



# A holistic motility understanding of the social phenomena underlying inter-city high-speed rail commuting: Evidence from China's Yangtze River Delta

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## ABSTRACT

As high-speed rail (HSR) becomes more widespread, inter-city commuting is becoming an increasingly prevalent social phenomenon, yet little attention has been paid to obtaining a deeper understanding of the interdependence of various factors and how they contribute to the phenomena. This paper fills the gap by utilising the concept of motility to frame the analyses of in-depth interviews with HSR commuters between Suzhou and Shanghai in China's Yangtze River Delta. As the first in-depth qualitative study on this topic, our findings advance a holistic understanding of the perception, experience, compromised habits, strategies, and decision trade-off underlying the HSR intercity commuting behind the dark mobility numbers. This new empirical evidence of HSR commuting sheds light on the interdependence of the three elements of motility (range of possibilities, competence and cognitive appropriation). With better employment opportunities accessible by HSR, yet due to the nature of work, personal and family situations, and mobility constraints, cognitive appropriation of HSR commuters leads to various deliberate habits and strategies for daily, weekly, and flexible commuting, which is a precarious balance between individual competence and range of possibilities prompted by HSR either favourable or unfavourable conditions. These issues reflect the value of motility for critical assessments of transport policy and wider associated policy areas to achieve subsequent improvement of personal well-being. Also, the dominant one-way commuting from neighbouring smaller cities to economic powerhouse reflects a need for strategies that coordinate economic function and transport accessibility and enable better balanced two-way economic and commuting patterns in the long run.

## 1. Introduction

Advances in transport technology have driven global urban expansion (Angel et al., 2011). High-speed rail (HSR), as a revolutionary transport system, plays a pivotal role in enhancing inter-city connectivity, which triggers multi-level spatial dynamism in addressing regional rebalance, urban regeneration or expansion (Chen & Wei, 2013; Long et al., 2018). In theory, HSR dramatically alters time-space perception, which potentially restructures social and economic relationships through new spatial and temporal arrangements. In practice, new mobility phenomena, including 'dual location households' (Snaith, 1990) and 'high mobility' (Viry & Kaufmann, 2015), have emerged,

primarily in relation to work-related long-distance travel.

The impact of long-distance commuting in industrialised societies is a well-established phenomenon that has shaped the lives of many people and related families for decades (Jansen, 1993; Lyons & Chatterjee, 2008). The arrival of HSR has further increased commuting distances, making more distant places accessible as part of enlarged functional territory beyond fixed administrative boundaries, while the travel time has, generally, remained constant. The advantages of HSR commuting for such long-distance travel have been widely publicised; the speed potential of HSR has been an observable phenomenon (Lawrence et al., 2019; Moyano et al., 2018). For instance, in France, many seasonal ticket holders using HSR live within one hour of Paris (Chen & Hall,

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2015), suggesting that places within one hour of major cities have a high proportion of commuters. The introduction of HSR has greatly expanded the number of cities that can be reached within one hour, while the negative effects of poor interchange experiences or high HSR fares remain uncertain (Hickman et al., 2015; Ren et al., 2020).

Most HSR research has focused on accessibility and spatial-economic impacts. A growing number of inter-city HSR commuting studies has drawn attention yet the approaches taken are dominantly quantitative modelling in order to generalise the significant relationship between HSR commuting and its associated conditions e.g. unemployment rate, labour market, HSR station location (Guirao et al., 2018); housing price, income, built environment, spatial structure (Ren et al., 2023); happiness (Chen & Chen, 2023); health and quality of services (Wang et al., 2020). Little attention has been paid to an in-depth and holistic understanding of commuters' perceptions, experiences and decisions underlying social phenomena of HSR inter-city commuting. This gap in the literature is noteworthy despite China's significant investment in HSR infrastructure, which far exceeds that of other countries (Statista, 2021). Considering China's vast territory, there is an optimistic assumption that time-space shrinkage achieved by inter-city HSR services will facilitate the 'same city' effects through regular HSR services. Daily long-distance HSR commuting has been a noticeable phenomenon between major and nearby smaller cities across Chinese mega-city regions (Rennie, 2021). A typical case is the Yangtze River Delta (YRD), involving Shanghai, as the dominant economic powerhouse for neighbouring cities such as Suzhou, Wuxi, and Jiaxing, where the mobility, scale and breadth of inter-city commuting far exceed those in other regions of the country (Li & Niu, 2022).

However, unlike the European cases (Chen, 2015; De Ureña, 2012), the YRD region has not yet demonstrated strong two-way inter-city commuting linkages between Shanghai and neighbouring cities (Chung et al., 2020). A recent paper on HSR inter-city commuting (between Shanghai and Jiaxing) and spatial structure, with the assumptions of economics, suggests "turning Jiaxing into a 'sleepers' town" could be both welfare-enhancing and pareto-improving as long as the intercity commuting cost is small enough" (Ren et al., 2023: 14), which appears surprisingly ignorant and passive, despite the advances of planning theory and strategies since the bid rent theory (Alonso, 1964). This paper challenges a dominant perspective of economics and generalisation in assessing transport investment and services. There remains uniqueness in the phenomena of inter-city commuting in China, and contextually relevant lessons, especially from a social perspective, which have not been learnt in depth. A case study of the YRD contributes to rich accounts underlying social phenomena of HSR commuting.

This study makes several contributions. Firstly, as the first in-depth qualitative study on a topic related to inter-city HSR commuting, our findings contribute to a holistic understanding of the perception, experience, compromised habits, strategies and decision trade-off involved of the underexplored emergent group behind this social phenomenon. Secondly, this study pioneers in the application of the motility framework to high-speed rail commuting which is contextualised in the interdependence among transport planning, territorial development and governance as well as personal competence and appropriation. This empirical case study provides refinement and adaptation of this framework. Thirdly, the study promotes a critical assessment of transport infrastructure development, contributing to a new debate that dialectically examines technological progress interrelated with social responses and values, focusing on improvements in individual well-being. This aspect is often overlooked during the rapid urbanisation and modernisation process. Finally, the study helps to spotlight the problems of regional uneven development and issues of planning in developed regions of China through the lens of transport infrastructure. This approach encourages self-reflection and enhancement in policy making and practice, aiming for inclusiveness and wellbeing.

This paper begins with reviewing existing research on HSR commuting and identifying the scarce research on its social phenomena.

The concept of motility is then introduced and adapted for the case of HSR commuting to explore and identify key factors underlying inter-city HSR commuting alongside spatial transformation. For a systematic and exploratory understanding of the social phenomena of inter-city HSR commuting, a qualitative study was conducted in the summer of 2018 prior to the onset of the COVID-19 pandemic. Suzhou-based inter-city HSR commuters' motivation, perception and experience accounts were examined using semi-structured interviews and content analyses. The findings are then synthesised in line with the refined framework (range of possibilities, competence, and cognitive appropriation) before the final remarks, which shed light on the policy implications to improve personal well-being.

## 2. Grasping the social phenomena of high-speed rail commuting through motility

### 2.1. High-speed rail and its social phenomena

Conventional studies of HSR impacts have regarded demographic changes as spatial-economic rather than social indicators. Although these population indicators provide insights into the changing conditions of cities with or without HSR, they do not reflect the attitudes or feelings of rail users or explain why people are leaving or moving into particular cities. Evidence suggests that HSR development has increased the likelihood of residential relocation by enhancing investment attractiveness, job opportunities, and housing prices of the cities and regions it serves (Ahlfeldt & Feddersen, 2018; Geng et al., 2015). However, some scholars have expressed apprehension regarding the long-term socio-economic impacts of HSR. In China, cities experiencing population loss have suffered greater disadvantages following the introduction of HSR, including weakening of the agglomeration economies and further exacerbating population losses. A recent publication (Chen & Chen, 2023) finds HSR can promote happiness and especially benefit residents in provincial capitals, individuals with a rural hukou (a household registration system in China that categorises citizens as urban or rural based on their place of birth), men, the elderly, and people with good health. However, this research focuses on cost-benefit analysis around income, price and built environment factors rather than delving into the interdependence of the underlying factors contributing to the observed statistical significance.

