry across those boundaries. If the latter is the case, then does a separate boundary space and set of conditions (ecotone) result from the interaction and blend between two sets of power-geometry, and is it fair to assume that students undergoing on-ramp transitions into a physical lecture theatre instantly transition to 'didactic learning mode'. Ecotones might encourage timetable designers to factor in time and space for students to manage the tensions and transitions between learning spaces.

The nature of these transitions and their degree of overlap/tension not only has theoretical significance in the context of ecotones, but has pragmatic implications for timetable and

physical space (re)design. This was realised when evaluating the refurbished Blackett LT2 space. By converting row-by-row seating into booths connected by teacher walkways, student groups could engage with physical 'micro-ecotones' within the medial space which presented a different set of conditions to broader ecotones at the fringe of LT2 like in the foyer. Ecotones not only encourage a reflection about the nature of transitional spaces summarised in table 8.1, but in the blending of formal and informal spaces in flipped classroom contexts where the nature of transition is changing (Whitton, 2018). Pendleton-Jullian (2019) makes a similar case for the epistemological and ontological shifts taking place in the sector, as increasing amounts of information outpace traditional disciplinary structures, to argue that education is now about:

> '. . . learning to manage a complex network of informational resources and skills so as to develop the capacity to assimilate them, internalise them, and then access them under a variety of situations' (p. 118).

This fast-moving and complex HE ecosystem is further complicated as the student population becomes more heterogeneous and each student has an increasingly personalised learning experience. This impels us to employ the ecotone metaphor sensitively, since different tensions arise for different user groups, such that not everybody will survive and/or thrive in the same physical ecotone. Ecotones might be better thought of as transitional spaces at the edge (Hagel et al., 2005) where the elastic power-geometry empowers a more diverse group of individuals to negotiate conditions in which they thrive. This links to individual/group agency and exploring how these ecotones might facilitate useful transitions in adjoining spaces which transform the core and feed back into the entire ecosystem, including for challenging territorialised ideologies and identities (Pendleton-Jullian, 2019). Ecotones may also provide an alternative lens for understanding the significance of these transitional spaces for motivation, belonging, well being and self-efficacy.

8.3 Designing transitional zones

The strategic refurbishment of a lecture theatre (Blackett LT2) and adjacent informal space (foyer) resulted in what I term a 'transitional zone'. This zone intended to better support on-ramp and off-ramp transitions and to progress in-situ and ex-situ transitions between passive and active learning. In the fringe space, this zone sought to nurture incidental learning interaction which supplemented formal learning in the adjacent LT2 space. Carnell (2017) found these incidental/serendipitous connections to be paramount:

> '...simply providing opportunities for interaction at multiple junctures throughout the campus; a few chairs, a bench, or even a window seat can facilitate these opportunities' (p. 3).

Whilst these simple campus changes are a 'nicety' which help to 'Create spaces that maximize collisions' (Coyle, 2018, p. 82), this thesis argues that meaningful 'collisions' between users do not occur devoid of a 'need' to connect or transition. These collision-rich spaces should ideally be developed around and connected with nodes of learning activity, like formal spaces, to support meaningful transition and impromptu interaction. Whilst a transitional zone is a pragmatic way of apprehending transitions between and within these refurbished learning spaces, it risks overlooking the nuanced blending of these spaces which produce zones of tension or ecotones. Pendleton-Jullian (2019) argues that the degree of connectivity across and through these ecotones with adjoining formal spaces determines their potential for disturbance and innovation. These 'corridors' seed the ecotone, and when left unadorned reproduce the expectation that students should not learn until they enter the formal learning space (Chism, 2006); they are therefore most powerful when developed as informal social spaces supported digitally and physically. The observed prevalence of incidental active learning in the better equipped ACEX breakout space, versus the

similarly sized pre-renovation Blackett foyer space, supports the notion that the difference in affordance of each space influenced how students engaged with the transitional space. Hence, the more purposeful creation of social space at the intersection between well designed physical and conceptual (e.g. timetable, pedagogic) infrastructure, combined with an awareness of ecotone complexity, seems most likely to result in effective active learning. The redesign of the Blackett transitional zone helped me to understand the influence of physical space on transition. By changing the 'infrastructural legibility' of the pre-renovation foyer through refurbishment, Pantidi (2013) posits that the 'social legibility' (the degree to which people understand how they can use a space) should also change (p. 211). The renewed affordances of the refurbished foyer provided users with more reason to dwell and connect during on-ramp and off-ramp transitions. This changed the metafunctions of the space (Stenglin, 2009) and caused students to make different meaning of the space (Leijon, 2016). Changing the spatial arrangements and resources (furniture, lighting etc.) of LT2 similarly influenced the meaning-making processes during situated learning (Leijon, 2016). The pre-renovation LT2 space had a strong framing (what connects or disconnects elements of a space) and large 'social distance' between the row-by-row 'student area' and the front 'teacher area'. This medial space division reproduced a fixed power-geometry between students, peers and educators (Ravelli and Stenglin, 2008) which has been shown to result in student alienation from interaction (Goffman, 1967). This alienation was observed manifesting in the traditional lecture space as 'failed', hidden and postponed transitions. Physically converting the row-by-row seating to connect-booth seating reduced the social distance between the student-owned booth and teacher-owned walkway. This broadened the actual and perceived ecotone in which students and lecturers could re-negotiate the 'agentic threshold' for active learning.

8.3.1 Broadening the 'learning container'

The traditional conceptualisation of the classroom as a 'learning container' continues to prevail based on teacher and student mindset (Imms and Kvan, 2021, p. 9). To challenge this mindset, I have argued for the potential role of physical fringe transitional spaces for supporting necessary on-ramp and off-ramp transitions into and out of formal lecture theatres. I have further argued that by purposefully redesigning the affordance or infrastructural legibility (Pantidi, 2013) of these fringe spaces, like the Blackett foyer space, that they develop an increased capacity as physical, temporal, social and cognitive extensions of pedagogic spaces like LT2. This challenges the notion of a 'learning container' with fixed boundaries and an expectation to gather silently during on-ramp transition or leave swiftly during off-ramp transition. Furthermore, by refurbishing the LT2 'learning container' adjacent to an informal foyer, transitions in perception, expectation and behaviour 'rippled' between the two spaces and further progressed (or regressed) in-situ transitions and tensions within the 'transitional zone', without seeming to compromise the original lecturing function of LT2. Participation in these refurbished learning spaces led to ex-situ transitions in perception, expectation and behaviour in other learning spaces, which can be seen in figure 8.1; this diagram builds from the previous iterations of the ecological systems model at the start of chapters 5, 6 and 7.

The strength and direction of these ex-situ transitions seemed dictated by the nature, design and intent of interactive learning in LT2, which gave students more or less 'reason' to connect in the adjacent foyer space. This was evident from my monitoring of either interaction relating to the LT2 seminar task, or more informal conversation about the novel session/architectural design which 'rippled' into the fringe foyer space. The transitional zone, in conjunction with conceptual infrastructure like the timetable, enabled the construction of a 'social scaffold' for incidental interaction and learning between the two spaces. This

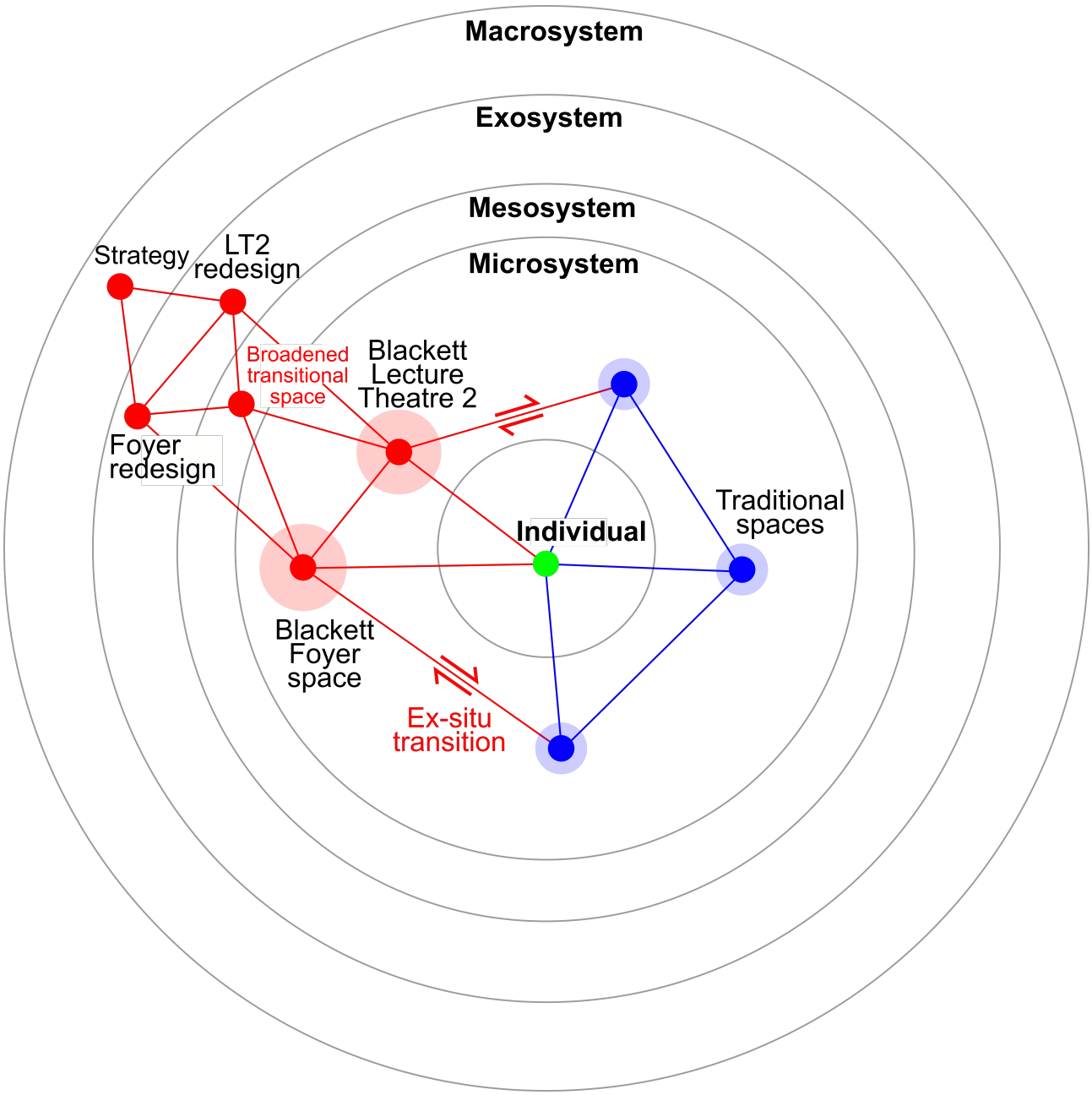


Figure 8.1: Ecological systems model showing broadened transitional space between refurbished Blackett LT2 and foyer spaces (coloured red) with ex-situ transitions connecting to other learning spaces (coloured blue)

was further confirmed by students and lecturers in in-depth interview who described the formation of social groups as considerably more difficult in traditional row-by-row lecture theatres than in LT2. Classroom physical layout and furniture arrangement has been shown to affect how a teacher manages verbal interaction (Jewitt, 2008) and the social relations that result (Leijon, 2016). The broadening of fringe and medial transitional space (implied in figure 8.1) made it easier for educators to transition what Beetham and Sharpe (2007) term

the 'locus of control' between themselves and the student (p. 21).

The increased frequency of transition between teacher-directed and student-directed learning activities resulted in more incidental learning within the transitional spaces. The significance of this incidental, serendipitous learning is evident in the literature, particularly as most scientific breakthroughs and transformative 'ah-ha' moments arise from unexpected events and encounters (Mezirow, 1991; Kuhn, 2012). Fine and Deegan (1996) define serendipity as '...an interactive outcome of unique and contingent 'mixes' of insight coupled with chance' (p. 434). Given serendipity is a lot about looking for one thing and finding another through accidental chance (Goodman, 1961), it may assist the transition toward more unplanned, research-based learning and learning by discovery (Griffiths, 2004). Pendleton-Jullian (2019) makes an ontological distinction between accreditation (professional standards and practices) and experimentation (creative research and enquiry) which together form a continuum of context. The mindset of students during off-ramp transition resembled a suggestible, liminal state where they seemed to be more sensitised to experimentation and serendipity; students exhibited a similar but distinctly different suggestibility during on-ramp transition where they possessed more individual and/or group 'certainty' of an upcoming session. Additionally, the way students engaged with off-ramp transitions seemed partly determined by the nature of activity in the preceding classroom session, which in general either aroused hypotheses and questions from active learning, or left students more detached from passive learning. The active, problem-based learning in refurbished LT2 (such as the seminars) primed students for interaction and increased the 'need' for ongoing fortuitous discovery during the off-ramp foyer transition. The renewed affordances of the refurbished foyer space better supported this enquiry by reinforcing the transition in power and ownership to the student, which increased the chance of meaningful 'collision' among these liminal students. Increased referencing with peers and technology was indeed observed in the refurbished foyer

space relative to the Blackett pre-renovation spaces.

As the sector transitions out of and learns from the COVID-19 pandemic, practitioners are increasingly debating about how best to use the increasingly limited face-to-face formal contact with students to achieve effective active learning (Beichner, 2014). Thinking about transitions between physical in-situ formal activity, proximal informal spaces and more distal ex-situ spaces, such as online, should be central to this debate. Furthermore, the concept of the 'learning container' is arguably no longer valid, at which point the ecotone concept might better capture the unique tension of these transitional spaces in which incidental learning and discovery occur within a hidden curriculum (Flinders et al., 1986). These in-between ecotones increase in abundance and complexity with greater integration of disciplines and technology, accelerated by COVID-19. Students are increasingly learning at the 'edge' of different spaces and contexts now that the learning ecosystem is less easily divisible into formal and informal learning. Moreover, flipped curricula expect students to independently digest online material in preparation for more active learning activities in the classroom, meaning the connections, tensions and transitions between informal study and formal contact determine the success of the approach. Not only does the increased self-directed workload of flipped curricula present a greater uncertainty and referencing need for students (Akçayır and Akçayır, 2018), but so too does the increased liminality provoked from the physical active learning. Refurbishing fringe transitional spaces or entire 'transitional zones' converts pre-existing physical infrastructure into broadened ecotones that are more reflective of the conceptual transitions required for flipped curriculum, and more supportive of the increased need for students to reference their liminality. This marks a re-conceptualisation of learning space defined by a 'class', toward a space defined by 'learning' (Oblinger, 2005).

8.3.2 'Stepping stone' spaces

All in-depth interview participants reported a positive change in perception of learning interaction in other learning spaces following their participation in the transitional zone. These interview responses suggest that in-situ transitions within the refurbished zone 'rippled out' via ex-situ transitions to affect learning activity in other learning spaces. This is strategically significant, given the potential of these ex-situ transitions to influence departmental and institutional culture in the macrosystem. The refurbished spaces might therefore be imagined as 'stepping stone' spaces, which empower students and lecturers to engage with non-traditional ways of teaching and learning (Campbell, 2020, p. 200). This stepping stone metaphor is compatible with 'rippling', ex-situ transition and bieocological thinking (see figure 8.1).

This metaphor may help to address a theme highlighted in section 2.4.2 which questioned whether 'changing space is enough' to achieve active/innovative learning. Some workers maintain that regardless of changes made to physical space, traditional learning and instruction will persist (Lackney, 2008; Bøjer, 2020). Walker and Entwistle (1999) argue that for in-situ transitions in learning activity to occur in the microsystem, transitions in the macrosystem must be instituted by senior management using reward and recognition. Other studies have argued that implementing a renovated learning space alone would not ensure significant gains on student tests, but that the accompaniment of research-based pedagogical techniques and intent would (Wilson and Jennings, 2000; Beichner, 2014). To develop this debate, the behavioural transitions documented in this study may merely be a result of the novelty of the refurbishment(s) which caused a temporary 'Hawthorne effect' instead of a genuine change to behaviour. This may have been a result of the symbolic strategic, research and pedagogic effort behind the refurbishment, which attached an implicit expectation to behave differently. This does suggest, however, that if students and educators feel they are

valued and a 'prestige' is attached to embracing better education approaches, then they may perceive less risk in undertaking the pedagogic venture. It also suggests that for physical and conceptual transitional space to be broadened in the microsystem and mesosystem for active learning, an associated broadening of design and/or strategic transitional space must take place in the exosystem and macrosystem (see figure 8.1).

As an ethnographer, these physical and conceptual learning spaces on the surface first appeared as 'stepping stones' to me. However, the metaphor implies that these refurbished spaces are discrete packages of space and time, which may overlook the increasing complexity of transition and learning. The relational nature and dimension for multiplicity of these spaces (Massey, 2009) calls for a more sophisticated metaphor. As aforementioned, these boundary spaces might increasingly be understood as ecotones as globalisation and new forms of communication technology expand the potential referential environment available to students (Wenger-Trayner et al., 2014). Ecotones are more concerned with student entrepreneurial engagement with their environment and the tensions they experience at the boundary of formal and informal, virtual and physical, and passive and active learning spaces. Rather than viewing refurbished spaces as 'definite' spaces, ecotone thinking might instead consider refurbished spaces as interventions which broaden the potential transitional space for a more diverse group of learners to connect their own personal learning ecology to the ecotone environment. The ecotone concept has therefore unshackled me from the binary thinking associated with the stepping stone concept, allowing me to appreciate the increasing complexity of the transition and blend between these different learning spaces. Whilst the divisibility connoted by 'transitional zones', 'learning containers' and 'stepping stones' has pragmatic utility for design of campus architecture and timetables, one should be increasingly mindful of the underlying complexity and potential for ecotones in which increasingly specialised students seek the 'edge' (Pendleton-Jullian, 2019).

The findings of this study suggest that the refurbished LT2 space elevated the perceived agency of educators who reported pre-existing intention to actively teach. However, for lecturers that did not possess this pre-existing pedagogic intent, their observed traditional approach remained similar during the period of data collection, with some participants expressing intention to make minor or major adjustments to their future practice. It is likely that for these more 'traditional' educators, a combination of a 'critical mass' of participation in the transitional zone, along with supplementary educational development and training might assist their transition toward more active approaches (Campbell, 2020). The point at which a 'critical mass' of active learning activity is reached for the 'agentic threshold' to prevail is subjective and dependent on the educator and their cohort. Weekly sessions repeating in LT2 as part of the seminar series, for example, allowed students and educators to develop relationships for re-negotiation of this threshold. Ecotone thinking might help us to understand this behavioural and cultural change as students and educators moving with or against the dominant tidal force of the estuary (learning space), governed by its intent, properties and tensions.

Transitions toward the 'agentic threshold' for active learning may be achievable not only via a 'critical mass' of participation in the transitional zone or ecotone, but via student and educator participation in redesign. Given Burke et al. (2016) note that the intentions of a refurbished learning space will only be fully realised if the users of that space support the pedagogic principles informing it, the success of the transitional zone seemed to rely on *both* the student and educator engaging meaningfully with the zone's affordances. By providing remuneration, tools and knowledge to a final year Physics student and staff partners involved in the foyer space redesign, the design partners underwent transitions in role (see figure 7.2) and 'habits of mind' (Imms and Kvan, 2021, p. 11) so that they could re-imagine the very environment in which they had previously taught/learned in. Whilst it is hard to disentangle

the effect of this participatory redesign approach on the eventual 'success' of the foyer during later actual usage, departmental consultation seemed to empower a more immediate sense of space ownership (Pierce et al., 2001). Browndorf (2014) concluded that by training students to take greater ownership of library resources, there were increases in active and experiential learning in the wider cultural commons. Nonetheless, an important distinction might be made between end use of these transitional spaces and partnership-driven redesign which results in their refurbishment. Migrating students and lecturers into a space typically occupied by architects and professional designers broadened both the physical and design transitional space/ecotone (see figure 8.1); the relationship between the agency experienced in each deserves further attention.

The sector-wide shift to flipped curricula demands a restructuring of physical and conceptual campus learning spaces (Radcliffe et al., 2008). Large scale refurbishments like LT2, however, are time- and money-intensive costing around £1 million. As universities financially recover from the COVID-19 pandemic, they are having to be selective about where to invest capital. The relative educational and economic impact of the more capital-intensive LT2 refurbishment versus the relatively low-cost foyer space refurbishment (£20, 000) is worthy of further attention. Furthermore, participatory approaches to space redesign might heighten economic return on these spaces because the design partners acquire more competent '...architectural vocabularies and spatial literacies' (Fisher, 2004, p. 37). Operating as a 'translational designer' between research and practice (Norman, 2010) to feed my PhD findings into the redesign and benefits appraisal of both the refurbished LT2 and foyer space has been beneficial. This has allowed me to test my research hypotheses and to confirm the practical viability of my findings via conversations with architects, members of estates and other practitioners. These conversations incidentally developed this community's perception of LT2 from a 'box within a theatre' to a 'transitional zone'.

8.3.3 Transition to what?

One of the fundamental aims of the refurbished 'transitional zone' was to progress staff/student perception of, perception of potential behaviour in (expectation) and actual behaviour in the in-situ spaces. This sought to empower staff and students to enact their individual and/or group agency to actively learn in the in-situ and ex-situ learning spaces and contexts. However, the 'transitional' potential of the zone could be more far-reaching than first appears. Whilst the redesign of this zone was not a planned or unplanned response to or result of the COVID-19 pandemic, these refurbished spaces now act as 'stepping stones' between a purely online-based pandemic education and socially distanced blending learning. The transition back to campus, in conjunction with other demands like growing student numbers (Ahlburg, 2020), is requiring the sector to review how physical spaces are managed, allocated, arranged and invested in. Developing a repository of these transitional zones in the longer term may constitute part of an evidence-based provision which enable universities to justify charging fees to students, as well as supporting post-pandemic cultural change and opportunities for transitioning identity and learning.

Given these transitional zones provide more flexible environments, they might be conceived of as zones in which diverse students undergo the important transition to independent, lifelong learning. This requires activities which result in 'innovative learning' to develop the four 21st century learning skills: creativity, collaboration, communication and critical thinking (Mahat et al., 2018). Furthermore, these zones might consider supporting transition between in-situ formal activity and ex-situ contexts like research and industry, including via digital reach. These ex-situ contexts require transitions in role and although they have not been explored in this study, the ability of students to transition into these environments seems partly determined by their *transitioning literacy* (Fisher, 2004) and learning transfer (Nicol, 2020). Connecting learning in these transitional zones to research contexts might be of

interest to thinkers like Fung and Carnell (2017) who developed the 'Connected Curriculum' framework in which students learn through research and enquiry. One of the intentions of these transitional zones might be to support transition toward:

> '...building communities of scholarly enquiry that challenge old divisions between research and teaching, between researcher, teacher and learner, and between higher education institutions and society' (Carnell and Fung, 2017, p. 1).

Following their experience in the transitional zone, student reference routes in LT2 transitioned from passive absorption of information to group-directed hypothesis generation, deliberation and testing with a more experienced coordinator. These routes were more active, critical and akin to the discovery process adopted in research. Furthermore, the interactive seminars, whilst encouraging more collaborative learning behaviour, additionally required students to *produce* information and output, not just to *absorb* it like in transmission lectures. These changes might develop what Giyoo and Inagaki (1986) refer to as both technical and *adaptive expertise*, which requires people to be responsive in novel situations that require multiple perspectives and transitions. Epstein (2019) defines these unfamiliar, novel domains as *wicked environments* which require transitioning between different disciplines and problem-solving approaches. This can lead to serendipitous scientific breakthroughs which cannot be reconciled with the pre-existing set of practices and beliefs (Kuhn, 2012). The transitional zone enabled richer incidental interactions during on-ramp, medial and off-ramp transitions, which shifted the relative perceptions of users and seeded important connections between academics and students. These connections may have transitioned into undergraduate research opportunities programmes (UROP) or other collaborations. Reclaiming these serendipitous spaces, which have arguably been lost in the realm of purely online learning amid the pandemic, seems important for supporting a more 'Connected Curriculum' (Fung and Carnell, 2017).

Transitional zones may also support the institution's strategic move toward centrally-driven, cross-departmental sharing of space. Whilst this has been met with resistance from members of departments who are territorial and protective of their spaces (Trowler, 2001), space sharing seeks to address a longstanding shortage of appropriate space for teaching, research, meetings or events. Whilst this resistance may be a function of the institutional context (disciplinary context, demographics and affluent estate/surrounding area), balancing the academic and political need to share College space with the need to preserve departmental identity/ownership frames an ongoing challenge. Financial challenges and changes to staff working approaches, including from COVID-19, are forcing institutions in general to review space allocation. Transitional zones might be perceived of as zones of transition between the home department and other departments/disciplines, inevitable as the world becomes more 'wicked' and the problems in society demand multidisciplinary approaches (Epstein, 2019). However, the high level of potential ownership in these zones, furthered by the partnership-driven redesign of the foyer, would on first reflection lead to territorialised disputes between departmental users and 'external' users (Trowler, 2001). This was mitigated by the College's negotiation with the Department of Physics to agree on the expectation of the Blackett LT2 space as a flagship active learning space available to the wider university community. Temple (2019) suggests that when a common-pool resource is maintained by its community of users within a shared place, the resource is prevented from falling victim to overuse or privatisation (Hess and Ostrom, 2003; Browndorf, 2014). Engaging the end user through participatory redesign of the foyer gave them power to negotiate the expectations of the space, which led to an increase in local social capital and potential openness to sharing among a broader user group. This partnership redesign work therefore seemed to implicate a separate set of transitions for the design partners and end users consulted, who developed more of a personal stake and level of ownership in the transitional zone.

8.4 Conclusion

This final section summarises the key findings of the thesis in relation to the research questions, discusses limitations, potential future work and the implications of the research.

8.4.1 Summary of research findings

Transitional learning spaces have been found in this study to possess an elastic power-geometry which not only support important in-situ transitions between learning spaces and activities, but when purposefully redesigned facilitate ex-situ transitions in behaviour and culture. This is significant, firstly because of the mounting corpus of literature into the relative effectiveness of active learning compared to traditional didactic transmission lecturing (Hake, 1998; Springer et al., 1999; Freeman et al., 2014). Secondly, because of our nascent understanding of the role of physical space (as a valuable institutional resource) in supporting transitions necessary for effective active learning (Temple, 2007; Boys et al., 2014; Carnell, 2017). Finally, studying transitional space has provided insight into the authentic challenges and opportunities faced by the undergraduate learner who, as a result of changing modes of education delivery (accelerated by COVID-19), are faced with a different 'conceptual' learning space (Akçayır and Akçayır, 2018). These factors foreground the first research question of the study, which I summarise and share relevant findings for below:

1. What are the nature of transitions in learning spaces?

Chapter 5 addressed this first research question by introducing findings from ethnographic observations, field interviews and occupancy analysis of learning behaviour within and between the traditional ACEX Lecture Theatre 1 (LT1) and adjacent breakout space. These findings were bolstered with ethnographic data relating to learning behaviour within and between the similarly configured pre-renovation Blackett Lecture Theatre 2 (LT2)

and adjacent foyer space. Studying student engagement with transition between formal, timetabled and informal, non-timetabled spaces allowed me to define transitions in to (on-ramp) and out of (off-ramp) formal timetabled learning (medial space). These in-situ transitional spaces were found to sit between teacher-controlled and student-controlled spaces, such that they possessed an elastic power-geometry in which students were able to more freely affirm, enquire, complain and use personal technology. These peer-to-peer behaviours were identified as cognitive referencing and affective socialisation of emotion in response to liminal states linked to difficult formal learning. Incidental active learning within medial and off-ramp transitions was driven by suppression of referencing behaviour in didactic transmission learning, which resulted in 'failed', hidden and postponed transitions. To link these findings to the first research question, transitions identified in two different STEMM, research-intensive departments might share similarity with other timetabled teaching spaces with circulatory space outside. Physical transitions 'obvious' to any user entering and exiting a timetabled lecture space are accompanied by 'conceptual' on-ramp and off-ramp transitions in power, ownership and behaviour which permit peer-to-peer referencing and active learning. During on-ramp transitions, student behaviour approximated individual and/or group anticipation/planning for the upcoming session, whilst in off-ramp transitions, students reflected on the session and oriented themselves toward the next learning space. Whilst the timetable set the dominant expectation for students to be present in a formal space at a certain time, behaviour during on-ramp and off-ramp transitions varied according to the intent of each individual, as well as the configuration of the timetable and affordances of the fringe/medial space. Furthermore, the nature of these transitions seemed connected to the expectation of the formal learning session which evolved following the Blackett LT2 refurbishment. The impact of the change in this physical and conceptual space infrastructure on the way students were engaging with transition is linked to the second research question:

2. How does the redesign of learning spaces influence transitions?

Chapter 6 addressed this second research question by using earlier findings to inform the refurbishment and evaluation of the Blackett LT2 space. Similar ethnographic methods were used in Blackett to the ACEX setting, with additional in-depth interviews used to explore student/lecturer perception, expectation and behaviour. By observing a mixture of interactive and didactic transmission sessions in both the pre-renovation and refurbished LT2, I came to understand the influence of the redesign on on-ramp, medial and off-ramp transitions. The addition of booths connected by walkways in LT2 changed the 'social distance' between students and educators who were able to engage more effectively in transition between activities. This change in physical learning space allowed educators to more easily transition power to students who could exercise greater individual and/or group agency to interact, share risk and vet questions. In-depth interviews allowed me to discover that following a period of teaching and learning activity in refurbished LT2, transitions in student perception of the space, peers, lecturer and themselves had occurred. These changes in relative perception prompted transitions in learning behaviour and reference routes more akin to group-directed hypothesis generation, deliberation and testing with a more experienced educator in the refurbished space. Referencing behaviour was found to be influenced by assessment credit, task intent, contrasts in power-geometry and the familiarity/relationship of the student with their social references (booth group or coordinator), developed through repeated activity in the refurbished LT2 space. Thoughtful redesign of LT2 hence broadened physical and conceptual transitional space in which students and lecturers could better engage in interaction and active learning. The subsequent redesign of the adjacent foyer sought to further broaden transitional space to better support on-ramp and off-ramp transitions, whilst reinforcing a 'prestige' to undertaking the pedagogic venture. Chapter 7 continued to address the second research

question by exploring how the in-situ transitions between the Blackett refurbished learning spaces (microsystems and mesosystem) related to the institution's strategic intention to change learning behaviour and culture (exosystem and macrosystem). I posit therefore that the in-situ transitions observed and reported in the transitional zone 'rippled out' from these refurbished spaces via ex-situ transitions into other learning spaces. A 'critical mass' of participation in the transitional zone progressed these ex-situ transitions in student and lecturer role, expectation, agency and behaviour toward attaining the 'agentic threshold' for active learning. Even 'traditional' transmission lecturers seemed to undergo transitions in expectation for learning interaction, which altered their relationship negotiated with students in both the refurbished (in-situ) and ex-situ learning spaces. These findings ultimately posit that the refurbished transitional zone supported in-situ and ex-situ transitions in perception, expectation, agency and behaviour necessary for effective active learning.

I embarked on this research with an awareness of student engagement with transitions as they moved between and navigated formal and informal learning spaces like campus lecture theatres and halls of residence. Data collection and analysis enabled me to categorise these transitions into sub-types (see table 8.1). I have later acknowledged that these transitional spaces, because of their betwixt nature, not only connect two physical/temporal learning spaces, but possess a separate set of tensions and conditions. With the proliferation of flipped, blended and online learning, these transitional spaces might be better conceptualised as 'ecotones' which emerge from the complex interactions between learning spaces/ecosystems (Pendleton-Jullian, 2019). However, unlike estuarine ecotones which emerge from the mixing of freshwater and saline ecosystems, ecotones in the learning context emerge from human-directed activity, such that each individual shapes and experiences the ecotone differently. Ecotones may help to reconcile the binary divides between learning spaces to harness and integrate the strengths of each learning space.