Secondly, transport planning and investment require rigorous equity assessments to ensure equitable and inclusive access to transport services. Despite the importance of equity assessments, research on the social impact of HSR remains scarce (Pagliara et al., 2022). Limited quantitative analyses conducted in China and Italy have identified two primary types of exclusion from transport services: geographical exclusion (inability to access transport services from remote areas, and economic exclusion relating to high transport costs) (Azzouz & Jack, 2021; Pagliara & Biggiro, 2017; Ren et al., 2020). It could be argued that HSR passengers may experience various forms of social exclusion, yet the extent to which social exclusion is manifested in the use of HSR remains unclear, such as time-based exclusion, affecting people of both sexes from all socio-economic backgrounds (e.g., time limitations of carers, parents of young children) and exclusion from facilities, such as retail stores, entertainment venues, educational and healthcare facilities because of financial or other constraints (Church et al., 2000). A recent analysis of social attributes of HSR passengers worldwide, including factors such as income, education, and occupation, reveals a significant differentiation in current HSR use (Dobruszkes et al., 2022), suggesting that social exclusion caused by HSR development must be effectively addressed.

Finally, an emerging dimension of HSR-related social phenomena focuses on the travel behaviour of passengers (Chan & Yuan, 2017; Chen et al., 2016; Ren et al., 2019). Some quantitative research on HSR has provided evidence of behavioural changes. However, the obsession with big data can hide the essential nuances of detail and neglect the social

phenomena behind dark mobility numbers. Therefore, compared to the dominant quantitative approaches, this qualitative study seeks to handle first-hand interview data carefully and obtain an in-depth understanding into human behaviours, especially the thoughts, perceptions, and decision trade-offs of HSR users. This provides valuable insights for policy implementations. A review of methods and models for HSR regional impacts highlights the absence of illuminating insights into specific cases in the existing literature (Chen and de Abreu e Silva, 2013), which is however carefully undertaken in our study.

## 2.2. High-speed rail as a mode facilitating inter-city commuting

Existing literature on commuting and labour mobility has identified five factors associated with commuting decisions. Firstly, improved accessibility and convenient transport communication networks contribute to commuting (Cavallaro & Dianin, 2019; Hu & Schneider, 2017). Secondly, high wages or incomes determined by labour supply are significant for commuting decisions, especially long-haul inter-city commuting (Carta & De Philippis, 2018; Dauth & Haller, 2020). Thirdly, affordable but more distant housing choices affect commuting (Haas & Osland, 2014; Islam & Saphores, 2022; Zhao et al., 2011). Fourthly, health and well-being are relevant to commuting, which is often stressful, negatively influencing commuters physically and mentally (Chatterjee et al., 2020; Künn-Nelen, 2016; Simón et al., 2020). Finally, some subjective considerations correlate to commuting, such as family and other social ties, which depend on commuters' socio-economic conditions, especially age and gender (Chidambaram & Scheiner, 2021; Havet et al., 2021; Sánchez & González, 2016). However, studies have mainly examined the relationship between commuting and single factors, as well as prioritised instrumental factors, such as age, gender, income, housing prices, accessibility, and health scores, rather than focusing on a comprehensive framework to consider interaction among multiple factors.

Inter-city HSR services create opportunities for diverse passenger markets. Harman (2006) identified three market categories associated with HSR use: the commuting market (travel time 1 h or less), the primary market (travel time between 1.5 and 2.5 h), and the long-distance market (travel time over 2.5 h), characterised specifically by commuters, business travellers, and tourists. There has been renewed interest in adopting the above approaches to exploring the impact of HSR on commuting decisions. For instance, an analysis of Spanish HSR links suggests that ticket cost and time spent on related travel are crucial factors when considering commuting (Moyano, 2016). Another investigation, mainly including metropolitan areas of Madrid, Barcelona, Seville and Malaga, reveals that the location of HSR stations, unemployment rates, and housing prices are essential variables in determining travel by HSR (Guirao et al., 2018). Similarly, an empirical study of the HSR network in Germany shows that the number of inter-regional commuters increases with the decline in travel time following HSR development (Heuermann & Schmieder, 2019). Those studies overlook the complex nature of commuting behaviour and decision-making and their underlying social impacts. As Cresswell (2001) highlighted, without meaning, these are just characters of movement rather than mobilities.

## 2.3. The concept of motility for understanding inter-city HSR commuting

'Motility' (Mobility Capital), which is a concept originally from biology and has been applied to sociology. Drawing on the work of Kaufmann and his collaborators (Flamm & Kaufmann, 2006; Kaufmann et al., 2004, 2008; Kaufmann, 2002, 2011; Viry & Kaufmann, 2015), the concept of motility consists of three interdependent elements; namely, access (the range of possible mobilities which are based on place, time and constraints and are affected by the spatial distribution of population, infrastructure, sedimentation of spatial policies and socio-economic position); competence (skills and abilities related to access

and appropriation including physical abilities, acquired skills related to rules and regulations of movement, or organisational skills for planning and synchronising activities), and cognitive appropriation (what actors do with access and skills; e.g., values, strategies, representations, habits). Despite the longstanding development of this concept, its application to transport studies is limited (Shliselberg & Givoni, 2018, 2019) and empirical evidence is scarce. Since alternative measures for evaluating social progress have shifted from economic production to human happiness and subjective well-being, considering the benefits of mobility in assessing transport systems for the latter is essential (Shliselberg & Givoni, 2018). Long-term well-being is a broader and more enduring concept than happiness, encompassing physical and mental health, social relationships, and overall life satisfaction (Arcidiacono and Di Martino, 2016; Seligman, 2011). Mobility, therefore, should be regarded as a resource for self-actualisation and prosperity.

Inter-city HSR commuting might not be the intended market for building high-speed rail. However, the time-space shrinkage effects of HSR have produced new possibilities and freedom of choice to secure good jobs in larger cities for personal success. As revealed in a report by Rennie (2021), the intercity HSR commute phenomena in China were regarded as 'a route to a better job rather than to a higher quality of life', which raises a key question: how have transport development and other wider possibilities or barriers shaped and interacted with personal mobility potential? No single case study critically evaluates transport systems and personal motility in the Chinese context exists. The adaptation of motility for analysis is justified in three aspects, namely (1) explaining better previously unexplained phenomena, (2) synthesising innovatively the existing phenomena and their associations, (3) helping clarify the limits of existing spatial and social mobility (Kaufmann et al., 2004:750). This study aims to fill this gap by operationalising the concept of motility to expand understanding of inter-city HSR commuting. The hypothesis is that HSR commuting reflects a collective result from the interdependence of three elements: access (range of possibilities), competence and cognitive appropriation. Commuting takes place when there is a manageable work-life balance but will not continue if the experience negatively impacts personal well-being. Deeper insight into the interdependence of three elements could result in a critical assessment of transport policy and other associated policy areas with subsequent improvements for enhancing personal well-being.