8.4.2 Limitations

Space and transition are central concepts in this study. Constructing a theoretical framework for analysis and interpretation using a variety of theories allowed me to understand the different transitions between the individual and their cognitive, social and physical environment. My primary use of Bronfenbrenner's bioecological model (Bronfenbrenner, 1979) has been useful, and has been supplemented with socio-spatial theories which allowed me to conceptualise the drivers for, mechanisms for, influences on and products of transition. This could be argued as both a strength and weakness of the study, given my theoretical framework is potentially less robust and empirically tested, yet might make a useful theoretical contribution to an under-researched area. Furthermore, bioecological theory was intended for understanding child development and has not been used in other studies in relation to space and transition, representing a potential limitation.

Naturalistic ethnographic methods, within mixed methods, were adopted to collect knowledge about transition in two different departmental settings. Whilst using occupancy data allowed me to explore phenomena in temporal and physical contexts beyond the immediately observed settings, generalising findings from this study should be done so with caution, given the context-dependency of these findings. Even my findings from earlier ethnographic accounts, which informed redesign of the Blackett spaces, were grounded and situated in the pre-renovation context. Nonetheless, my methodology has potential to be applied in other similar spaces and contexts to understand transitional phenomena. With this being said, not every institution is privileged with occupancy monitoring technology, nor does every institution have the time to conduct longitudinal ethnographic studies of refurbished spaces. The unavailability of occupancy data in the Blackett setting was an additional limitation given the technology had not been installed in that building. This meant I was unable to analyse a broader temporal pattern of usage like in ACEX, which arguably made my Blackett

findings more limited in their triangulation.

Recruitment of students and lecturers for later in-depth interview, from cohorts that I had already observed or field interviewed, may have led to volunteer bias (Rosnow and Rosenthal, 1976). Whilst I tried to minimise this bias by ensuring student participants volunteered themselves, I cannot be sure that their views were representative of the broader group or if they modified their responses to be perceived in a certain way. Methodologically speaking, the hermeneutic phenomenological approach adopted refutes the idea of a single truth and treats data and findings as a social construction between my own life world and the participants' values and interpretations (Geertz, 1973). This required me to remain reflexive by adjusting my positionality in response to my reading, thinking and data collection, such that I could develop data and findings which were as rigorous as possible (Sandberg, 2005). To have bracketed my potentially valuable previous experience with the researched institution would have been impractical and potentially less insightful.

Observing various taught cohorts using the spaces of interest was useful for identifying variation, yet this meant it was hard to achieve longitudinal understanding of usage. Toward the latter phase of data collection, the advent of the COVID-19 pandemic meant that only 4 observations were carried out in the refurbished foyer space. This paucity of observation insight was partially compensated for by the in-depth interview data with student and lecturer participants who had limited experience of the foyer space. However, because the in-depth interviews had to be conducted remotely via Teams, the video-based approach reduced my ability to gather non-verbal information as effectively as face-to-face interview approaches (Braun et al., 2017). Furthermore, undergraduate students and educators were the main participants observed and interviewed because of their use of the spaces studied and the focus of the research questions. The perspectives of lecturers was invaluable because they allowed me to better understand influences on student transition, and how expectations

for active learning were socially constructed. Collecting further lecturer perspectives from field interviews in the ACEX setting would have been beneficial in retrospect. Allowing space to guide participant inclusion, exclusion and recruitment was effective, yet privileged the views of student/educator users over other stakeholders. Gaining the perspectives of other stakeholders such as architects, building managers and senior management may have helped to build a more comprehensive picture of what can be learned about the role of transitional spaces; this was unfortunately not achievable within the time frame of the thesis.

Whilst I collected data in a single STEMM, research-intensive, London campus-based institutional context, my ideas may apply more 'universally' to other similar or even dissimilar HE institutions which adopt timetabled learning and increasingly contend with blended learning. The initial limitation of my ideas regards their practical application to space (re)design, given the requirement for suitably configured informal spaces adjacent to formal teaching spaces is not applicable to all areas of the pre-existing institutional campus layout. Equally, not all HE institutions possess a similarly affluent, tightly packed estate, and hence may have more or less potential for this transitional space re-purposing. Regardless, new builds might factor 'transitional zones' into design and planning, which have equally important implications for those dealing with conceptual infrastructure like curriculum, timetables and pedagogy.

This links to a potential conceptual limitation in the study which emerged in my discussion regarding ecotones, and how they may encourage us to better understand and design learning spaces differently to traditional binary perspectives of learning space. My relatively nuanced definitions of fringe and medial transition might be made even more transferable to other institutional contexts by thinking about these transitional spaces as ecotones, in which the overlap and tension of different spaces, that is the 'blend' between them, presents particular opportunity for an increasingly diverse learner.

8.4.3 Future work

This research has contributed to a better understanding of transitional space. Future work may help to extend this research by targeting a number of areas. On-ramp, medial and off-ramp transitions were defined as significant in relation to physical timetabled learning in the STEMM, research-intensive institutional context. An exploration of these transitional spaces in other learning contexts is needed to help constrain their general prevalence and nature. Are there, for example, equivalent transitional spaces in the virtual realm and if so, how do they contrast with physical transitional spaces for supporting referencing during difficult learning. Furthermore, what is the significance of ecotones between physical, conceptual and virtual space, and how are these blended learning spaces now presenting separate conditions and opportunities for surviving and thriving.

To build on the second research question, further work might adopt similar naturalistic ethnographic protocols using more of a longitudinal approach to understand how student and educator behaviour transitions from the inception of space redesign to the attainment of the 'agentic threshold' for active learning. Understanding the role of the 'transitional zone' in supporting ex-situ transitions in student and educator perception, expectation, behaviour and agency might be captured more authentically using auto-ethnographic approaches in which participants keep diaries of their transitions in to and out of the refurbished spaces. Given the literary debate around the potential of space as a change agent, this would be particularly interesting with regards to traditional educators who enter these refurbished spaces wedded to didactic transmission approaches. Further work might also apply scepticism around space as a change agent and explore alternative, more 'cost-effective' ways of supporting in-situ and ex-situ transitions toward active learning. For example, how might the role of educator development influence the agentic threshold and support ex-situ transitions in traditional learning spaces. Within a similar vein, how might the behavioural

manifestations and empirical indicators of ex-situ transition be defined to more accurately 'measure' the relative educational and economic benefits of refurbishing fringe transitional spaces and/or traditional raked lecture theatres.

How might the (re)design of transitional zones be further refined to reflect the needs of and contribute to better understanding of flipped and blended curricula. The smart addition of interactive technology within fringe spaces could support pre- and post-class activity and broaden the resulting ecotone for student-directed active learning. Furthermore, how can these transitional zones become part of a repository of shared institutional resources which provide a distinct on-campus learning experience to a purely online experience. What are the implications of this on-campus learning for student and staff belonging, identity and well being, particularly as we transition out of full remote working.

The perspectives of architects, building managers and senior management might be solicited regarding transitional spaces and zones. How might these conversations help to shift mindset away from design of demarcated architectural spaces to transitional spaces, places and zones which are educationally functional and cognisant of the underlying complexity of ecotones. How might partnership-driven approaches to (re)design better enable these conversations and achieve a more authentic collaboration between students, staff and other stakeholders by broadening 'design transitional space'. Broadening of this design ecotone potentially extends to curriculum designers and planners who deal with conceptual and virtual infrastructure, as well as to policy makers and senior management. Whilst this study has considered 'in-situ partnership' involving current students and educators, how might student graduates, alumni and members of a wider community be engaged in these change processes to make retrospective contribution to modifying education infrastructure via 'ex-situ partnership'. Furthermore, what is the relative agency between the experience of students using these physical transitional spaces, and students equipped to redesign them through partnership.

8.4.4 Implications of study

This thesis contributes to an empirically-grounded understanding of physical and conceptual transitional space in active learning which has set up opportunities for future work. This understanding has aroused consideration around the implications of the study's findings, including how these transitional spaces might be thought of as ecotones.

This thesis has firstly established a lexicon for other researchers to adopt when studying transitional spaces (italicised here). These terms include *on-ramp*, *medial* and *off-ramp* transitions which are a structural consequence of in-person timetabled learning. Referencing suppression in didactic transmission lectures resulted in *'failed'*, *hidden* and *postponed* transitions. These transitional spaces were found to have broadened within the Blackett refurbished *transitional zone*, which better supported *in-situ* and *ex-situ* transitions. These terms seek to make an important conceptual and linguistic contribution to an area of research in its infancy.

This language, in combination with mixed methods including ethnographic methods and novel occupancy data, have provided a means of understanding learning transition between campus learning spaces. The on-ramp and off-ramp transitional spaces constitute a small subset of potential transitional spaces within these physical learning contexts. Nonetheless, they have been identified as sites of peer-to-peer referencing, incidental active learning and elastic power-geometry across two different disciplinary settings; they therefore deserve further attention, including in other learning contexts. Nurturing the potential of these transitional spaces through smart redesign of physical and conceptual infrastructure - testable and proven via the redesign of the Blackett LT2/foyer space and strategic-driven changes made to pedagogic design - resulted in transitional space with heightened student ownership and agency for active learning. Furthermore, supplementing this thinking with ecological concepts like ecotones (Pendleton-Jullian, 2019) seems to be a useful way

forward when designing for a more responsive and flexible HE environment. This thinking extrapolates the ideas of this study to be potentially applicable in other HE institutions at the national or international sector level.

The local redesign of the Blackett foyer space resulted in a partnership-driven (re)design methodology (Casanova et al., 2018) which has been successfully tested via StudentShapers. This design methodology has since been applied in other departments across the institution's main South Kensington campus with resounding success. This partnership process gave agency to the end users of these spaces who subscribed to and championed the principles of active learning and transition with which the spaces sought to embody. Engaging end users therefore broadened a 'design transitional space' which led to better education and economic outcomes. These relatively low-cost transitional space refurbishments have become of interest to members of estates, senior management and other audiences involved in education and management of the university estate. When coupled with a more capital-intensive refurbishment of the adjacent lecture theatre, the resulting 'transitional zone' can be conceived of as a physical and temporal 'space' which enables transitions between formal and informal learning, transitions in power between educator and student, transitions between different departments and disciplines, transitions between the physical and virtual space, and with the right design and intent, transitions between passive and active learning. This zone might be increasingly thought of as an ecotone in which useful blending and tensions exist within and between the adjoining spaces.

Following this study, the historic conceptualisation of the formal 'learning container' with 'dead' non-timetabled space either side might now be reconsidered, given fringe transitional spaces (15-20 minutes in extent) might also be designed into timetables at the start and end of the teaching session to pedagogically extend the potential space for learning and transition. Transitional zones might therefore seek to re-imagine the learning

container by broadening transitional space which empowers students to deal cognitively and emotionally with difficult learning in formal, timetabled spaces. It is arguably wasteful to view adjacent informal spaces as mere corridors, given they possess value when connected with the formal spaces and increasingly comprise valuable ecotones in and of their own right. Redesigning physical and conceptual infrastructure should seek to leverage the potential of the pre-existing learning space internal and external to the classroom. These ecotones pervade different levels of the ecosystem, representing tensions within physical space, curriculum and institutional strategy, as framed by Bronfenbrenner's ecological systems model in this study. Rather than perceiving these transitions and tensions as compromise, however, we should increasingly recognise them as opportunities. Future refurbishment and investment into infrastructure, rather than develop definite/binary learning spaces which favour the formal and/or informal, might now focus on (re)claiming flexible ecotones which students increasingly seek and thrive in. This may set a clearer direction for sector-wide and institutional transition in a post-COVID HE ecosystem.

Bibliography

Adkoli, B. V., Al-Umran, K. U., Al-Sheikh, M., Deepak, K. K., and Al-Rubaish, A. M. (2011). Medical students' perception of professionalism: a qualitative study from Saudi Arabia. *Medical teacher*, 33(10):840–845.

Agar, M. H. (1996). *The professional stranger: An informal introduction to ethnography*. Academic Press.

Ahlburg, D. A. (2020). Covid-19 and UK Universities. *The Political Quarterly*, 91(3):649–654.

Ahn, M. Y. and Davis, H. H. (2020). Four domains of students' sense of belonging to university. *Studies in Higher Education*, 45(3):622–634.

Akçayır, G. and Akçayır, M. (2018). The flipped classroom: A review of its advantages and challenges. *Computers & Education*, 126:334–345.

Alexander, R., Feeney, J., Hohaus, L., and Noller, P. (2001). Attachment style and coping resources as predictors of coping strategies in the transition to parenthood. *Personal Relationships*, 8(2):137–152.

Alghraibeh, A. M. and Juieed, N. M. (2018). The Relationship between Affective and Social Isolation among Undergraduate Students. *International Education Studies*, 11(1):89–99.

Allen, D. and Tanner, K. (2005). Infusing active learning into the large-enrollment biology class: seven strategies, from the simple to complex. *Cell biology education*, 4(4):262–268.

Altinbasak, E. (2016). *Designing Schools for Future: Comparison of Teacher Attitudes and Preferences toward Classroom Environment*. PhD thesis, North Carolina State University.

Annala, J. and Mäkinen, M. (2017). Communities of practice in higher education: contradictory narratives of a university-wide curriculum reform. *Studies in Higher Education*, 42(11):1941–1957.

Antonelli, P., Hall, P., Aldersey-Williams, H., and Roberts, R. (2008). *Design and the elastic mind*. The Museum of Modern Art.

Asmar, C. (2002). Strategies to enhance learning and teaching in a research-extensive university. *International Journal for Academic Development*, 7(1):18–30.

Atkinson, P., Coffey, A., Delamont, S., Lofland, J., and Lofland, L. (2001). *Handbook of ethnography*. Sage.

Augé, M. (1995). *Non-places: Introduction to an Anthropology of Supermodernity*. Verso.

Bafna, S. (2003). Space syntax: A brief introduction to its logic and analytical techniques. *Environment and behavior*, 35(1):17–29.

Banfield, G. (2004). What's Really Wrong with Ethnography?. *International Education Journal*, 4(4):53–63.

Barab, S., Arici, A., Aguilera, E., and Dutchin, K. (2019). Ecosystem Empowerment: Unlocking human potential through value creation. In *Ecologies for Learning and Practice*, pages 129–145. Routledge.

Barnett, R. (2000). University knowledge in an age of supercomplexity. *Higher education*, 40(4):409–422.

Barnett, R. (2007). *Will to learn: Being a student in an age of uncertainty*. McGraw-Hill Education (UK).

Barnett, R. (2009). Knowing and becoming in the higher education curriculum. *Studies in higher education*, 34(4):429–440.

Barnett, R. (2017). *The ecological university: A feasible utopia*. Routledge.

Barnett, R. and Jackson, N. (2019). *Ecologies for Learning and Practice: Emerging Ideas, Sightings, and Possibilities*. Routledge.

Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational research*, 45(2):143–154.

Bates, A. W. T. and Sangra, A. (2011). *Managing technology in higher education: Strategies for transforming teaching and learning*. John Wiley & Sons.

Beetham, H. and Sharpe, R. (2007). *Rethinking pedagogy for a digital age: Designing and delivering e-learning*. Routledge.

Beichner, R. J. (2014). History and evolution of active learning spaces. *New Directions for Teaching and Learning*, 2014(137):9–16.

Beichner, R. J., Saul, J. M., Abbott, D. S., Morse, J. J., Deardorff, D., Allain, R. J., Bonham, S. W., Dancy, M. H., and Risley, J. S. (2007). The student-centered activities for large enrollment undergraduate programs (SCALE-UP) project. *Research-based reform of university physics*, 1(1):2–39.

Bell, D. (1995). Knowledge and its Pretenders. *Psychosis: Understanding and treatment*, page 70.

Benjamin, A. and Architects, N. Y. E. (2003). *Blurred zones: investigations of the interstitial; Eisenman Architects 1988-1998*. Monacelli Press.

BERA (2018). Ethical guidelines for educational research (4th edn)(London, BERA). *British Educational Research Association*.

Bernstein, B. (1990). Class, codes and control. Vol. IV: The structuring of pedagogic discourse.

Bernstein, B. (2003). *Class, codes and control: The structuring of pedagogic discourse*, volume 4. Psychology Press.

Beyes, T. and Michels, C. (2011). The production of educational space: Heterotopia and the business university. *Management Learning*, 42(5):521–536.

Bhaskar, R. (2008). *Dialectic: The pulse of freedom*. Routledge.

Birdsall, W. F. (2010). Learning commons to communicative commons: Transforming the academic library. *College & Undergraduate Libraries*, 17(2-3):234–247.

Blackmore, J., Bateman, D., Loughlin, J., O'Mara, J., and Aranda, G. (2011). Research into the connection between built learning spaces and student outcomes. *Department of Education and Early Childhood Development*.

Blackmore, P. and Kandiko, C. (2012). *Strategic curriculum change: Global trends in universities*. Routledge.

Bligh, B. and Flood, M. (2017). Activity theory in empirical higher education research: choices, uses and values. *Tertiary Education and Management*, 23(2):125–152.

Bloom, B. S. (1964). *Taxonomy of educational objectives: Affective domain*, volume 2. Longmans, Green.

Bøjer, B. (2020). Creating a Space for Innovative Learning: The Importance of Engaging the Users in the Design Process. In *Teacher Transition into Innovative Learning Environments*, pages 33–46. Springer, Singapore.

Bourdieu, P. (1977). *Outline of a Theory of Practice*. Cambridge university press.

Bourdieu, P. (1989). Social space and symbolic power. *Sociological theory*, 7(1):14–25.

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Sage.

Boys, J., Melhuish, C., and Wilson, A. (2014). *Developing Research Methods for Analyzing Learning Spaces That Can Inform Institutional Missions of Learning and Engagement Report from the Recipients of the 2013-2014 Perry Chapman Prize*. Planning for Higher Education (SCUP).

Bradbeer, C. (2016). Working together in the space-between. In *Evaluating learning environments*, pages 75–90. Springer.

Brand, S. (1995). *How buildings learn: What happens after they're built*. Penguin.

Braun, V. and Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2):77–101.

Braun, V. and Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. Sage.

Braun, V. and Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4):589–597.

Braun, V., Clarke, V., and Gray, D. (2017). *Collecting qualitative data: A practical guide to textual, media and virtual techniques*. Cambridge University Press.

Braun, V., Clarke, V., and Terry, G. (2014). Thematic analysis In Rohleder, P., & Lyons, A. *Qualitative research in clinical and health psychology*, pages 95–113.

Brew, A. (2010). Imperatives and challenges in integrating teaching and research. *Higher Education Research & Development*, 29(2):139–150.

Bridges, W. (2009). *Managing transitions: Making the most of change*. Da Capo Press.

Bronfenbrenner, U. (1977). Lewinian space and ecological substance. *Journal of Social Issues*, 33(4):199–212.

Bronfenbrenner, U. (1979). *The ecology of human development*. Harvard University Press.

Bronfenbrenner, U. (1988). Interacting systems in human development. Research paradigms: Present and future. *Persons in context: Developmental processes*, 2:25–49.

Bronfenbrenner, U. (2001). The Bioecological Theory of Human Development. *Making Human Beings Human: Bioecological Perspectives on Human Development; Bronfenbrenner, U., Ed*, pages 3–15.

Bronfenbrenner, U. and Ceci, S. J. (1994). Nature-nuture reconceptualized in developmental perspective: A bioecological model. *Psychological review*, 101(4):568.

Bronfenbrenner, U. and Morris, P. A. (1998). The ecology of developmental processes. *Handbook of child psychology*, 1(5):993–1028.

Bronfenbrenner, U. and Morris, P. A. (2007). The Bioecological Model of Human Development. In *Handbook of Child Psychology*. John Wiley & Sons, Inc.

Brooks, D. C. (2011). Space matters: The impact of formal learning environments on student learning. *British Journal of Educational Technology*, 42(5):719–726.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The journal of the learning sciences*, 2(2):141–178.

Brown, J. S. (2000). Growing up: Digital: How the web changes work, education, and the ways people learn. *Change: The Magazine of Higher Learning*, 32(2):11–20.

Brown, M. J., Lee, E. A., Grohman, M. G., and Gans, N. (2015). Cognition as Situational Inquiry: John Dewey Meets Jean Lave.

Browndorf, M. (2014). Student library ownership and building the communicative commons. *Journal of Library Administration*, 54(2):77–93.

Buchan, J. (2017). Learning without boundaries: Reconceptualising the curriculum in Innovative Learning Environments. In *SYMPOSIUM PROCEEDINGS AUSTRALASIA 2017*, page 47.

Burke, A. S. and Fedorek, B. (2017). Does "flipping" promote engagement?: A comparison of a traditional, online, and flipped class. *Active Learning in Higher Education*, 18(1):11–24.

Burke, P. J., Crozier, G., and Misiaszek, L. I. (2016). *Changing pedagogical spaces in higher education: Diversity, inequalities and misrecognition*. Taylor & Francis.

Campbell, L. (2020). Teaching in an Inspiring Learning Space: an investigation of the extent to which one school's innovative learning environment has impacted on teachers' pedagogy and practice. *Research Papers in Education*, 35(2):185–204.

Carmean, C. and Haefner, J. (2002). Mind over matter: Transforming course management systems into effective learning environments. *EDUCAUSE review*, 37(6):27–33.

Carnell, B. and Fung, D. (2017). *Developing the higher education curriculum: Research-based education in practice*. UCL Press.

Carnell, B. S. (2017). Connecting physical university spaces with research-based education strategy. *Journal of Learning Spaces*, 6(2):1–12.

Casanova, D., Di Napoli, R., and Leijon, M. (2018). Which space? Whose space? An experience in involving students and teachers in space design. *Teaching in Higher Education*, 23(4):488–503.

Casey, E. (2013). *The fate of place: A philosophical history*. Univ of California Press.

Castells, M. (1996). *The information age*, volume 98. Oxford Blackwell Publishers.

Chaiklin, S. (2001). *The theory and practice of cultural-historical psychology*. Aarhus University Press.

Chi, M. T. H., Roy, M., and Hausmann, R. G. M. (2008). Observing tutorial dialogues collaboratively: Insights about human tutoring effectiveness from vicarious learning. *Cognitive science*, 32(2):301–341.

Chickering, A. W. and Ehrmann, S. C. (1996). Implementing the seven principles: Technology as lever. *AAHE bulletin*, 49:3–6.

Chinn, P. L. and Falk-Rafael, A. (2015). Peace and Power: A Theory of Emancipatory Group Process. *Journal of Nursing Scholarship*, 47(1):62–69.

Chism, N. V. N. (2006). Challenging traditional assumptions and rethinking learning spaces. *Learning spaces*, pages 1–2.

Claxton, G., Chambers, M., Powell, G., and Lucas, B. (2011). The learning power of school. *Victoria, Australia: Hawker Brownlow Education*.

Cleland, J. and Durning, S. J. (2015). *Researching medical education*. John Wiley & Sons.

Cleveland, B. W. (2011). Engaging spaces: Innovative learning environments, pedagogies and student engagement in the middle years of school. In *LEaRN*.

Clifford, J. and Marcus, G. E. (1986). *Writing culture: the poetics and politics of ethnography: a School of American Research advanced seminar*. Univ of California Press.

Cohen, L., Manion, L., and Morrison, K. (2013). *Research methods in education*. Routledge.

Contractor, N. (2013). Moneyball for nanoHUB: theory-driven and data-driven approaches to understand the formation and success of software development teams. In *Business Process Management*, pages 1–3. Springer.

Cook-Sather, A., Bovill, C., and Felten, P. (2014). *Engaging students as partners in learning and teaching: A guide for faculty*. John Wiley & Sons.

Corlett, S. and Mavin, S. (2018). Reflexivity and researcher positionality. *The SAGE handbook of qualitative business and management research methods*, pages 377–399.

Coyle, D. (2018). *The culture code: The secrets of highly successful groups*. Bantam.

Creswell, J. and Poth, C. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications.

Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative*. Prentice Hall Upper Saddle River, NJ.

Damasio, A. (2019). *The strange order of things: Life, feeling, and the making of cultures*. Vintage.

Davis, S. and Dolan, K. (2016). Contagious learning: Drama, experience and perezhivanie. *ERIC*, 7(1).

De Certeau, M. (1984). *The Practice of Everyday Life translated by S Rendall*. University of California Press.

Deakin, H. and Wakefield, K. (2014). Skype interviewing: Reflections of two PhD researchers. *Qualitative research*, 14(5):603–616.

Deaton, S. (2015). Social Learning Theory in the Age of Social Media: Implications for Educational Practitioners. *Journal of Educational Technology*, 12(1):1–6.

Deed, C. and Alterator, S. (2017). Informal learning spaces and their impact on learning in higher education: Framing new narratives of participation. *Journal of Learning Spaces*, 6(3).

Deed, C. and Lesko, T. (2015). 'Unwalling' the classroom: Teacher reaction and adaptation. *Learning Environments Research*, 18(2):217–231.

Deleuze, G. and Guattari, F. (1988). *A thousand plateaus: Capitalism and schizophrenia*. Bloomsbury Publishing.

Denzin, N. K. (1996). *Interpretive ethnography: Ethnographic practices for the 21st century*. Sage publications.

Dewey, J. (1966). *Democracy and education*. Macmillan.

Dewey, J. (1986). Experience and education. In *The Educational Forum*, volume 50, pages 241–252. Taylor & Francis.

DfE (2018). Factors affecting teacher retention: qualitative investigation. *Department for Education*.

Dillenbourg, P. (1999). *Collaborative learning: Cognitive and computational approaches. advances in learning and instruction series.* ERIC.

Disch, W. B., Harlow, L. L., Campbell, J. F., and Dougan, T. R. (2000). Student functioning, concerns, and socio-personal well-being. *Social Indicators Research*, 51(1):41–74.

Dochy, F., Segers, M., Van den Bossche, P., and Gijbels, D. (2003). Effects of problem-based learning: A meta-analysis. *Learning and instruction*, 13(5):533–568.

Donovan, M. S., Bransford, J. D., and Pellegrino, J. W. (1999). How people learn. *Retrieved March*, 8:2006.

Dovey, K. and Fisher, K. (2014). Designing for adaptation: The school as socio-spatial assemblage. *The Journal of Architecture*, 19(1):43–63.

Duncan, N. G. (1981). Home ownership and social theory. *Housing and identity: Cross-cultural perspectives*, 98:134.

Dweck, C. S. (2008). *Mindset: The new psychology of success*. Random House Digital, Inc.

Edwards, M. R. and Clinton, M. E. (2019). A study exploring the impact of lecture capture availability and lecture capture usage on student attendance and attainment. *Higher Education*, 77(3):403–421.

Eisner, E. (1985). Five basic orientations to the curriculum. *The educational imagination*, pages 61–86.

Eison, J. and Bonwell, C. (1991). Active learning: creating excitement in the classroom. *Washington, DC: George Washington University*.

Elden, S. (2007). There is a politics of space because space is political: Henri Lefebvre and the production of space. *Radical philosophy review*, 10(2):101–116.

Elgin, C. Z. (2013). Epistemic agency. *Theory and Research in Education*.

Elkington, S. and Bligh, B. (2019). Future Learning Spaces: Space, Technology and Pedagogy.

Emirbayer, M. and Mische, A. (1998). What is agency? *American Journal of Sociology*, 103(4):962–1023.

Engeström, R. (1995). Voice as communicative action. *Mind, culture, and activity*, 2(3):192–215.

Engeström, Y. (1987). Learning by Expanding–An Activity-Theoretical Approach to Developmental Research. *Diss., Univ. Helsinki, Helsinki*.

Engeström, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics*, 43(7):960–974.

Engeström, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualization. *Journal of education and work*, 14(1):133–156.

Engeström, Y. and Middleton, D. (1996). *Cognition and communication at work*. Cambridge University Press.

English, H. B. and English, A. C. (1958). A comprehensive dictionary of psychological and psychoanalytical terms: A guide to usage.

Epstein, D. (2019). Range: Why generalists triumph in a specialized world. *Penguin*.

Esposito, A., Sangrà, A., and Maina, M. (2013). Chronotopes in learner-generated contexts. A reflection about the interconnectedness of temporal and spatial dimensions to provide a framework for the exploration of hybrid learning ecologies of doctoral e-researchers. *eLearn Center Research Paper Series*, pages 15–28.

Fagen, A. P., Crouch, C. H., and Mazur, E. (2002). Peer instruction: Results from a range of classrooms. *The physics teacher*, 40(4):206–209.

Fetterman, D. M. (2019). *Ethnography: Step-by-step*, volume 17. SAGE Publications, Incorporated.

Field, J. (2012). Transitions in lifelong learning: Public issues, private troubles, liminal identities. *Studies for the Learning Society*, 2(2-3):4–11.

Fine, G. A. and Deegan, J. G. (1996). Three principles of serendip: insight, chance, and discovery in qualitative research. *International Journal of Qualitative Studies in Education*, 9(4):434–447.

Finkelstein, A., Ferris, J., Weston, C., and Winer, L. (2016). Informed principles for (re) designing teaching and learning spaces. *Journal of Learning Spaces*, 5(1).

Fish, W. (2010). *Philosophy of perception: A contemporary introduction*. Routledge.

Fisher, K. (2004). Revoicing Classrooms: A Spatial Manifesto. In *FORUM: for promoting 3-19 Comprehensive Education*, volume 46, pages 36–38. ERIC.

Fisher, K. (2010). Technology-enabled active learning environments: An appraisal. *Centre for Effective Learning Environments, OECD*.

Flinders, D. J., Noddings, N., and Thornton, S. J. (1986). The null curriculum: Its theoretical basis and practical implications. *Curriculum Inquiry*, 16(1):33–42.

Flood, A. (2010). Understanding phenomenology. *Nurse researcher*, 17(2).

Forrester, J. W. (1971). *World dynamics*. Wright-Allen Press.

Foucault, M. (1984). Space, knowledge and power. *The foucault reader*, 239(256).

Foucault, M. (1992). *Discipline and punish: The birth of the prison*. Penguin.

Foucault, M. (2018). *The order of things*. Routledge.

Fredholm, A., Henningsohn, L., Savin-Baden, M., and Silén, C. (2020). The practice of thresholds: autonomy in clinical education explored through variation theory and the threshold concepts framework. *Teaching in Higher Education*, 25(3):305–320.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., and Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 111(23):8410–8415.

Freire, P. (2018). *Pedagogy of the oppressed*. Bloomsbury publishing USA.

Freud, S. and Strachey, J. (1930). Civilization and its Discontents. *The Standard Edition*, 21:64–145.

Frost, L. and Hoggett, P. (2008). Human agency and social suffering. *Critical social policy*, 28(4):438–460.

Fung, D. and Carnell, B. (2017). UCL Connected Curriculum: Enhancing programmes of study.

Gadamer, H.-G., Weinsheimer, J., and Marshall, D. G. (2004). *EPZ truth and method*. Bloomsbury Publishing USA.

Gallagher, S. (1992). *Hermeneutics and education*. SUNY press.

Gaventa, J. (2003). Power after Lukes: an overview of theories of power since Lukes and their application to development. *Brighton: Participation Group, Institute of Development Studies*.

Geertz, C. (1973). *The interpretation of cultures*, volume 5019. Basic books.

Gibson, J. J. (1977). The theory of affordances. *Hilldale, USA*, 1(2):67–82.

Gilovich, T., Kruger, J., and Medvec, V. H. (2002). The spotlight effect revisited: Overestimating the manifest variability of our actions and appearance. *Journal of Experimental Social Psychology*, 38(1):93–99.

Giorgi, A. (1994). A phenomenological perspective on certain qualitative research methods. *Journal of phenomenological psychology*, 25(2):190–220.

Giyoo, H. and Inagaki, K. (1986). Two courses of expertise. *Child Development and Education in Japan.–New York: WH Freeman*, pages 263–272.

Goffman, E. (1967). *Interaction ritual: Essays on face-to-face interaction*. New York: Pantheon Books.

Goodman, L. A. (1961). Notes on the etymology of serendipity and some related philological observations. *Modern Language Notes*, 76(5):454–457.

Goodyear, P. and Ellis, R. A. (2019). Ecological thinking about education strategy in universities. *Ecologies for Learning and Practice: Emerging Ideas, Sightings, and Possibilities*.