## 3. A qualitative study

A pilot case study of Suzhou-based long-distance HSR commuters was undertaken in two stages. The HSR commuting is a phenomenon where a right range of HSR commuters (age, jobs, conditions) was difficult to be captured straightaway for qualitative interviews. Therefore, the survey at first was helpful to identify various socio-economic characteristics of commuters and issues more widely, as well as those HSR commuters who expressed their willingness to take part in the follow up interview, then more in-depth qualitative investigation was carried out accordingly. The initial stage comprised 288 valid questionnaires, which have been analysed and published in two papers. One explores travel mode choice, commuting patterns and frequency (Chung et al., 2020), and the other examines the physical and mental health of HSR commuters (Wang et al., 2020). Through regression analyses, these two quantitative studies identify several constraints of inter-city commuting in the YRD, such as the unfriendliness and inconvenience of the transport system and services for the first and last miles, the negative impacts of low quality of rental units and relative unaffordability of housing in Shanghai on the health of weekly commuters. However, a holistic understanding of inter-city HSR commuters, who perceive, respond to, and practise using the HSR system by trading off personal conditions and related policies, has not been examined thoroughly. Therefore, this is complemented in the second stage by conducting in-depth interviews with commuters of varying socio-economic characteristics and commuting types (daily, weekly, flexible) to evaluate



the continuously advancing transport infrastructure from a social perspective. Differing from a more substantive positivist approach to answering a ‘what’ question, this paper was more interested in understanding the phenomenon through a ‘why’ question, with the findings and analyses derived from the second stage.

### 3.1. Study area

Suzhou, a major prefectural level city in the Jiangsu province and the Yangtze River Delta (YRD) area, has consistently ranked among the top ten in terms of annual GDP gross across China for an extended period. Through the opening of the Shanghai-Nanjing (HuNing) and Beijing-Shanghai (JingHu) HSR lines respectively in 2010 and 2011, Suzhou has been closely connected with Shanghai, the largest city in the YRD area. The two cities’ downtowns, 100 km apart, can be reached in approximately 30 min on HSR via four main HSR stations in Suzhou and three in Shanghai (Fig. 1).

Table 1 shows a morning timetable of intercity HSR train times and stopping patterns between Suzhou and Shanghai on a standard weekday. Although 24 trains (most of them stopping at Suzhou station) were in operation before 9:30 a.m., the suitable trains for taking were limited. First, Suzhou commuters, unless their residence is in the precinct of the station area, had to decide which nearby station to take trains to as these HSR station locations are distant from each other and main settlement areas (such as the old town and new development zones). Second, all the HSR and metro stations in China require security checks, and the whole compound of the rebuilt Suzhou station is massive, which takes time to go through and navigate. The extraordinary interchange experiences of taking HSR stations in China are well illustrated in Hickman et al. (2015) and Chen et al. (2015). Suzhou North, SIP, and SND stations are relatively smaller in size and easier to navigate, but they have a much smaller number of trains stopping, resulting in constrained options. Regardless, high mobility phenomena are apparent (Rennie, 2021). It is worth noting that inter-city commuting remains one-way dominant, e.g. commuting from Suzhou to Shanghai rather than the reverse. Moreover, unlike Spain and Northern France, no regional HSR commuting train services have yet been separately developed to serve the high demand for inter-city commuting through high-speed rail between major cities and their surrounding cities in China. Instead, in the case of Suzhou, a higher-frequency express metro line, S1 (now renamed Line 11), was developed and has operated since June 2023 to connect Suzhou and Shanghai. This line, which starts in the suburbs of Suzhou and Shanghai

(Weiting-Huaqiao), respectively, costs 8 RMB for the whole journey but takes nearly an hour to travel. If travelling from Suzhou city centre (Suzhou Station) to Shanghai city centre (Shanghai Station) by metro alone, commuters would need to transfer five times, taking three and a half hours each way.

### 3.2. Data collection and analyses

In this qualitative study (Stage 2), interviewees who participated in the questionnaire expressed their interests and availability for the follow-up interview. Of the 288 questionnaires from the first phase, we identified 15 respondents with accurate contact details. We contacted them individually to inquire their willingness to participate in the second phase of the interview. Due to personal reasons, only ten participants confirmed their willingness. As the interview date approached, two could not be reached. We reviewed their social-economic characteristics in the questionnaire and determined that other participants could adequately represent them. In the end, we had to exclude these two potential participants. Eight inter-city commuters, aged between 20 and 50 years and holding various occupations (managers or professionals in design consultancy, finance, software, IT, engineering, real estate, automobile industry), with high mobility experiences ranging from 6 months to 8 years, agreed to participate in the July 2018 interviews (see Appendix A for details of participants).

We employed a deductive approach using content analyses to build a motility framework and test the hypothesis (White & Marsh, 2006). Before conducting interviews, in line with the motility framework, the research team initially developed key concepts potentially associated with HSR commuting scenarios, converting them into initial codes with included definitions in a codebook. The interview questions were developed to align with concepts in the framework and initial codes, aiming to untangle interdependence among *Range of Possibilities*, *Competence*, and *Cognitive Appropriation* within which the social phenomena are embedded. We asked general questions to avoid bias, such as ‘Can you recount your experiences as an inter-city commuter via HSR?’ Based on the responses, certain questions were emphasised during interviews to reflect key factors influencing interviewees’ mobility patterns. Additionally, we broadened our comprehension by asking questions such as ‘How do you utilise your time and space during your HSR commuting experience?’, ‘What is your perception of inter-city commuting using HSR over long distances?’, ‘What impact do you believe high mobility experiences have had on your life and social

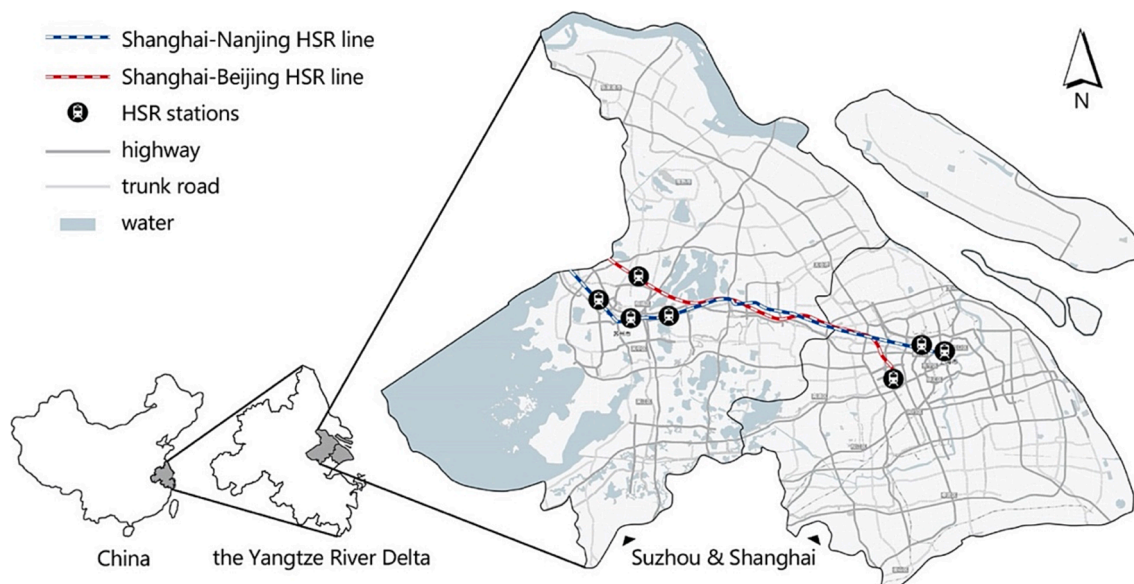


Fig. 1. Map of Suzhou and Shanghai with inter-city HSR lines and stations (Source: Wang et al (2020)).