Griffiths, R. (2004). Knowledge production and the research–teaching nexus: The case of the built environment disciplines. *Studies in Higher education*, 29(6):709–726.

Hafferty, F. W. and O'Donnell, J. F. (2015). *The hidden curriculum in health professional education*. Dartmouth College Press.

Hagel, J., Hagel III III, J., and Brown, J. S. (2005). *The only sustainable edge: Why business strategy depends on productive friction and dynamic specialization*. Harvard Business Press.

Haigh, F., Kemp, L., Bazeley, P., and Haigh, N. (2019). Developing a critical realist informed framework to explain how the human rights and social determinants of health relationship works. *BMC public health*, 19(1):1–12.

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American journal of Physics*, 66(1):64–74.

Hammersley, M. and Atkinson, P. (2007). Ethnography. Principles in practice. 2007. *London and New York: Routledge*.

Hammond, M. and Wellington, J. (2019). *Education Research: The Basics*. Routledge.

Harrop, D. and Turpin, B. (2013). A study exploring learners' informal learning space behaviors, attitudes, and preferences. *New Review of Academic Librarianship*, 19(1):58–77.

Harvey, D. (1993). From space to place and back again: Reflections on the condition of postmodernity. *Mapping the futures: Local cultures, global change*, pages 3–29.

Hattie, J. and Timperley, H. (2007). The power of feedback. *Review of educational research*, 77(1):81–112.

Hayes, N., O'Toole, L., and Halpenny, A. M. (2017). *Introducing Bronfenbrenner: A guide for practitioners and students in early years education*. Taylor & Francis.

HEDQF (2019). Social Learning Environments. *Student views of their university*.

Hess, C. and Ostrom, E. (2003). Ideas, artifacts, and facilities: information as a common-pool resource. *Law and contemporary problems*, 66(1/2):111–145.

Hestenes, D., Wells, M., and Swackhamer, G. (1992). Force concept inventory. *The physics teacher*, 30(3):141–158.

Hewitt, J. P. (1976). Self and society. *A symbolic interactionist social psychology. Newton, MA: Allyn and Bacon*.

Hillier, B. and Hanson, J. (1989). *The social logic of space*. Cambridge University Press.

Hodkinson, P. and Hodkinson, H. (2001). Problems of measuring learning and attainment in the workplace: complexity, reflexivity and the localised nature of understanding. *Context,*

Power and Perspective: Confronting the Challenges to Improving Attainment in Learning at Work, University College Northampton, pages 8–10.

Holmes, C. L., Harris, I. B., Schwartz, A. J., and Regehr, G. (2015). Harnessing the hidden curriculum: a four-step approach to developing and reinforcing reflective competencies in medical clinical clerkship. *Advances in Health Sciences Education*, 20(5):1355–1370.

Hornecker, E. (2005). A design theme for tangible interaction: embodied facilitation. In *ECSCW 2005*, pages 23–43. Springer.

Hornecker, E. and Buur, J. (2006). Getting a grip on tangible interaction: a framework on physical space and social interaction. In *Proceedings of the SIGCHI conference on Human Factors in computing systems*, pages 437–446.

Hume, A. and Coll, R. (2010). Authentic student inquiry: the mismatch between the intended curriculum and the student-experienced curriculum. *Research in Science & Technological Education*, 28(1):43–62.

Hunley, S. and Schaller, M. (2009). Assessment: The Key to Creating Spaces That Promote Learning. *Educause review*.

Hunt, D. M. (1986). Formal vs. informal mentoring: Towards a framework. In *Mentoring: Aid to Excellence in Career Development, Business and the Professions–Proceedings of the First International Conference on Mentoring*, volume 2.

Hurdley, R. (2010). The power of corridors: Connecting doors, mobilising materials, plotting openness. *The Sociological Review*, 58(1):45–64.

Husserl, E. (1952). Ideas pertaining to a pure phenomenology and to a phenomenological philosophy: Second book. *Trans. R. Rojcewicz and A. Schuwer. Dordrecht, Boston, and London: Kluwer Academic Publishers*.

Illeris, K. (2002). The three dimensions of learning: contemporary theory in the tension field between the cognitive, emotional and social. *Roskilde University Press, Frederiksberg*.

Il'enkov, E. V. (1977). *Dialectical logic: Essays on its history and theory*. Progress Publishers.

Imms, W. and Byers, T. (2017). Impact of classroom design on teacher pedagogy and student engagement and performance in mathematics. *Learning Environments Research*, 20(1):139–152.

Imms, W. and Kvan, T. (2021). *Teacher Transition into Innovative Learning Environments: A Global Perspective*. Springer Nature.

Imperial College London (2017). Learning and Teaching Strategy. *Retrieved from https://www.imperial.ac.uk/learning-and-teaching-strategy/*.

Imperial College London (2020). College Strategy 2020-2025. *Retrieved from https://www.imperial.ac.uk/strategy/*.

Imperial College Union (2016). NSS Response. *Retrieved from https://www.imperialcollegeunion.org/sites/default/files/NSS%20Response%202016%20FINAL.pdf*.

Ingold, T. (2000). *The perception of the environment: essays on livelihood, dwelling and skill*. Psychology Press.

Jacklin, H. (2000). Locating pedagogy. In *British Sociological Association Annual Conference, York University, April*, pages 17–20.

Jackson, N. J. (2013). The concept of learning ecologies. *Lifewide learning, education & personal development*, pages 1–21.

James, N. and Busher, H. (2016). Online interviewing. *Qualitative Research. 4th ed. London & California: SAGE Publications Inc*, pages 245–259.

James, W. (1975). Pragmatism: a new name for some old ways of thinking (1907). *Cambridge: Harvard UP*.

Jamieson, P. (2009). Developing the university campus as a place of learning. In *LEaRN*. Australian Institute of Architects.

Jewitt, C. (2008). Multimodality and literacy in school classrooms. *Review of research in education*, 32(1):241–267.

Jindal-Snape, D. (2009). *Educational transitions: Moving stories from around the world*, volume 33. Routledge.

JISC (2006). Designing spaces for effective learning: A guide to 21st century learning space design. *Joint Information Systems Committee Development Group*.

Johannisson, B. (1987). Beyond process and structure: social exchange networks. *International Studies of Management & Organization*, 17(1):3–23.

Johnson, D. W. and Johnson, R. T. (1987). *Learning together and alone: Cooperative, competitive, and individualistic learning*. Prentice-Hall, Inc.

Johnson, D. W., Johnson, R. T., and Smith, K. (2007). The state of cooperative learning in postsecondary and professional settings. *Educational Psychology Review*, 19(1):15–29.

Jones, M., Michael, C., Mandala, J., and Colachico, D. (2008). Collaborative Teaching: Creating a Partnership between General and Special Education. *International Journal of Learning*, 15(7).

Jones, M. L. (2007). Using software to analyse qualitative data. *Research*, 1(1):64–76.

Kegan, R., Kegan, L. L. L. R., and Lahey, L. L. (2009). *Immunity to change: How to overcome it and unlock potential in yourself and your organization*. Harvard Business Press.

Keohane, N. O. (2006). *Higher ground: Ethics and leadership in the modern university*. Duke University Press.

Keppell, M., Souter, K., and Riddle, M. (2011). *Physical and virtual learning spaces in higher education: Concepts for the modern learning environment*. IGI Publishing (IGI Global).

Kerr, C. (2001). *The uses of the university*. Harvard University Press.

Khan, A., Egbue, O., Palkie, B., and Madden, J. (2017). Active learning: Engaging students to maximize learning in an online course. *Electronic Journal of E-Learning*, 15(2):107–115.

Kitchenham, A. (2008). The evolution of John Mezirow's transformative learning theory. *Journal of transformative education*, 6(2):104–123.

Knapp, M. L., Hall, J. A., and Horgan, T. G. (2013). *Nonverbal communication in human interaction*. Cengage Learning.

Kokko, A. K. and Hirsto, L. (2020). From physical spaces to learning environments: processes in which physical spaces are transformed into learning environments. *Learning Environments Research*, pages 1–15.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. FT press.

Kouritzin, S. (2002). The "half-baked" concept of "raw" data in ethnographic observation. *Canadian Journal of Education/Revue canadienne de l'éducation*, pages 119–138.

Krasny, M. E., Lundholm, C., and Plummer, R. (2010). Resilience in social–ecological systems: the roles of learning and education.

Kuhn, T. S. (2012). *The structure of scientific revolutions*. University of Chicago press.

La Valle, I. and Blake, M. (2001). *National adult learning survey 2001*. DfES Nottingham.

Lackney, J. A. (2008). Teacher environmental competence in elementary school environments. *Children Youth and Environments*, 18(2):133–159.

Lakoff, G. and Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought*, volume 640. Basic books New York.

Land, R., Rattray, J., and Vivian, P. (2014). Learning in the liminal space: a semiotic approach to threshold concepts. *Higher Education*, 67(2):199–217.

Lave, J. (1988). *Cognition in practice: Mind, mathematics and culture in everyday life*. Cambridge University Press.

Lave, J. and Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge university press.

Laverty, S. M. (2003). Hermeneutic phenomenology and phenomenology: A comparison of historical and methodological considerations. *International journal of qualitative methods*, 2(3):21–35.

Lazarou, D., Sutherland, R., and Erduran, S. (2016). Argumentation in science education as a systemic activity: An activity-theoretical perspective. *International Journal of Educational Research*, 79:150–166.

Le Fevre, D. M. (2014). Barriers to implementing pedagogical change: The role of teachers' perceptions of risk. *Teaching and teacher education*, 38:56–64.

LeCompte, M. D. and Preissle, J. (1993). Ethnography and qualitative design in educational research.

LeCompte, M. D. and Schensul, J. J. (1999). *Designing and conducting ethnographic research*, volume 1. Rowman Altamira.

Lefebvre, H. (1970). *The urban revolution*. U of Minnesota Press.

Lefebvre, H. and Nicholson-Smith, D. (1991). *The production of space*, volume 142. Oxford Blackwell.

Leighton, V. (2017). Teaching space: Does a teacher's spatial competency affect their teaching and effect the different types of learning that takes place in a classroom. *Transitions Australasia: What is needed to help teachers better utilize space as one of their pedagogic tools, Melbourne*.

Leijon, M. (2016). Space as designs for and in learning: investigating the interplay between space, interaction and learning sequences in higher education. *Visual Communication*, 15(1):93–124.

Lempp, H. and Seale, C. (2004). The hidden curriculum in undergraduate medical education: qualitative study of medical students' perceptions of teaching. *Bmj*, 329(7469):770–773.

Leont'ev, A. (1978). Activity, consciousness, and personality. *Prentice-Hall*.

Lim, F. V., O'Halloran, K. L., and Podlasov, A. (2012). Spatial pedagogy: Mapping meanings in the use of classroom space. *Cambridge journal of education*, 42(2):235–251.

Lippman, P. C. (2010). *Evidence-based design of elementary and secondary schools: A responsive approach to creating learning environments*. John Wiley & Sons.

Luckin, R. (2008). The learner centric ecology of resources: A framework for using technology to scaffold learning. *Computers & Education*, 50(2):449–462.

Lumsden, E. (2012). *Early Years Professional status: a new professional or a missed opportunity*. PhD thesis, University of Northampton.

Luria, A. R. (1970). The functional organization of the brain. *Scientific American*, 222(3):66–79.

Luttmann, E. (2008). Blurring the Disconnect:[Inter] positioning Place within a Struggling Context. *Masters theses, University of South Florida*.

Madden, R. (2017). *Being ethnographic: A guide to the theory and practice of ethnography*. Sage.

Mahat, M., Bradbeer, C., Byers, T., and Imms, W. (2018). Innovative Learning Environments and Teacher Change: Defining key concepts. In *LEaRN*. University of Melbourne, LEaRN.

Marcus, G. E. (1995). Ethnography in/of the world system: The emergence of multi-sited ethnography. *Annual review of anthropology*, 24(1):95–117.

Markus, T. A. (1993). *Buildings & power: Freedom and control in the origin of modern building types*. Psychology Press.

Martens, S. E., Meeuwissen, S. N. E., Dolmans, D., Bovill, C., and Könings, K. D. (2019). Student participation in the design of learning and teaching: Disentangling the terminology and approaches. *Medical teacher*, 41(10):1203–1205.

Martin, T., Rivale, S. D., and Diller, K. R. (2007). Comparison of student learning in challenge-based and traditional instruction in biomedical engineering. *Annals of biomedical engineering*, 35(8):1312–1323.

Marx, K. and Engels, F. (1970). *The german ideology*, volume 1. International Publishers Co.

Mason, T. C., Arnove, R. F., and Sutton, M. (2001). Credits, curriculum, and control in higher education: Cross-national perspectives. *Higher Education*, 42(1):107–137.

Massey, D. (2005). For space. *Sage*.

Massey, D. (2007). *World city*. Polity.

Massey, D. (2009). Concepts of space and power in theory and in political practice. *Documents d'anàlisi geogràfica*, (55):15–26.

Massey, D. (2013). *Space, place and gender*. John Wiley & Sons.

Massey, D., Bird, J., Curtis, B., Putnam, T., Robertson, G., and Tickner, L. (1993). Mapping the Futures: local cultures, global change. *Power-geometry and a progressive sense of place, London: Routledge*, 5969.

Massey, D. B., Allen, J., and Sarre, P. (1999). *Human geography today*. Polity Press Cambridge.

Matthews, K. E., Cook-Sather, A., Acai, A., Dvorakova, S. L., Felten, P., Marquis, E., and Mercer-Mapstone, L. (2019). Toward theories of partnership praxis: An analysis of interpretive framing in literature on students as partners in teaching and learning. *Higher Education Research & Development*, 38(2):280–293.

McNeil, J. and Borg, M. (2018). Learning spaces and pedagogy: Towards the development of a shared understanding. *Innovations in Education and Teaching International*, 55(2):228–238.

Means, B. and Neisler, J. (2020). Suddenly online: a national survey of undergraduates during the COVID-19 pandemic. Technical report, Digital Promise.

Menzies, J. L. and Baron, R. (2014). International postgraduate student transition experiences: The importance of student societies and friends. *Innovations in Education and Teaching International*, 51(1):84–94.

Merriam, S. B. (1999). Time as the integrative factor. *New directions for adult and continuing education*, 1999(84):67–75.

Merrill, M. (2010). *Louis Kahn: On Thoughtful Making of Spaces: the Dominican Motherhouse and a Modern Culture of Space*. Lars Müller.

Merrill, M. D. (2002). First principles of instruction. *Educational technology research and development*, 50(3):43–59.

Mezirow, J. (1978). Perspective transformation. *Adult education*, 28(2):100–110.

Mezirow, J. (1985). A critical theory of self-directed learning. *New directions for continuing education*, 25:17–30.

Mezirow, J. (1991). *Transformative dimensions of adult learning*. ERIC.

Michel, N., Cater, J. J., and Varela, O. (2009). Active versus passive teaching styles: An empirical study of student learning outcomes. *Human Resource Development Quarterly*, 20(4):397–418.

Michelson, G. and Mouly, S. (2000). Rumour and gossip in organisations: a conceptual study. *Management Decision*.

Middleton, A. (2018). *Reimagining spaces for learning in higher education*. Macmillan International Higher Education.

Miles, M. B., Huberman, A. M., and Saldaña, J. (2018). *Qualitative data analysis: A methods sourcebook*. Sage publications.

Millen, D. R. (2000). Rapid ethnography: time deepening strategies for HCI field research. In *Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques*, pages 280–286.

Mishra, L., Gupta, T., and Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open*, 1:100012.

Monahan, T. (2000). Built pedagogies & technology practices: Designing for participatory learning. In *Participatory Design Conference, Palo Alto, CA*.

Montessori, M. (1917). *The advanced Montessori method*, volume 1. Frederick A. Stokes Company.

Morgan, D. (2018). Learning in Liminality: a hermeneutic phenomenological investigation of student nurse learning during a study abroad journey.

Mruk, C. J. J. (2006). *Self-esteem research, theory, and practice: Toward a positive psychology of self-esteem*. Springer Publishing Company.

Muhammad, S., Sapri, M., and Sipan, I. (2014). Academic buildings and their influence on students' wellbeing in higher education institutions. *Social indicators research*, 115(3):1159–1178.

Mulcahy, D., Cleveland, B., and Aberton, H. (2015). Learning spaces and pedagogic change: envisioned, enacted and experienced. *Taylor & Francis*, 23(4):575–595.

Murphy, E. and Manzanares, M. A. (2008). Contradictions between the virtual and physical high school classroom: A third-generation Activity Theory perspective. *British Journal of Educational Technology*, 39(6):1061–1072.

Nassar, U. A. and Hosam, E.-S. (2014). TRANSITION SPACE IN HIGHER-EDUCATION BUILDINGS AS AN EFFICIENT "BEHAVIOR SETTING" MODEL. *Academia.edu*.

Neary, M. and Saunders, G. (2011). Leadership and learning landscapes: The struggle for the idea of the university. *Higher Education Quarterly*, 65(4):333–352.

Nelson, E. and Johnson, L. (2017). Addressing the challenges of Innovative Learning Environments for practicum: Socio-spatial entanglements. In *SYMPOSIUM PROCEEDINGS AUSTRALASIA 2017*, page 41.

Newby, P. (2010). *Research methods for education*. Pearson Education.

Newton, J. (2003). Implementing an institution-wide learning and teaching strategy: Lessons in managing change. *Studies in higher education*, 28(4):427–441.

Nicol, A. A. M., Owens, S. M., Le Coze, S. S. C. L., MacIntyre, A., and Eastwood, C. (2018). Comparison of high-technology active learning and low-technology active learning classrooms. *Active Learning in Higher Education*, 19(3):253–265.

Nicol, D. (2019). Reconceptualising feedback as an internal not an external process. *Italian Journal of Educational Research*, pages 71–84.

Nicol, D. (2020). The power of internal feedback: Exploiting natural comparison processes. *Assessment and Evaluation in Higher Education*, pages 1–23.

Niemimaa, M. (2017). Sociomaterial Ethnography: Taking the Matter Seriously New Method for Development of Information Security Policies -NM4DISP View project. *In MCIS*.

Norman, D. A. (2010). The research-Practice Gap: The need for translational developers. *Interactions*, 17(4):9–12.

Oblinger, D. (2005). Leading the transition from classrooms to learning spaces. *Educause quarterly*, 1(7-12).

Oblinger, D. G. (2006). Space as a change agent. *Learning spaces*, 1:1–2.

O'Brien, W., Gunay, B., Tahmasebi, F., and Mahdavi, A. (2017). Special issue on the fundamentals of occupant behaviour research. *Journal of Building Performance Simulation*, 10:5–6.

O'donoghue, T. (2006). *Planning your qualitative research project: An introduction to interpretivist research in education*. Routledge.

Oolbekkink-Marchand, H. W., Hadar, L. L., Smith, K., Helleve, I., and Ulvik, M. (2017). Teachers' perceived professional space and their agency. *Teaching and Teacher Education*.

Ormerod, R. (2006). The history and ideas of pragmatism. *Journal of the Operational Research Society*, 57(8):892–909.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.

O'Toole, L., Hayes, N., and Halpenny, A. M. (2019). Animating Systems: The ecological value of Bronfenbrenner's bioecological model of development. In Barnett, R. and Jackson, N., editors, *Ecologies for Learning and Practice*, pages 19–31. Routledge.

Pantidi, N. (2013). *An Ethnographic Study of Everyday Interactions in In- novative Learning Spaces*. PhD thesis, The Open University.

Pearce, D. S. (2019). Independent review of the Teaching Excellence and Student Outcomes Framework (TEF): report to the Secretary of State for Education: August 2019.

Pendleton-Jullian, A. (2019). Education and Innovation Ecotones. In Barnett, R. and Jackson, N., editors, *Ecologies for Learning and Practice: Emerging Ideas, Sightings, and Possibilities*, pages 112–128. Routledge.

Perry, C. and Allard, A. (2003). Making the connections: Transition experience for first-year education students. *Journal of Educational Enquiry*, 4(2):74–89.

Petersen, C. I. and Gorman, K. S. (2014). Strategies to address common challenges when teaching in an active learning classroom. *New Directions for Teaching and Learning*, 2014(137):63–70.

Piaget, J. and Cook, M. (1952). *The origins of intelligence in children*, volume 8. International Universities Press New York.

Pickett, S. T. A., Kolasa, J., and Jones, C. G. (2010). *Ecological understanding: the nature of theory and the theory of nature*. Elsevier.

Pierce, J. L., Kostova, T., and Dirks, K. T. (2001). Toward a theory of psychological ownership in organizations. *Academy of management review*, 26(2):298–310.

Piketty, T. (2015). About capital in the twenty-first century. *American Economic Review*, 105(5):48–53.

Pippin, R. B. and Pippin, R. B. (1989). *Hegel's idealism: The satisfactions of self-consciousness*. Cambridge University Press.

Pitts, A. (2013). Thermal Comfort in Transition Spaces. *Buildings*, 3:122–142.

Pitts, A., Saleh, J. B., and Sharples, S. (2008). Building transition spaces, comfort and energy use. In *25th International Conference on Passive and Low Energy Architecture: Towards Zero Energy Building*. University College Dublin.

Pollak, D. (2009). *Neurodiversity in higher education: Positive responses to specific learning differences*. John Wiley & Sons.

Ponticell, J. A. (2003). Enhancers and inhibitors of teacher risk taking: A case study. *Peabody Journal of Education*, 78(3):5–24.

Popenici, S. and Brew, A. (2013). Reading Walls on University Corridors. In *Discourse, power, and resistance down under*, pages 145–156. Springer.

Postholm, M. B. (2008). Cultural historical activity theory and Dewey's idea-based social constructivism: Consequences for Educational Research. *Outlines. Critical Practice Studies*, 10(1):37–48.

Praglin, L. (2006). The nature of the "in-between" in DW Winnicott's concept of transitional space and in Martin Buber's das Zwischenmenschliche. *J. Stud. Interpers. Process.*, 2:81–89.

Prensky, M. (2008). The role of technology. *Educational Technology*, 48(6):1–3.

Price, I. F., Matzdorf, F., Smith, L., and Agahi, H. (2003). The impact of facilities on student choice of university. *Facilities*.

Prince, M. J. and Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of engineering education*, 95(2):123–138.

Punch, K. F. (2013). *Introduction to social research: Quantitative and qualitative approaches*. sage.

Qin, Z., Johnson, D. W., and Johnson, R. T. (1995). Cooperative Versus Competitive Efforts and Problem Solving. *Review of Educational Research*, 65(2):129–143.

Radcliffe, D., Wilson, H., Powell, D., and Tibbetts, B. (2008). Designing next generation places of learning: Collaboration at the pedagogy-space-technology nexus. *The University of Queensland*, pages 1–20.

Ramu, V., Taib, N., Aziz, N. F., and Ismail, M. (2018). Transitional Spaces in Higher Education as Efficient Informal Academic Learning Spaces. *Jurnal Kejuruteraan, Teknologi dan Sains Sosial*, 1(1):1–11.

Ravelli, L. J. and Stenglin, M. (2008). Feeling space: Interpersonal communication and spatial semiotics. *Handbook of interpersonal communication*, 2:355.

Remuzzi, A. and Remuzzi, G. (2020). COVID-19 and Italy: what next? *The lancet*, 395(10231):1225–1228.

Riddle, M. D. and Souter, K. (2012). Designing informal learning spaces using student perspectives. *Journal of Learning Spaces*, 1(2).

Riggins-Caspers, K. M., Cadoret, R. J., Knutson, J. F., and Langbehn, D. (2003). Biology-environment interaction and evocative biology-environment correlation: Contributions of harsh discipline and parental psychopathology to problem adolescent behaviors. *Behavior Genetics*, 33(3):205–220.

Riley, D. (2007). Educational technology and practice: Types and timescales of change. *Journal of Educational Technology & Society*, 10(1):85–93.

Risquez, A., Moore, S., and Morley, M. (2007). Welcome to college? Developing a richer understanding of the transition process for adult first year students using reflective written journals. *Journal of College Student Retention: Research, Theory & Practice*, 9(2):183–204.

Rogers, C. R. (1951). *Client-centered therapy: Its current practice, implications, and theory, with chapters*. Houghton Mifflin Oxford, United Kingdom.

Rosa, E. A. (1998). Metatheoretical foundations for post-normal risk. *Journal of risk research*, 1(1):15–44.

Rosa, E. M. and Tudge, J. (2013). Urie Bronfenbrenner's theory of human development: Its evolution from ecology to bioecology. *Journal of Family Theory & Review*, 5(4):243–258.

Rosnow, R. L. and Rosenthal, R. (1976). The volunteer subject revisited. *Australian Journal of Psychology*, 28(2):97–108.

Ryan, S., Freeman, H., Scott, B., and Patel, D. (2000). *The virtual university: The internet and resource-based learning*. Psychology Press.

Sagan, O. (2011). Between the lines: The transitional space of learning. In *Re-shaping learning: A critical reader*, pages 67–79. Brill Sense.

Sandberg, J. (2005). How do we justify knowledge produced within interpretive approaches? *Organizational research methods*, 8(1):41–68.

Sanders, P. C. (1868). On a New List of Categories. In *Proceedings of the American Academy of Arts and Sciences*, pages 287–298.

Sandrone, S. and Schneider, L. D. (2020). Active and distance learning in neuroscience education. *Neuron*, 106(6):895–898.

Sanger, J. (1996). *The compleat observer?: A field research guide to observation.* Number 2. Psychology Press.

Savin-Baden, M. (2007). *Learning Spaces: Creating Opportunities For Knowledge Creation In Academic Life: Creating Oppurtunities for Knowledge Creation in Academic Life.* McGraw-Hill Education (UK).

Savin-Baden, M. (2008). Liquid learning and troublesome spaces: Journeys from the threshold? In *Threshold concepts within the disciplines*, pages 75–88. Brill Sense.

Savin-Baden, M. (2019). Learning Ecologies: Liminal states and student transformation. In *Ecologies for Learning and Practice*, pages 46–60. Routledge.

Savin-Baden, M. and Major, C. H. (2013). *Qualitative research: The essential guide to theory and practice.* Routledge.

Sclater, S. D. (2003). What is the subject? *Narrative inquiry*, 13(2):1–14.

Scribner, S. and Cole, M. (1973). Cognitive consequences of formal and informal education. *Science*, 182(4112):553–559.

Seitz, S. (2016). Pixilated partnerships, overcoming obstacles in qualitative interviews via Skype: A research note. *Qualitative Research*, 16(2):229–235.

Senge, P. M., Kleiner, A., Roberts, C., Ross, R., and Smith, B. (1994). The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization, 1994. *N. Brealy*.

Sennett, R. (2018). *Building and dwelling: ethics for the city*. Farrar Straus and Giroux.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher*, 27(2):4–13.

Siems, F., Lengauer, J., and Bruton, J. (2006). Architectural Design of Universities and its Impact on Student Satisfaction: Theory and Results of an Empirical Study. In *DS 38: Proceedings of E&DPE 2006, the 8th International Conference on Engineering and Product Design Education, Salzburg, Austria, 07.-08.09. 2006*.

Sirgy, M. J., Grzeskowiak, S., and Rahtz, D. (2007). Quality of college life (QCL) of students: Developing and validating a measure of well-being. *Social Indicators Research*, 80(2):343–360.

Smith, T. B., Wayne, R. K., Girman, D. J., and Bruford, M. W. (1997). A role for ecotones in generating rainforest biodiversity. *Science*, 276(5320):1855–1857.

Sohrabi, B. and Iraj, H. (2016). Implementing flipped classroom using digital media: A comparison of two demographically different groups perceptions. *Computers in Human Behavior*, 60:514–524.

Soja, E. W. (1989). *Postmodern geographies: The reassertion of space in critical social theory*. Verso.

Somekh, B. and Lewin, C. (2005). *Research methods in the social sciences*. Sage.

Sonesson, G. (2013). The natural history of branching: Approaches to the phenomenology of firstness, secondness, and thirdness. *Signs and Society*, 1(2):297–325.

Souter, K., Riddle, M., Sellers, W., and Keppell, M. (2011). Spaces for knowledge generation. *Australian Learning & Teaching Council*.

Spradley, J. (1979). Asking descriptive questions. *The ethnographic interview*, 1:44–61.

Spradley, J. P. (2016). *Participant observation*. Waveland Press.

Springer, L., Stanne, M. E., and Donovan, S. S. (1999). Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research*, 69(1):21–51.

Srivastava, A. (2007). *Transition: a spatial translation*. PhD thesis, University of Cincinnati.

Stauffer, R. C. (1957). Haeckel, Darwin, and ecology. *The Quarterly Review of Biology*, 32(2):138–144.

Stenglin, M. K. (2009). Space odyssey: Towards a social semiotic model of three-dimensional space. *Visual Communication*, 8(1):35–64.

Stephens-Davidowitz, S. and Pabon, A. (2017). *Everybody lies: Big data, new data, and what the internet can tell us about who we really are*. HarperCollins New York.

Suchman, L. A. (1987). *Plans and situated actions: The problem of human-machine communication*. Cambridge university press.

Sudman, S. and Bradburn, N. M. (1982). *Asking questions*. Jossey-Bass Inc Pub.

Swain, J. (2016). *Designing research in education: Concepts and methodologies*. Sage.

Symonds, Q. (2020). The impact of the coronavirus on global higher education.

Tam, G. and El-Azar, D. (2020). 3 ways the coronavirus pandemic could reshape education. In *World Economic Forum*.

Temple, P. (2007). Learning spaces for the 21st century: A review of the literature.

Temple, P. (2008). Learning spaces in higher education: an under-researched topic. *London Review of Education*, 6(3):229–241.

Temple, P. (2009). From space to place: University performance and its built environment. *Higher Education Policy*, 22(2):209–223.

Temple, P. (2018). Space, place and institutional effectiveness in higher education. *Policy Reviews in Higher Education*, 2(2):133–150.

Temple, P. (2019). University spaces: Creating cité and place. *London Review of Education*, 17(2):223–235.

Terry, D. J. (1991). Coping resources and situational appraisals as predictors of coping behavior. *Personality and Individual Differences*, 12(10):1031–1047.

Theobald, E. J., Hill, M. J., Tran, E., Agrawal, S., Arroyo, E. N., Behling, S., Chambwe, N., Cintrón, D. L., Cooper, J. D., and Dunster, G. (2020). Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math. *Proceedings of the National Academy of Sciences*, 117(12):6476–6483.

Thibaut, J. W. (2017). *The social psychology of groups*. Routledge.

Thousand, J. S., Villa, R. A., and Nevin, A. I. (2006). The many faces of collaborative planning and teaching. *Theory into practice*, 45(3):239–248.

Thrift, N. and Valentine, G. (2009). Space: the Fundamental Stuff of Human Geography. *Key Concepts in Geography*, pages 95–108.

Tolman, E. C. (1932). *Purposive behavior in animals and men*. University of California Press.

Trowler, P. R. (2001). *Academic tribes and territories*. McGraw-Hill Education (UK).

Tuan, Y. (1977). Space and place: The perspective of experience. *U of Minnesota Press*.

Tubaro, P., Ryan, L., and d'Angelo, A. (2016). The visual sociogram in qualitative and mixed-methods research. *Sociological Research Online*, 21(2):180–197.

Tuckman, B. W. (1972). Conducting Educational Research. Har-court, Brace, Jovanovich. *Inc., New York*.

Tudge, J. R. H., Mokrova, I., Hatfield, B. E., and Karnik, R. B. (2009). Uses and misuses of Bronfenbrenner's bioecological theory of human development. *Journal of family theory & review*, 1(4):198–210.

Tudge, J. R. H., Odero, D. A., Hogan, D. M., and Etz, K. E. (2003). Relations between the everyday activities of preschoolers and their teachers' perceptions of their competence in the first years of school. *Early Childhood Research Quarterly*, 18(1):42–64.

Turan, Z. and Goktas, Y. (2016). The Flipped Classroom: instructional efficency and impact of achievement and cognitive load levels. *Journal of e-learning and knowledge Society*, 12(4).