**Table 1**  
Inter-city HSR train times between Suzhou and Shanghai on a typical weekday.

Train Code	HSR stations in Suzhou				HSR station in Shanghai	
	Suzhou New District (SND)	Suzhou	Suzhou Industrial Park (SIP)	Suzhou North	Shanghai Central	Shanghai Hongqiao
D305		5:27			6:26	
G7213		6:38	6:46		7: 17	
D313		6:51			7:41	
G7029		7:03			7:30	
G7211		7:09			7:44	
G7031		7:21			7:54	
G7209		7:26	7:35		8: 06	
G7033		7:37	7:46		8: 22	
G7101	7:37	7:47				8:19
G7035		7:57			8: 35	
D3125		8:03				8:46
G7001		8:14			8:40	
D321		8:18			9:09	
G7037		8:19	8:28		8: 58	
D311		8:24			9:15	
G7505				8:25		8:55
G7581		8:28				9:11
G7349				8:42		9:07
G7039		8:43			9:15	
G1377				8:52		9:22
G7103		8:53				9:25
G7271		8:58			9:33	
G7355		9:08				9:44
G7003		9:14			9:39	
Frequency	1	21	4	3	16	8

Source: 12,306 China Railway (July 2018).

relationships?', and 'Would you continue inter-city commuting in the future, and if so, why?'

All interview transcripts were translated into English for subsequent

data analysis. Two members of the research team independently conducted two rounds of manual coding. Several meetings were arranged to evaluate the data using the initial code frame. The research team then

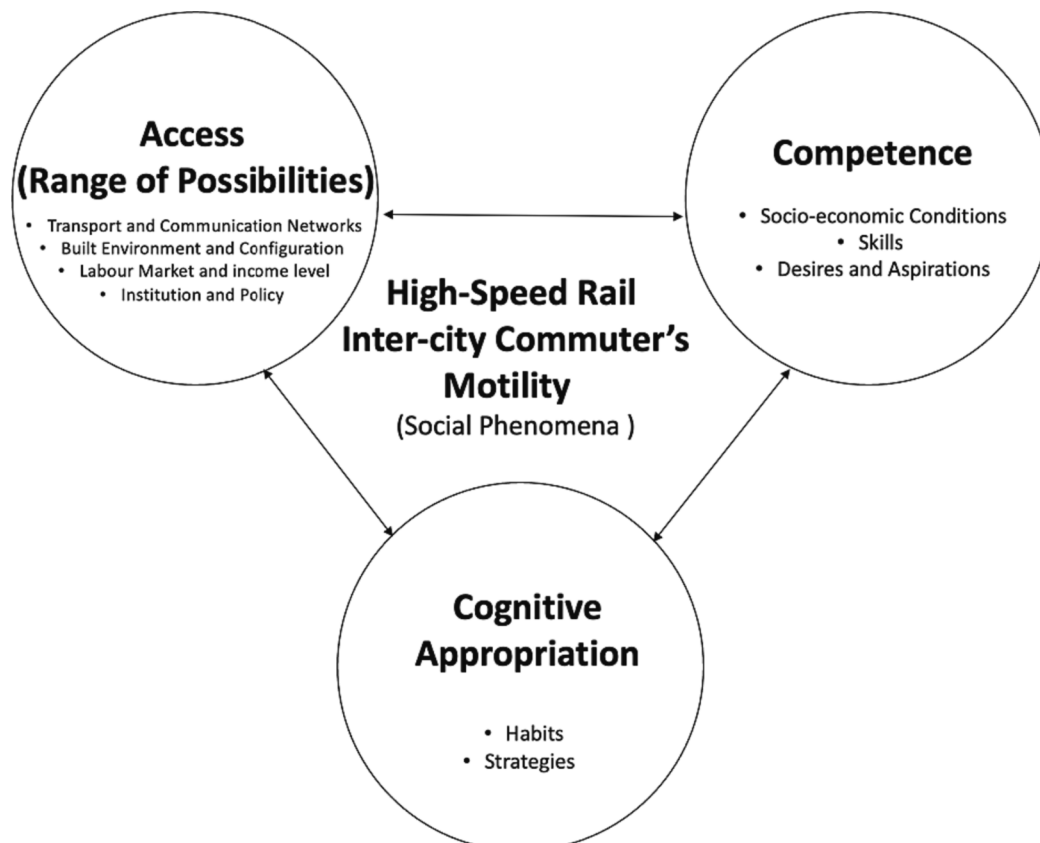


Fig. 2. The Refined Motility Framework (Source: Kaufmann, 2011; Viry and Kaufmann, 2015; Kaufmann et al., 2004)

categorised the confirmed nodes into themes, linked themes, selected quotes, and expanded on the proposed motility framework. To support the analysis in organising codes, recoding frequency, and visualising results, NVivo 12.6 was utilised. In total, 12 themes with 119 codes were generated.

## 4. Findings

The findings from the in-depth interview help refine the existing motility framework (Fig. 2), illustrating the interdependence between key dimensions. The first analytical dimension, the *Range of Possibilities*, is reflected in four external factors that provide a new mobility impetus influencing HSR commuting decisions, namely, transport and communication networks (services provision), built environment and configuration (attachment and quality of life), labour market (high-income jobs available in HSR inbound rather than outbound cities), and institution and policy (existing or new). The second analytical dimension, *Competence*, the personal skills and capacity to be mobile, is determined by three factors, namely, socio-economic conditions (age, marital status, family situations, income), skills (required to make the movement possible), and desires and aspirations (career ambitions or lifestyles). The third dimension, *Cognitive Appropriation*, elucidates how HSR commuters perceive the range of possibilities and are shaped by their conditions, needs, plans, and aspirations to appropriate strategies, habits, and motives that reflect specific travel behaviours.

### 4.1. Access (range of possibilities)

#### 4.1.1. Transport and communication networks

Two benefits of HSR services that garnered praise from respondents and underpinned their commuting decisions are: (1) efficiency (time-saving) and (2) comfort. Research shows that travel time is one of the most critical commitments in HSR commuting (Moyano, 2016). Respondents indicated that reducing travel time and increasing travel efficiency constitute a significant motivation for inter-city commuters. As Interviewee [H] said, *'The rapidity of HSR has reduced the sense of long spatial distances. A few years ago, I felt the distance of several hundred kilometres was very far. Now, many cities can be reached in just two or three hours.'*

Respondents also identified comfort as a reason for choosing HSR for daily commuting, revealing that they can rest, sleep or work while travelling, which is a more pleasant experience than squeezing into metros or buses. These accounts suggest that HSR is preferred for inter-city commuters because of its high-quality comfort and convenience. Interviewee [F] shared, *'My colleagues in Shanghai commute by metro, spending around one hour. I do not think they are more comfortable than me. They need to squeeze into the metro, and there is never a place to sit during rush hour. On HSR, I have a seat, and I can take a nap.'*

However, access (range of opportunity) is not always positive. Deficiencies in HSR service provision are highlighted, including a limited quantity of tickets, timetabling with limited services during rush hours, and issues related to interchanges and last and first-mile connections. The limited quantity of tickets was the most annoying issue. The uncertainty of available tickets is likely to result in competition for securing seats on the next available HSR trains. This, in turn, affects both work and daily schedules, causing considerable stress to commuters and negatively influencing their physical and mental well-being. Interviewee [B] expressed, *'When I cannot get a ticket, it places considerable pressure on my schedule. It will take two and a half hours to reach work in Shanghai. It is horrible, making me exhausted.'*

Another concern is the timetabling of HSR with limited services during the morning rush hour. This forces commuters to meticulously plan their routine, causing a highly hectic work life. Several respondents indicate that this constrained timeline compels them to finish their work before a specific time to catch the limited HSR service.

Moreover, poor accessibility to HSR stations located outside city

centres, a common problem in Chinese cities widely recognised in the existing literature (Chen & Wei, 2013; Dai, 2015; Wang et al., 2013), leads respondents to express concerns about interchange issues. These include 'last and first mile' connections and transferring with bikes, taxis, and buses, which are perceived to waste a significant amount of their time. They would like the commuting time to be effectively reduced by improving connections to HSR stations and interchange between different transport modes. HSR stations should be located around areas with good accessibility and efficient interchanges (Wang et al., 2020). Research has shown that daily HSR commuters tend to rent or buy housing near HSR stations or around transport nodes with easy access to HSR stations (Chung et al., 2020; Diao et al., 2017). Removing interchange barriers between different modes of transport is imperative for promoting their HSR commuting experience. Interviewee [E] shared his thoughts. *'I keep wondering if I should buy an e-bike. If I could ride the e-bike for a last-mile connection when I leave the metro in both Suzhou and Shanghai, it would be more convenient than walking. However, carrying an e-bike onto the metro is not allowed.'*

#### 4.1.2. Built environment and configuration

The role of the built environment and configuration influences commuters' decision-making in several aspects. An important consideration is the difference in built environment between Suzhou and Shanghai. Residential property in Suzhou, with similar housing conditions, comes at a lower cost than in Shanghai. The reduced expenses for living, education and housing are associated with lower stress levels and a happier lifestyle. Conversely, in Shanghai, with the same income level, one would have relatively tight budgets to cover expenses. Therefore, inter-city commuting could help maintain a better quality of living in Suzhou, while earning a higher income in Shanghai. As Interviewee [G] expressed, *'The quality of life in Suzhou is higher than in Shanghai because of its low population density. Also, many high-rise buildings are located in Shanghai's urban area, which makes me feel depressed. In Suzhou, I live in the old town where the environment and air quality are much better.'* Interviewee [A] shared the housing issues in Shanghai, *'Shanghai housings' affordability, liveability, and living conditions are much worse than Suzhou's. You can only afford a one-bedroom apartment in Shanghai, but you can obtain two or three bedrooms in Suzhou. The cost of living in Suzhou is much lower. In fact, Suzhou is a common choice for inter-city commuters.'*

Respondents believed they must balance the location of their residence and workplace with the accessibility of HSR stations. When commuters secure a suitable job in Shanghai, they must assess the convenience of commuting from the chosen company to the nearby HSR station and also consider rental housing options in Shanghai. While respondents generally prefer locations adjacent to metro stations, narrowing down their choices to metro station service areas often result in a reduction of job opportunities and housing options. In particular, the rental cost of housing close to metro stations is higher than those further away. Public transport facilities have significantly heightened the value of surrounding residential housing (Li et al., 2019; Tian et al., 2017). Therefore, the higher rental prices near metro stations in Shanghai can also pose potential pressure for weekly commuters. Interviewee [D] shared that *'I would choose to rent closer to my company in Shanghai. I considered housing rental prices as a priority. However, the area for me to rent a place is fixed...In my current situation, the metro stations connect my rental house and company with only four stops. It is very convenient.'*

#### 4.1.3. Labour market and income level

Different cities offer different types of job opportunities. Shanghai, a major economic and financial centre in China, provides better career development opportunities than its neighbouring cities. As suggested by Clark et al. (2019), decent income and extensive career development opportunities are two positive factors that profoundly enhance the well-being of Chinese residents. Respondents echoed this point, upholding their decisions to commute to work in Shanghai, confirming that

employment opportunities have a decisive impact on the decision of inter-city commuting. Interviewee [D] expressed, *'My work is about commercial real estate, which closely relates to city development and is more active in first-tier cities... When I stay in Shanghai, I go shopping or hang out, which is also part of my work, and I can make observations in such an environment.'* However, no respondents have mentioned how second-tier cities in the YRD, like Suzhou and Jiaxing, offer attractive employment opportunities to facilitate inter-city HSR commuting from Shanghai.

The benefits attached to better job opportunities in Shanghai are not available in other neighbouring cities, especially high incomes. Most inter-city commuters work in the private sector, especially in finance, information technology (IT), real estate, and machine manufacturing. They earn more than 10,000 RMB monthly, which is significantly higher than the average monthly income of 1,493 RMB (National Bureau of Statistics, 2021). Inter-city commuters are generally the high-income group. However, interviewees confirmed that some commuting graduates with low earnings anticipate potential career development in the future. For them, high inter-city commuting costs remain an issue. These commuters thus view the company's subsidy as an essential income component. Although the subsidy rarely covers all commuting costs, they tend to spend as little as possible. As Interviewee [C] said, *'Half my travel costs can be covered by subsidies, so I do not have to sacrifice my income to bear all the costs. This was considered when I chose this job.'* Moreover, this not only affects the choice of inter-city commuting but also alters commuting patterns from a daily to a weekly basis. For instance, Interviewee [E] mentioned, *'I do not have a company subsidy; hence, for sure, I would not commute across cities daily and rent an apartment in Shanghai at the same time.'*

#### 4.1.4. Institution and policy

Interviewees expressed concerns about dilemmas and expectations relating to institutional environment and policy support. One such factor is the hukou system which is often overlooked as transport mobility achievement overshadows social mobility. Citizens are tethered to their place of birth and granted specific rights and benefits, such as education, healthcare, and social welfare benefits. Consequently, living costs in cities vary according to the hukou status of workers (Song, 2014).

Notably, policies on provident funds and social insurance in China can hinder mobility and inconvenience inter-city life. Without an integrated provident fund and social insurance system among various cities, the situation poses difficulties for inter-city commuters regarding mortgage payments and health care. The challenges remain similar whether paying in Shanghai or Suzhou. Although new policies were designed to make it easier for employees to use welfare for payment across cities, the barriers remained inconvenient for inter-city commuters wishing to settle in a city. In the words of Interviewee [C], *'Every city has its own system of social insurance and provident funds. This would be a huge problem for me. For example, I cannot pay my loan in Suzhou using provident funds since they have been paid in Shanghai. I must take extra money from my salary to repay the loan, making my life more stressful...I am paying my social insurance and provident funds to Suzhou. I raised this very important point to the company at my induction.'*

Interviewees also highlighted the problematic Zhongtie Yintong card, a seasonal pass for frequent HSR users. Inter-city commuters found it inconvenient. The weaknesses of the Zhongtie Yintong Card include limited usage stations, fixed HSR routines, and dependence on real-time passenger volume. While intended to be a policy benefit for HSR users, in practice, it generates inconvenience and uncertainty in their daily commuting routine. Such restrictions on usage decrease the number of available HSR trains for commuters; meanwhile, difficulties associated with getting on the train increase during rush hours. Interviewees shared their willingness to continue using the card if improvements in the future are made to remedy current shortcomings. As Interviewee [A] said, *'In fact, this card is not the same as a monthly pass. It is a prepaid card with many problems. If the HSR train is full of passengers, you cannot get on. This card ensures you can get on the HSR on specific days, but it does not*

*stipulate a time.'* Interviewee [D] added more details: *'The card has many limitations. When I arrived at the HSR station, I found I was unable to use the card to get on many of the HSR trains. It is restricted within the HuNing line. The departure and terminal stations of the HSR train must be Shanghai and Nanjing Station when using the card. The number of HSR trains available to me decreased considerably. It is unreliable, so I no longer use it.'* Overall, interviewees long for attention from government officials to address these issues from users' perspectives by relaxing the restrictions and introducing changes in social policy and ticketing services as illustrated above.