Turner, V. (1998). *From ritual to theatre: The human seriousness of play*. Performing arts journal publ.

Twyford, K., Le Fevre, D., and Timperley, H. (2017). The influence of risk and uncertainty on teachers' responses to professional learning and development. *Journal of Professional Capital and Community*.

Valks, B., Arkesteijn, M. H., and Den Heijer, A. C. (2018). Smart campus tools 2.0: An international comparison. *Delft University of Technology*.

Van Gennep, A. (1960). The Rites of Passage, trans. MB Vizedom and GL Caffee. *London/Henley: Routledge & Kegan Paul*.

Von Bertalanffy, L. (1956). General system theory. *General systems*, 1(1):11–17.

Von Meiss, P. (2013). *Elements of Architecture: From Form to Place+ Tectonics*. EPFL Press.

Vygotsky, L. (1980). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Walker, P. and Entwistle, N. (1999). Conceptions of teaching and levels of understanding: Emerging structures and shifting awareness. *Improving Student Learning: Improving Student Learning Outcomes, Oxford Brookes University, Oxford Centre for Staff and Learning Development, Oxford*, pages 309–318.

Wegner, E. and Nückles, M. (2013). Studies in Higher Education Knowledge acquisition or participation in communities of practice? Academics' metaphors of teaching and learning at the university. *Taylor & Francis*, 40(4):624–643.

Weinstein, C. S. (1981). Classroom design as an external condition for learning. *Educational Technology*, 21(8):12–19.

Wenger-Trayner, E., Fenton-O'Creevy, M., Hutchinson, S., Kubiak, C., and Wenger-Trayner, B. (2014). *Learning in landscapes of practice: Boundaries, identity, and knowledgeability in practice-based learning*. Routledge.

Whitton, P. D. (2018). *The new university: space, place and identity*. PhD thesis, Manchester Metropolitan University.

Wilson, J. M. and Jennings, W. C. (2000). Studio courses: How information technology is changing the way we teach, on campus and off. *Proceedings of the IEEE*, 88(1):72–80.

Winnicott, D. W. (1971). *Playing and reality*. Penguin.

Wojciszke, B., Baryla, W., Szymków-Sudziarska, A., Parzuchowski, M., and Kowalczyk, K. (2009). Saying is experiencing: Affective consequences of complaining and affirmation. *Polish Psychological Bulletin*, 40(2):74.

World Economic Forum (2020). The Future of Jobs Report. Technical report, World Economic Forum, Geneva, Switzerland.

Wright, E. R. and Lawson, A. H. (2005). Computer mediated communication and student learning in large introductory sociology classes. *Teaching Sociology*, 33(2):122–135.

Yilmaz, K. (2011). The cognitive perspective on learning: Its theoretical underpinnings and implications for classroom practices. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 84(5):204–212.

Zaretskii, V. K. (2009). The zone of proximal development: What Vygotsky did not have time to write. *Journal of Russian & East European Psychology*, 47(6):70–93.

Zhang, Z. (2014). 'Let's Go for the Chicken-Drum': The Everyday Production of Social Space in a Chinese University. In *The Physical University*, pages 212–232. Routledge.

Zimmerman, P. T. (2008). Liminal Space in Architecture: Threshold and Transition. *Masters theses, University of Tennessee*.

Appendices

Appendix 1: Research information sheet

Transitional Space in Active Learning: Perspectives from an Undergraduate STEM Education Context

Overview

I am a PhD student in the Centre for Higher Education Research and Scholarship (CHERS) at Imperial College London. My research seeks to better understand student perception of, and engagement with transitions in power and agency that are necessary for active learning. This is a timely study as both the institution and wider Higher Education sector move toward greater student-centred, active learning. The need to understand the nature of physical, temporal and cognitive transitional space is driven by its role in influencing perceived agency and barriers to active learning.

My main research question is:

How do undergraduate students perceive and engage with transitional space?

Beyond this, my aims and objectives are to:

- Capture undergraduate student perception of transitional space by observing learning behaviours and activities during, before and after timetabled sessions in different learning settings
- Understand how remodelling physical learning space may influence student and lecturer perceived agency in active learning

Methods

I am using a phenomenological approach to understand the lived experiences of students and within this mixed methods to investigate their perceptions of and engagement with transitional spaces responsible for active learning.

I am using ethnographic observation to record student learning behaviours in both informal (e.g. breakout) and formal (e.g. lecture) spaces. I use brief ethnographic field interviews (no longer than 5-10 minutes) to further my observational data and to collect important contextual details that may not be observable. I always carry out these field interviews in nearby informal spaces to avoid disruption in the lecture session and always seek informal consent from participants. I am particularly interested in how students transition between the self-directed (informal), non-timetabled spaces and their formal, timetabled learning as part of a wider transition to active learning. To capture physical and temporal transitions, I perform observations in adjoining informal, non-timetabled and formal, timetabled spaces. I use published timetables to plan my observations and automated occupancy monitoring to examine general patterns of student movement between these spaces.

I now plan to enrich this data and understanding with more detailed semi-structured interviews to investigate student and lecturer perception following renovation of adjoining formal and informal learning spaces that have been better redesigned for transition and active learning. These longer interviews will serve to add depth by exploring if changing space has changed perception of active learning. All participants remain anonymous and all data collected is handled and stored securely according to best practice and Imperial College regulations.

If you have any further questions please feel free to contact me (luke.mccrone12@imperial.ac.uk) or my supervisor, Martyn Kingsbury (m.kingsbury@imperial.ac.uk).

Luke McCrone
PhD Researcher
Centre for Higher Education Research and Scholarship, Imperial College London
South Kensington Campus
London SWY 2AZ
Email: lm2912@ic.ac.uk

Appendix 2: Participant information sheet

Participant information sheet

Research title: Transitional Space in Active Learning: Perspectives from an Undergraduate STEM Education Context

You are being invited to partake in this research project. Before you decide to do so, it is important that you understand why the research is being done and what it will involve.

This research is exploring how undergraduate students engage with and perceive transitional space and the implications of this for active learning. The information you provide will contribute to an understanding of the nature of transition and the perceived barriers to active learning. It will also feed into an institutional understanding of the role of physical space in active learning and transition.

To attempt to acquire this information I will use a style of semi-structured interview to ask you a series of questions about your experience of teaching/learning in the refurbished learning spaces in the Blackett building, South Kensington campus.

Before I gain your informed consent to partake, I would like to make you aware of the following important points:

- This research is part of a PhD programme under the Centre for Higher Education Research and Scholarship at Imperial College London.
- Your participation in this study is voluntary and you are under no obligation to participate.
- If you do take part, notes will be taken during the interview, the interview will be audio or video recorded and later transcribed for qualitative analysis.
- You will be able to withdraw your data up until transcription and anonymisation.
- The interview will last for no longer than 1 hour at a time that does not interfere with your work activity.
- This research has no bearing on the outcome of your degree or technical work.
- Any personal details provided, including your name, will be kept confidential. Your details will be anonymised if the data is published to prevent you from being identified.
- Your data may or may not be presented in research publications, conference papers or in my PhD thesis.
- This study will be carried out in accordance with the Ethics Code of Imperial College London (https://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/legal-services-office/public/what-we-do/Ethics-Code-(June-2016).pdf), which includes assurance that data about you will be held securely, handled in accordance with the Data Protection Act 1998 (https://www.imperial.ac.uk/admin-services/secretariat/information-governance/data-protection/), and disposed of in line with Imperial's retention policy.

Thank you in advance for your participation.

Luke McCrone
PhD Researcher
Centre for Higher Education Research and Scholarship, Imperial College London
South Kensington Campus
London SWY 2AZ
Email: lm2912@ic.ac.uk

Appendix 3: Informed consent form

INFORMED CONSENT FORM

Title of project: Transitional Space in Active Learning: Perspectives from an Undergraduate STEM Education Context

Name of researcher: Luke McCrone

Please tick box

1. I confirm that I have read and understand the participant information sheet for the above study. I may keep this information sheet for my records and I have had the opportunity to ask questions which have been answered fully. ☐
2. I understand that my participation is voluntary and I am free to withdraw from participation, without giving any reason and without being penalised or disadvantaged in any way. ☐
3. I understand that sections of my recorded comments and transcript text may be looked at by responsible individuals from Imperial College London. I give permission for these individuals to access this data as relevant to this and future research. ☐
4. I am willing to have this interview audio or video recorded. ☐
5. I understand that this consent form will be kept separate from the data and that the researcher will maintain my anonymity throughout the project, including in publication. ☐
6. I agree to take part in the above study. ☐

……..	……..	…….....
Name of Participant (Printed)	**Date**	**Signature**
……..	……..	……
Name of Researcher (Printed)	**Date**	**Signature**

Appendix 4: ACEX student field interview script

Introduction

Sorry to disturb you. Just to introduce myself, I am an Imperial College PhD student undergoing research in the field of education development. I have just been making some observations of students in this space and wanted to ask you a short set of questions which will take no longer than 5-10 minutes.

Would you be comfortable with me asking you a few questions? You have every right to say no and should be reassured that any data I collect from this interaction will be anonymised, remain confidential and will in no way be used to identify you or affect your educational progression here at Imperial.

Questions

1. What are you currently studying here at Imperial?
2. What year of study are you currently in?
3. How often do you use this space?
4. Where have you just come from?
5. I observed what seemed to be you [state observed activity], may I ask if this was the case?
6. What else do you tend to do in this space usually?
7. Why did you choose this specific space? What do you like about it?
8. Where else would you typically carry out the same activity on or off campus, and why?
9. If you had to imagine your perfect learning space, what would it be like?

Do you have any questions for me before we conclude the interview?

Appendix 5: Blackett student field interview script

Introduction

Sorry to disturb you. Just to introduce myself, I am an Imperial College PhD student undergoing research in the field of education development. I have just been making some observations of students in this foyer space and Lecture Theatre 2 (LT2) and wanted to ask you a short set of questions which will take no longer than 5-10 minutes. I am particularly interested in your experience since the refurbishment of the lecture theatre.

Would you be comfortable with me asking you a few questions? You have every right to say no and should be reassured that any data I collect from this interaction will be anonymised, remain confidential and will in no way be used to identify you or affect your educational progression here at Imperial.

LT2 questions

1. What are you currently studying here at Imperial?
2. What year of study are you currently in?
3. Do you like the new lecture space? What do you like?
4. Do you dislike the new lecture space? What do you dislike?
5. Does learning feel different in this space?
6. Has the change in design affected how you interact with your peers?

Foyer questions

7. How were you just using this space?
8. Do you use this space differently to before it was changed?
9. How could you foresee yourself using it in future?
10. Do you tend to use this space alone or with groups of people?
11. What sort of things do you talk about in this space?
12. To use this space more efficiently for learning, how might you change this space?
13. Where else do you study on or off campus, and why?
14. If you had to imagine your perfect learning space, what would it be like?

Do you have any questions for me before we conclude the interview?

Appendix 6: Blackett lecturer field interview script

Foyer questions

1. What did you hope for students to gain from the session?
2. Do you expect students to do any work in preparation for your session?
3. Are you expecting students to do any follow-up work after the session e.g. coursework assignments, group projects etc?
4. Do you expect them to complete this work individually or in groups?
5. Where would you expect these students to carry out this activity?
6. How often would you imagine the students use the foyer area just outside?
7. What do you imagine they might use it for?
8. How might you change this space to make it more conducive to learning?

LT2 questions

9. Did you have concerns prior to the lecture theatre refurbishment?
10. Did you foresee opportunities of this refurbishment?
11. Having now taught in the space, have your perceptions changed?
12. How do you feel when teaching in this space? Is it comfortable?
13. How would you compare that experience to teaching in other spaces, be it raked seating or flat floor space?
14. Have you noticed a change in student behaviour?
15. Does the new design make it easier for you and students to transition between different types of teaching activities?
16. Has this change in space design influenced how you approach and think about your teaching practice?

Do you have any questions for me before we conclude the interview?

Appendix 7: Blackett student in-depth interview script

Introduction

Thank you for agreeing to take part in this interview. Feel free to be as honest as possible in your answers and if you do not understand a question then I am always happy to repeat myself.

The research is focusing primarily on the refurbished lecture theatre and foyer spaces in Blackett and your perception and experience of using these and other spaces. I will start by asking you a series of routine questions to find out some contextual details about you. In the later questions, I will ask exploratory questions to give you the opportunity to share more about your experiences in these spaces. My interest in the factors influencing transitions to active learning remains central to the overall theme of the interview.

Just to remind you that you can stop at any time, you do not have to answer any questions you do not want to, and that the recording will be transcribed and anonymised so that you will not be identifiable. I will type some notes as the interview progresses but please try to ignore this and focus on answering the questions at your own pace.

Can I confirm that you are happy for me to begin recording the interview?

For consensual purposes, can you please confirm that you have read the participation information sheet, consent to this interview and are happy being video and audio recorded.

Contextual questions

1. In which ways have you used Lecture Theatre 2 (LT2)?
2. Which timetabled sessions have you had in LT2 since its refurbishment?
3. How often are these timetabled sessions?
4. Do you ever use LT2 outside of these timetabled sessions?
5. If so, what do you use it for?
6. Which other raked-style lecture theatres have you been taught in in Blackett?
7. What LT2-related work are you now learning online given COVID-19 changes?

Exploratory questions

8. What do you think of LT2?
9. What do you like about LT2?
10. What do you dislike about LT2?
11. How do you think it compares with other similar spaces like LT1?
12. Do you think you work as a group differently in LT2?
13. Do you think you work differently compared to other spaces?
14. Is it any easier to get into this group work than in other spaces?
15. How would you compare your ability to carry out group work in LT2 with the online seminars?
16. Who are you as an individual directing your questions to in LT2?
17. Has it changed how you and the lecturer interact?
18. Has it changed your relationship with the lecturer?
19. Do you think your experience of group work in LT2 has changed how you approach group work in other spaces?
20. How about how you approach group interaction in the online space?
21. Has your experience in LT2 changed your expectation of learning in other spaces?
22. Has it changed your expectation of interaction in lectures?

23. Has any change carried over into your (and/or your lecturer's) behaviour in other lecture rooms?

Foyer

24. How do you use the adjacent foyer space next to LT2?
25. Do you use it any differently since it has been changed?
26. Has this change in space affected when you expect to turn up to your sessions in LT2?
27. Have you ever used this foyer space to interact with others about learning?
28. Is there anything unique about the space that allows you to engage in this learning interaction?
29. How does this learning compare to your learning in LT2?

Summary

30. Do you think your experience in LT2 has changed how you learn?
31. Do you predict the same change happening with your peers?
32. Do you predict the lecturers will change?
33. Are you now more likely to discuss your learning with others in general?
34. Do you think the changes we have talked about overall are positive or negative?

Do you have any questions for me before we conclude the interview?

Appendix 8: Blackett lecturer in-depth interview script

Contextual questions

1. In which ways have you used Lecture Theatre 2 (LT2)?
2. What sessions have you/are you teaching in this space since its refurbishment?
3. What student years have you taught?
4. Did you ever teach in LT2 prior to the refurbishment?
5. Which other raked-style lecture theatres have you taught in in Blackett?

Exploratory questions

6. What do you think of LT2?
7. What do you like about LT2?
8. What do you dislike about LT2?
9. How do you think it compares with other similar spaces like LT1 (or other raked spaces they have taught in)?
10. Do you think students have been working as groups differently in LT2?
11. Do you think they work differently compared to other spaces?
12. Who are they directing questions to?
13. Have you noticed a change in student interaction with you?
14. Are they interacting any more or less with you?
15. Are they any more or less confident in initiating interaction?
16. Are students asking any more or less questions?
17. Has this changed your expectation of student interaction in other spaces?
18. Has your experience in LT2 changed your expectation of learning in other spaces?
19. Has it changed your expectation of interaction/learning in lectures?
20. Has it changed your expectation of student interaction in the online space?
21. Has any change carried over into your (and/or your students') behaviour in other lecture rooms?
22. Has any change carried over into your (and/or your students') behaviour in the online space?