## 4.2. Competence

### 4.2.1. Socio-economic conditions

The first identified socio-economic condition is age, representing that young people have a stronger physical capacity to endure stressful commuting than older people. As young HSR commuters were identified as the dominant age group in the stage one findings (Wang et al., 2020), we assumed that most young people readily accept inter-city commuting, which is consistent with the interview results. Spending ninety minutes on single inter-city travel seems to be acceptable. Interviewee [B] observed, *'I saw plenty of people commuting daily in this way. I believe they can endure the fatigue caused by inter-city commuting, just like me. If their companies allow them to finish work before 6 pm, the commuting time is only ninety minutes.'*

Young single interviewees have shown flexibility, but they express concerns about the potential restrictions in the future due to marriage and family conditions. These factors could influence their attitudes towards inter-city commuting and impact their future employment decisions, especially workplace choices. Interviewee [E] who delayed getting married and starting a family expressed, *'Whether I work and live in either Suzhou or Shanghai will depend on where my boyfriend is. For now, I am just doing what I like.'* Similarly, Interviewee [D] expressed, *'As I am not married yet, I am free to go anywhere. I have no ties. I had no family in Suzhou when I graduated, so I decided to work in Shanghai for better career development. Things may change if I have a family.'*

Middle-aged commuters who have already reached senior management levels are reluctant to continue inter-city commuting in the future. Their primary concern lies more with the effect of inter-city commuting on family relationships than on work and income. Interviewee [A] ceased his intercity HSR commuting after six months and said, *'If you are younger or do not prioritise your family, working overtime rather than returning to Suzhou is more important. However, people like us who are getting older would be concerned more about family. I guess my young colleagues feel they can leave the pressure of family responsibilities to other family members.'*

Family concerns are the most frequently mentioned of all responses relating to socio-economic conditions. Inter-city commuting reduces the time available to spend with families. Daily commuters usually arrive home after 8p.m., even if they leave work at 6p.m. and do not engage in social activities. In dual-income families, the situation is more complex (Bryant, 2020). In an emergency, inter-city commuters are disadvantaged. For instance, one participant's mother went missing several times due to Alzheimer's disease, and he could not help as he was working sixty miles away. In such circumstances, the adverse, alienating effects of inter-city commuting must be considered.

### 4.2.2. Organisational skills

With restricted time, interviewees have showcased their organisational skills in family and non-family-related planning activities. Some respondents considered that HSR commuting limits time available for workday activities, especially family-related ones. Daily inter-city commuters thus tend to compensate by spending more time with families on weekends. For instance, Interviewee [H] occasionally sacrificed his lunch break at work to get a haircut rather than doing it at weekends. However, Interviewee [E] who could only become a weekly commuter



due to the demand of long working hours requires skilful planning for weekend family activities. *'I am a programmer. Because of the nature of my work, I finish work very late in the evening. There is no HSR train back to Suzhou in the evening, so I cannot return to Suzhou each day.'*

HSR commuting also influences time arrangements for non-family-related activities, such as leisure activities with friends in the city of residence and socialising with colleagues in the workplace. Some inter-city commuters, not planning to live long-term in the city of work, may also try to maintain social relationships with friends at home on weekends. Commuters' social relationships might be affected when there is insufficient socialising in their cities of residence and workplace. However, most commuters, who intended to advance their careers and settle in cities such as Shanghai, enjoyed activities there to develop new relationships and expand their social connections. In general, the social circle of inter-city commuters was not complex. A daily inter-city commuter (Interviewee [B]) explained: *'The social circle is certainly based in Shanghai because most people I work and talk with, such as customers and colleagues, are all in Shanghai. So, Suzhou is just a place of residence. Only friends and relatives who have relationships with my family are in Suzhou. This is a common situation for commuters.'*

#### 4.2.3. Desires and aspirations

Regardless of socio-economic conditions, interviewees were frank about their aspirations for inter-city commuting, such as broadening horizons, advancing careers, receiving high income, and enjoying a good quality of life. In Interviewee [F]'s own words, *'In Shanghai, you can meet people from different places with their own connections. When getting to know these people, you gradually recognise that you have been developing new connections with those in the same industry. Also, you always meet your fellow townsmen working in Shanghai; they share with you valuable experiences from various industries. You thus learn from them and improve yourself.'*

Therefore, despite potential disadvantages in health, family and social relationships, these commuters, especially young adults, chose this commuting mode to pursue their desires and aspirations. Some individuals become entrepreneurs due to self-motivation, while some are inspired by senior people in high positions. It is impressive that female respondents expressed greater willingness in this regard. Interviewee [C] said, *'My CEO is already sixty years old. She sleeps less than me and has more business trips than me. She was highly educated at university. I think she does not need to work so hard. Why did not I work hard to be as good as her? This is just a choice of lifestyle, and I have felt good so far.'* Interviewee [D] expressed her ambition, *'At this stage, my career development is important. If there is an excellent opportunity in Shanghai, I think that a little hard work is not a big problem. It is like paying a tuition fee, but I can obtain more.'*

#### 4.3. Cognitive appropriation

The stress and uncertainty constraining inter-city commuting by HSR have been highlighted by interviewees. Firstly, commuters often felt stressed during their inter-city travel experience on the HSR. They worried about the difficulty of getting to their workplace or meetings on time, which has led to a negative mental impact intertwined with the uncertainties of work pressure and family responsibilities. Interviewee A stated, *'The most stressful part of the day was going to the station, worrying about traffic jams, not being able to find a parking space (laughs), worrying about missing the train, and missing a meeting.'* Secondly, HSR commuters must adhere to a fixed train schedule, which adds to the mental stress. Unlike other modes of transport such as driving or buses, HSR schedules are normally on time. Once a train is missed, commuters would feel anxious. Interviewee A also noted, *'There is a difference in the pressure between two scenarios: one where the daily requirement is punctuality and the other where the daily challenge is the uncertainty and the fear of missing trains one has to encounter.'* Overall, respondents felt that HSR inter-city commuting is a more passive option or a choice of necessity. Commuters have to cognitively appropriate strategies and habits for their own

commuting patterns. However, once they transition to a more relaxed lifestyle, they will likely enjoy it more and might choose to give up HSR inter-city commuting.

HSR inter-city commuters in modern urban life place a high value on using their precious time. They often adopt various strategies to minimise the commuting time outside of using the HSR and increase efficiency, especially during rush hours. For example, regular inter-city commuters usually identify specific carriage positions to cope with congested transport systems and reduce unnecessary waiting and walking time. Similarly, when using other public transport systems connecting the HSR to complete their commute, such as the metro system, they stand next to a specific door to get off at their destination station and leave the carriage as soon as possible. Therefore, knowing how to choose a carriage to minimise walking time during the journey becomes practical. This behaviour reflects the appropriation made by HSR inter-city commuters as they adapt to the cities where they live and work and become familiar with using the transport system. Interviewee [F] shared his strategy for saving time, *'I know which carriage door to the stairs is the closest. I stand every day at the 11th door of that place, and outside is the stair. We had a lot of people getting off at that stop. If you are a second slower, you cannot get out. So we would squeeze into Gate 11 even if the rest of the carriage was empty.'*

To minimise the negative impact of HSR inter-city commuting, commuters adopt a simple, direct, and quick approach to handle trivial matters. When faced with a trade-off between cost and time, they are more inclined to accept a moderate cost increase within an acceptable range to achieve results quickly. For example, Interviewee [E]'s experience shows that the inter-city commuter may try to avoid the online shopping price comparison process and usually use the telephone to handle problems unless they can be solved on-site with family. On the other hand, if the task could be accomplished by walking or taking a car with family together, even though it might not result in time saving, it could be seen as a way of combining family time for building trust and communication. These activities, although ordinary, contribute to fostering family bonds. Moreover, Interviewee [C] shared how she considered whether to accept work in different places by flexible HSR inter-city commuting patterns mainly based on the following priority principles: (1) whether it is feasible to travel between living and working place (up to 120 min in one way is ideal) and (2) whether it is feasible to travel between living and working places once to twice a week (up to 120 min in a single trip is ideal, and is based on whether the new job can provide better career development).

#### 4.4. Synthesis: Dismantling mobility patterns

As shown in the first stage of findings published by Wang et al. (2020) and Chung et al. (2020), the Suzhou-Shanghai HSR has facilitated three distinct mobility patterns of HSR intercity commuting: daily, weekly, and flexible (a combination of business travel and commuting). With the motility framework, this qualitative study unveils that the determinants of the three mobility patterns vary, and the corresponding groups have different attitudes and perceptions.

The daily inter-city commute by HSR is the most common pattern. The advantages of HSR, including comfortable seating and time-saving capacity compared with other inter-city and intra-city transport systems, are the primary facilitations for inter-city commuters. The built environment in Shanghai has a higher density than that in Suzhou. Many daily commuters own properties in Suzhou, which are more spacious and provide a better living environment than in Shanghai. Given the perceived poorer quality of life in Shanghai, these people would rather spend much time each day on the commuting journey. For those married with children, daily commuting is necessary to maintain good family relations. This group is generally young or middle-aged, with strong family ties, and is willing to make appropriate time arrangements and tolerate physical and mental stress caused by daily inter-city commuting. High incomes, company subsidies, and the pursuit of self-



actualisation and prosperity mitigate the negative effects. Together, these factors determine their mobility patterns. However, in the foreseeable future, as individuals age, experience decline in health, and place greater importance on their families, their attitudes towards this pattern could turn negative and may profoundly alter their mobility behaviour.

For weekly commuters, inflexible HSR timetabling systems are a deterrent related to the nature of specific jobs in the labour market. Those commuters who often need to work overtime cannot effectively use HSR systems with fixed times and frequencies. Insufficient policy support, such as the inconvenient Zhongtie Yintong card, also negatively affects commuters' experiences of HSR services. Consequently, they prefer crowded but frequent subway services which continuously operate late into the night compared with HSR services with seats but very limited frequencies. From another perspective, part of the labour market requires these employees to stay at the workplace for extended periods to maintain social relationships with customers. They have to endure a suboptimal built environment by renting a small room in Shanghai for weekly commuting to pursue career development. However, some individuals in this group, especially those working in specific industries such as commercial property and fashion, acknowledge that they would not be able to replicate the same living environment in Shanghai as they have in Suzhou for a certain period of time in life. Nonetheless, they make the most of the experiences and services that Shanghai has to offer otherwise, especially in shopping, entertainment, and food and beverage in their daily lives. Weekly commuters are primarily young, single people without family ties. Despite the restrictions of the hukou system, which prevents the use of provident funds and social insurance across cities, and concerns related to accessing medical care and purchasing a home where they live, the weekly commuting pattern remains acceptable for this group. They currently hold a neutral or positive attitude towards the current pattern. However, this can potentially turn negative for inter-city HSR commuting as their socio-economic attributes change, especially in terms of marital and family status.

Finally, the flexible pattern aligns more with the initial purpose of HSR use: inter-city business travel. This group has high work freedom, no fixed workplace, and no strict commuting times. The deterrents and interactions prominent in the first two patterns do not apply to this type of inter-city commuters. They have a positive attitude towards using HSR for inter-city commuting.

## 5. Discussion and conclusion

This paper applies the motility framework (Kaufmann, 2002, 2004, 2011) to provide explanations and deeper insight into the interdependence of access, competence, and cognitive appropriation underlying the social phenomena of inter-city commuting by HSR in the YRD region of China. As shown in this case study, high mobility practices have been facilitated for those with the matched skills to fulfil personal desires and aspirations when a large city (Shanghai) and a neighbouring smaller city (Suzhou) with distinct labour markets and built environment profiles are closely connected by HSR in terms of time-saving and comfortable services. Nevertheless, several negative external factors, such as the inflexible HSR timetabling and ticketing system, the hukou system and internal factors relating to socio-economic conditions, are found to be constraints for high mobility practice. Consequently, the widely publicised advances in China's transport infrastructure development, represented by HSR, have been appropriated against external factors with a range of internal competence such as age, marital status, family situations, organisational skills, desires and aspiration to maintain such high mobility practice with responsive strategies and habits. In other words, many current mobility patterns are perturbing. When the status quo changes, circumstances, such as getting older, married or family matters, are likely to constrain time arrangements, which could lead to negative attitudes towards HSR commuting, thus terminating the

commuting practice.

Whilst acknowledging the potential impact of changes in economic development and remote work on travel and associated social phenomena, empirical evidence from this case study suggests that the current design, planning, and operation of objective HSR systems in the YRD region, primarily between Suzhou and Shanghai, need to proactively account for the emergent group of inter-city commuters. Failure to do so might perpetuate negative attitudes and potentially counteract the effect of inter-city HSR commuting on the pursuit of self-actualisation and prosperity, ultimately promoting commuters to alter the behaviour. This study underscores the importance of people-centred transport infrastructure development that is beneficial to human well-being. The negative attitude should not be entirely neglected.

Insight attained from this qualitative case study with the context-specific motility framework echoes the term 'mobility management' used in Kesselring (2006) to reflect the way individual subjective motility (mobility potential) is embodied in the 'juggling and struggling with mobility constraints' (p.272). We argue that the so-called objective advantages of HSR, such as convenience, timesaving, and comfort, fail to consider individual mobility potential (motility). These experiences and considerations, neglected in the mainstream HSR development debate, critically pinpoint spatial and social mobility mismatches in HSR commuting experiences. As most HSR commuters have expressed, when a suitable job becomes available in Suzhou, they will not continue with such formidable efforts that brought them closer to a better job at the expense of a better quality of life. On this point, HSR connectivity between two neighbouring cities does not benefit both in the same way. Most of the time, the volume of job opportunities, career development potential, and high incomes created by megacities in Chinese regions have contributed to the influx of people from neighbouring cities, but the outflow does occur due to the high cost of living (Li et al., 2022; Li & Niu, 2022; Mu & Yeh, 2020). There should be a more balanced two-way commuting through a better coordination of economic development between a major city and neighbouring cities beyond the current one-way dominance. Indeed, we would not anticipate a future where the neighbouring cities become sleeping cities for welfare-enhancing, as Ren et al. (2023) suggest.