Foyer

23. What do you think of the adjacent foyer space next to LT2?
24. Do you use it any differently since it has been changed?
25. Have you ever used this foyer space to interact with students?
26. Is there anything unique about the space that allows you to engage in this interaction?
27. How does this interaction compare to your interaction in LT2?
28. Do you foresee opportunities with this space in your own teaching?

Summary

29. Do you think your experience in LT2 has changed how you teach?
30. Do you predict the same change happening with other lecturers?
31. Do you predict a change in student learning behaviour?
32. Do you think students are now more likely to discuss their learning with others in general?
33. Do you think the changes we have talked about overall are positive or negative?

Do you have any questions for me before we conclude the interview?

Appendix 9: Observation field notes example

ACEX observation 14.1.

Date: Friday 30th November 2018
Lecture observation: Process Analysis (CE1-02)
Lecture time: 11-12
Observation start time: 10:54
Time zone: 1
Location: ACEX LT1 / Breakout space
People in lecture: ~120
People in breakout: 9 users @ 10:56
Mood: Was not feeling good last night after a gym session and limited sleep the night before. Feeling rested today though.
Sociogram: Yes
Context: Dr N. S. was teaching a session that I thought someone else was teaching. 1st years have had two lectures in the morning already, Mathematics and Physical Chemistry. Again, this is the final lecture on a Friday so will be interesting to see if the breakout space is used any differently.

Only 3-4 students leave lectures between the two sessions. I am positioned toward the back left of the lecture theatre.

One student walks into LT1 around 11:01 and says to their friend: “I'm going to fail my degree, it doesn't matter”. One student is on her phone on the back row of the back of the lecture theatre. 5 students walk in as a group at 11:06 5 minutes after the lecture has started. Two Caucasian males are chatting toward the back, smiling and slouched in their seats.

A male and a female enter late around 11:18. An Indian male enters at 11:19 and sits at the back. As the lecturer says: “this is the one equation you need to remember from this course”, students make note and highlight.

At 11:30, the majority of students are engaged yet two students have a quick look at their phone close to the back, one texting on snapchat. Two females talk at the back, clarifying a concept.

Lecturer is saying things like “try it for yourself”, and “you'll see that it is not that complicated” and "this is covered in the problem sheet".

Students have an exam next Friday 7th December, which is scheduled in LT1. Lecturer said “you've got a whole weekend to come” when referring to questions and a lecture on Blackboard.

Lecture finished at 11:53, and students filter out heading for the exit. Two apparent Indian males stand around by the lecture entrance/exit in the breakout space. Other male students add to the group and so they remain standing around. The majority of students head for the exit. This group leaves at 11:56, so only stood around for 3 minutes.

A separate group of 6 students stands around in a circle chatting by the litter bins in the breakout space. Another group of 5 males is standing around.

Students standing around high table moved to zone 2 are talking about how hard they have been working, one saying “I studied Physics yesterday for 5 hours”.

A male and female are eating lunch in zone 1 in the corner booth at 12:06, talking about 'lectures' and something more emotionally loaded about a friend being in rehab for drugs.

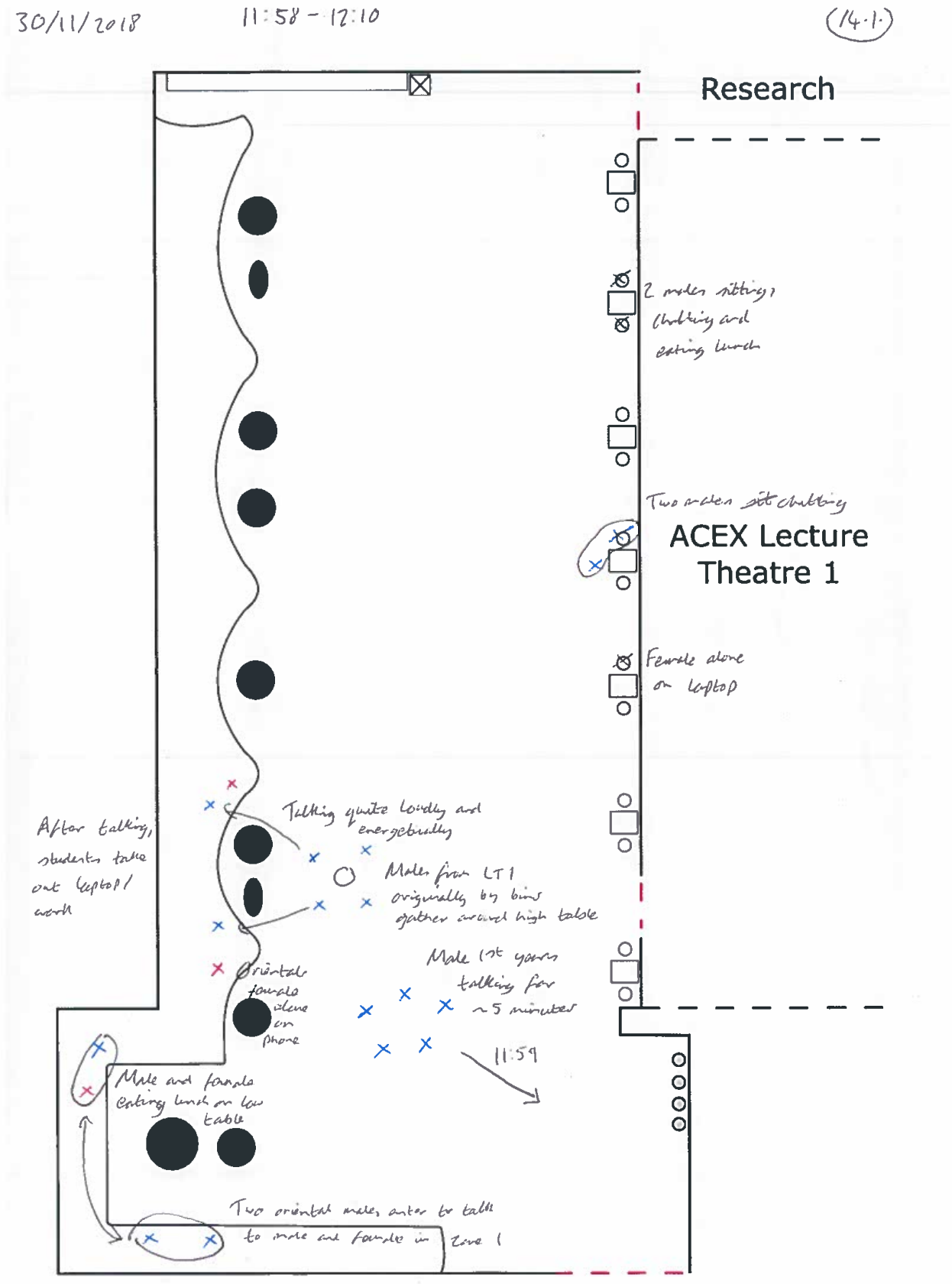
Only two male students who remained after LT1 have remained in the breakout space discussing work on the high rise table.

3 male students identified from the lecture enter the space at 12:22 holding lunch in their hands, looking for a place to sit. They sit towards the far end of zone 2. Occupancy in space is currently around 20 people.

Male and female in zone 1 are discussing about “what they want to do” in future, talking about programming, Biotechnology and internships. The two oriental males are invited to ask the same question in this conversation, but are quite disengaged with the conversation on their phones. They seem hopeless in finding work as they describe the shortfalls in their language proficiency and how “1 person gets chosen from 8 for assessment centres”.

No interviews were conducted today. Observation finished at 12:30.

Appendix 10: Raw sociogram example



Appendix 11: Timetable transition occupancy raw data

Raw occupancy data for the ACEX spaces used to calculate the percentage of students engaging in meaningful on-ramp and off-ramp transitions for type 1 and type 2 timetables.

Timetable	**Transition**	**Difference in LT1 occupancy**	**Difference in breakout occupancy**	**Students engaged in transition (%)**
1	Off-ramp	11	4	36
1	On-ramp	57	16	28
1	Off-ramp	64	13	20
1	On-ramp	54	5	9
1	Off-ramp	67	6	9
1	On-ramp	65	5	8
1	Off-ramp	49	8	16
1	On-ramp	30	9	30
1	Off-ramp	90	9	10
1	On-ramp	49	20	40
1	Off-ramp	59	7	12
1	On-ramp	77	8	10
1	Off-ramp	84	19	23
1	On-ramp	85	10	12
1	Off-ramp	86	17	20
1	On-ramp	65	12	18
1	Off-ramp	71	18	25
1	On-ramp	48	11	28
2	On-ramp	32	7	21
2	Off-ramp	35	10	29
2	On-ramp	21	9	43
2	On-ramp	25	11	44
2	Off-ramp	17	7	41
2	On-ramp	18	6	33
2	On-ramp	19	19	100
2	Off-ramp	18	12	67
2	On-ramp	41	10	24
2	Off-ramp	25	4	16
2	On-ramp	12	12	100
2	Off-ramp	16	10	63

Appendix 12: In-depth interview transcript excerpt

Interviewer: Luke McCrone
Interviewee: Joe
Date of interview: 20/04/2020
Start time of interview: 15:03 (BST)
End time of interview: 16:14 (BST)
Location of interview: Teams
File duration: 01:11:02

Luke: And, have you found students are asking any more or less questions overall? [0:33:45]

Joe: Err, hard to say, I think the, ermm [pausing] one of the issues that we probably didn't get quite right was the amount of material to try to cover in the time available. Ermm and I would like to solve that by making the sessions longer. But erm I don't think we are going to get that, so may have to cut some material out, so actually if the amount of material is better suited for the length of the session, I think we would see, we would see better these kinds of changes are students becoming happier to ask questions or not. Ermm but I mean I have to, I have to say looking at the seminar survey, err that we did in term 1, the number one err thing that came out of that was how much the students liked the group working, so I think maybe it's the wrong question to say are students more willing to ask questions from the academics, because they are just talking to each other, and, and that's, I mean that's a big success for the seminar sessions but also for the space because that's coming from this positive environment that they are in.

Luke: So you absolutely sort of perceive that positively, the talking more to each other? [0:35:02]

Joe: Yeh definitely, that was, so that I mean that goes, that goes along with the view that you have to defer to the teacher as the authority figure and you don't bring anything valuable to the party, so if you think that about yourself, then you are going to think that about other people as well and so if you can yeh, if you can get students realising that they have something, something useful to say to each other then that's err, that's a victory in itself I think.

Luke: And would you say that this has changed your expectation of student interaction in other spaces?

Joe: [pausing] Erm yeh maybe because in these, ermm, sessions that I've talked about which I've taught this last term 2, it was in the Pippard lecture theatre in Sherfield so a kind of traditional raked style lecture theatre, capacity maybe 150, 200, but the class was really small, it was way too bigger room, so I had maximum 20 students, but down to 10 minimum, and so when we had the ermm, these problem solving classes, it was pretty easy to circulate around, but the atmosphere was really different, erm so it was yeh it was very much students weren't really expecting to be talking to one another. Ermm, it was designed differently so, and they were used to these kinds of classes, they were basically working on their own but talking to the person next to them when they had problems, err, so I think I'd probably, I was probably a bit, a little bit taken aback with that in comparison to what I'd been used to in term 1 with lots of interaction, ermm and yeh so then I guess also the fact that I was then giving lectures and

then forgetting that in a lecture students don't, aren't comfortable interacting, so I, I did, I think I did have some success in, ermm breaking that down a little bit, but, ermm, it would have been, yeh it would have been interesting to see what would've happened if I'd done exactly the same session in LT2, whether that would have been any better. How much that's down to the students and the session design rather than space.

Luke: And, following on from that has it, has it changed your expectation of student interaction in the online space, albeit seems like a limited err experience of that, but, yeh. [0:37:56]

Joe: I think the, the thing with the whiteboards was really, a real success and I think, I think that probably wont work as well on the Teams whiteboard or whatever, whatever it is that they would use, but ermm in a way its more, its more democratising, in the Teams thing, because they really can draw on it all at once, ermm so they can take, ermm they can take one, one of several colours of pen and start drawing and you might find they are drawing on top of one another depending on how laggy it is, but ermm I, I guess I would be happy to do that now and I would see that as a big benefit to getting students to do stuff together, whereas before I would've been, when I got those whiteboards, I was like I'm not sure this is going to work, ermm they might turn their noses up at it but.

Luke: Yeh.

Joe: Ermm it just worked really well so, ermm its definitely changed how I view that part of the interaction and I suppose that would have been one of my worries because with the text-based chat, err function only, then it becomes a little bit difficult to share information. So when I did, when I did my online session last term, at the end of last term, which wasn't very successful, I hadn't discovered this whiteboard feature at that point, so when I was trying to explain something to them, I ended up kind of taking a piece of paper, I would have a big thick marker and I drew it on here then I held it up for them, which is a bit rubbish really but ermm, it kind of just about worked but ermm it was quite clunky whereas the, the err, this feature that they can, you can share that, and you can draw on it, ermm its much better, so we, so we talked about in the err, for the sessions this coming term doing it another thing where they have a shared spreadsheet which they fill in values on to. We did a little test of that it seems to work quite well. So we might try that one out as well, err so that was, I suppose that was, I suppose the technology point that I was a bit nervous about but it turned out to work, err and it makes me more willing to try that kind of thing, a shared document that they are all adding to at once. It certainly worked well in the session, ermm it was a really successful thing, so if we were going to be doing that whole session online next year, I'd be quite happy to do that thing with the shared spreadsheet and I think it would work quite well.

Luke: OK.

Joe: Yeh although I mean yeh, having groups do having groups do mini experiments together wouldn't be possible in the same way, so you'd have to either get individuals or one person does the actual thing and the others think about it.

Luke: And, has your experience in LT2 changed your expectation of learning in other spaces, including in lectures? [0:41:20]

Joe: Ermm I would say that my expectations have changed across the course of this year and that's partly down to some of thinking in the PG Cert I've been doing, ermm but I think that's kind of informed by what I've been seeing in the seminars as well so I think the two things together have probably changed my expectations a bit so in particular, just some of the err big picture kind of goals of the sessions, err so the opportunity to develop kind of independent learning, erm it links in a bit to err what we were talking about with the erm people joining in discussions and err the conversation going off in different directions. So I know that Vijay, Vijay built that into some of the ones that he did, I don't know if you were there for any of those.

Luke: No, I wasn't.

Joe: Those had, those had success sometimes when they were, sounds a bit like our experience that it was occasionally successful, occasionally unsuccessful. Ermm yeh so I think that would be one thing err I suppose similar to that then this conversation with the reps makes, makes me realise that ermm our role of walking around err is bigger than helping people with the technical content of the session and answering their questions, so our err, our role is partly vetting the environment for learning so its not just about the space, the environment is not just about the space.

Luke: Mhmm.

Joe: So I think just having a bigger view of that and, but that's kind of amplified by what I've seen about how, how big an impact the physical environment had on their willingness to work so, I think ermm yeh and the stuff I was saying about the change in err, change in some people's attitudes after that test like thing, err its again it's the same point that they, they don't feel safe in the environment to take risks because of that, ermm so yeh, I suppose yeh I suppose that kind of feeds into the same thing, so there are lots of aspects to setting up an environment which I think, so yeh that space has helped me to realise its very important, err and I need to, I need to kind of just build that into other things I do in a more integrative way.

Luke: And erm just picking up on that point there about err the ability of students to take risk, ermm how would you contrast the ability of you to encourage that in LT2 versus the other spaces you've taught in, and maybe even in the online space, if you want to ermm say anything on that? [0:44:28]

Joe: [pausing] Yeh ermm, I think its easier for students to take risks with their group than it is to take a risk talking to either a TA or particularly a seminar leader or when the whole class is listening. So I think that helps but it, essentially it's a kind of low, low level of embarrassment if you say something wrong in front of your peers, ermm so I think taking risks, some students said that time pressure err was a negative so it made them less willing to take risks, they were more thinking how can I make sure I've done the minimum to, to kind of tick the box to get the credit, ermm if time wasn't then thinking how can I err or you know can I explore this possibility to see if this is a good way to solve it and that's the kind of, more the, that's more the kind of thing that we were hoping they would be doing.

Luke: OK.

Appendix 13: South Kensington campus map