As for other constraints, this case study contributes by providing evidence on the identified constraints to commuting and enriching the understanding of those not deeply explored but applicable to the Chinese context. Some factors have been emphasised in existing commuting studies, such as being forced to choose between expensive housing close to transport nodes or inexpensive housing a distance from transport nodes (Haas & Osland, 2014; Islam & Saphores, 2022; Zhao et al., 2011), and age and marriage-related constraints on family and other social ties (Chidambaram & Scheiner, 2021; Havet et al., 2021; Sánchez & González, 2016). To some extent, the above-mentioned issues are directly responsible for inter-city commuters' stress, health problems, and multifaceted unhappiness, especially for daily travellers. These results align with existing studies (Chatterjee et al., 2020; Künn-Nelen, 2016; Simón et al., 2020). However, a new perspective noted in this study as an essential constraint, China's hukou system results in inter-city HSR commuters being unable to enjoy the same social welfare at their workplace as at their residence, particularly the use of provident funds for housing and health insurance for medical expense reimbursement. Issues caused by the unique hukou system have received attention in some transport studies (Cao & Hickman, 2019; Liu et al., 2019; Zhao & Howden-Chapman, 2010). This paper provides new empirical insight into the restrictive impact of hukou systems on mobility via HSR in counteracting the high mobility facilitated by HSR, which the public sector should consider. The impacts of relevant institutions and policies should be more carefully considered in HSR-related studies.

Regarding policy implications, the findings echo motility as a policy objective (Shliselberg & Givoni, 2018). This leads to a critical assessment of transport policy and other associated policy areas, prompting

subsequent improvements to enhance personal well-being. This aspect, which is often less considered in transport planning and policymaking, gains importance. The concern contradicts current national initiatives to pursue rapid economic development and transport infrastructure construction in the Chinese context. However, looking into the foreseeable future, it becomes essential for transport scholars and practitioners, as part of the motility framework, to view individuals, population cohorts, and society as a whole and to think critically about the significance of transport infrastructure in high mobility. Based on this case study, it is evident that the design of HSR and related service provision in the YRD region has not carefully considered the emerging group of inter-city commuters.

For instance, the problematic Zhongtie Yintong card highlights that this ticketing system does not seem to identify specific trains for commuting relationships from long-distance HSR services. Instead, it penalises commuting rather than prioritising it. Although the general demand on the line for inter-city commuting during rush hours has been evident, the availability of trains is still limited and inconvenient (Chung et al., 2020; Li & Niu, 2022; Wang et al., 2020). HSR could be a route to better jobs in both directions with clear differentiation in the kind of jobs and workers in each direction; however, this is not the obvious case in China. If a second-tier neighbouring city, such as Suzhou, could be attractive enough for jobs complementary to those in Shanghai, the balanced demand for HSR commuting might be interesting for the rail operator due to more profits, then motivate to increase the frequency of specific trains for inter-city commuting (Wu et al., 2014). To achieve this, both cities should establish a collaborative partnership or governance to develop spatial strategies for mutual multiple benefits in terms of economic development (business and industry), housing provision, and personal well-being.

The paper sheds light on the social implications for transport improvement in both emerging and advanced economies. For emerging countries pursuing and expecting HSR to drive their spatial economies, such as India (Garg & Gupta, 2021; Verma et al., 2013) and Egypt (Belal et al., 2020), the social implications for the whole experience of inter-city HSR commuting should be considered in the planning and construction process to improve the sustainability of HSR systems from both

an economic and social perspective. For the advanced economies, the renewal of transport systems is ongoing (Golub et al., 2013; Grebler, 1964; Holden, 2007), while many countries have struggled with the widened spatial-economic polarisation. How new or upgraded transport infrastructure would impact decision-making and daily life from a social perspective is not fully understood. The refined motility framework illustrated in this paper provides a useful lens for future studies.

There are still areas for improvement in this study. First, this was carried out in 2018 summer, before COVID-19, which might be considered out of date. Although the COVID-19 epidemic can be seen as a turning point for research to influence results, we argue that any data from post-2019 is corrupted by COVID-19, and we are not yet in a stable post-Covid situation. It is fairly obvious from ridership data that we have still not either got back to pre-Covid levels or a stable 'new normal'. Therefore, this disruption should be recognised, but no decisive evidence exists that it permanently alters a person's mobility decision-making. Our findings remain valuable but welcome further comparative analyses and discussion. Second, the sample size is relatively small. Although the selected respondents largely cover the principal socio-economic conditions of HSR-related inter-city commuters, each respondent may not represent the perceptions of all commuters with similar socio-economic conditions. Third, although Suzhou and Shanghai are representative cities, showing common inter-city commuting phenomena in one of China's most developed and prominent regions, our findings may not relate to all HSR-related inter-city commuting conditions across the country or borders. Therefore, further extensive and in-depth exploration of related topics in other regions with a comparative perspective looking into varied conditions such as developmental trajectories, geographical conditions, political regimes, and cultural backgrounds is warranted.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Appendix A. Information about interviewees

ID	Gender	Age	Occupation	Commuting Experience	Mobility Pattern	Household structure	Residential context
A	Male	50–59	Senior manager in architectural design company	Half a year	Daily	Married, one child	Home in Suzhou
B	Male	20–29	Financial software professional	Six years	Daily	Married, one child	Home in Suzhou
C	Female	30–39	Business manager in IT company	Eight years	Flexible	Married, one child	Home in Suzhou, renting in Shanghai
D	Female	30–39	Business manager in commercial real estate company	One year	Weekly	Single	Home in Suzhou, renting in Shanghai
E	Female	30–39	Software programming technician	Four years	Weekly	Single	Home in Suzhou, renting in Shanghai
F	Male	20–29	Power engineer	Two years	Daily	Single	Home in Suzhou
G	Male	40–49	Senior manager in real estate company	Two years	Daily	Married, one child	Home in Suzhou
H	Male	30–39	Foreign-invested automobile project manager	Four years	Daily	Married, one child	Home in Suzhou

#### References

- Chen, G., de Abreu e Silva, J., 2013. Regional impacts of high-speed rail: A review of methods and models. *Transportation Letters* 5 (3), 131–143.
- Snaith, J., 1990. Migration and dual career households. In: Johnson, J.H., Salt, J. (Eds.), *Labour Migration- The internal geographical mobility of labour in the developed world*. Routledge, London, pp. 155–171.
- Ahlfeldt, G.M., Feddersen, A., 2018. From periphery to core: measuring agglomeration effects using high-speed rail. *J. Econ. Geogr.* 18 (2), 355–390.
- Alonso, M., 1964. *Location and Land Use*. Harvard University Press, Cambridge, MA.
- Angel, S., Parent, J., Civco, D.L., Blei, A., Potere, D., 2011. The dimensions of global urban expansion: Estimates and projections for all countries, 2000–2050. *Prog. Plan.* 75 (2), 53–107.
- Arcidiacono, C., Di Martino, S., 2016. A critical analysis of happiness and well-being. Where we stand now, where we need to go. *Community Psychol. Global Perspective* 2 (1).
- Azzouz, L., Jack, A., 2021. Social Exclusion and High-Speed Railways: Evidence from China. *Open Transp. J.* 15 (1).
- Belal, E.M., Khalil, A.A., El-Dash, K.M., 2020. Economic investigation for building a high-speed rail in developing countries: The case of Egypt. *Ain Shams Eng. J.* 11 (4), 1001–1011.

- Bryant, M.L., 2020. Bringing home the bacon, times two: a look at dual-income families. *Compens. Benefits Rev.* 52 (2), 34–38.
- Cao, M., Hickman, R., 2019. Understanding travel and differential capabilities and functionalities in Beijing. *Transp. Policy* 83, 46–56.
- Carta, F., De Philippis, M., 2018. You've come a long way, baby. Husbands' commuting time and family labour supply. *Reg. Sci. Urban Econ.* 69, 25–37.
- Cavallaro, F., Dianin, A., 2019. Cross-border commuting in Central Europe: features, trends and policies. *Transp. Policy* 78, 86–104.
- Chan, C.-S., Yuan, J., 2017. Changing travel behaviour of high-speed rail passengers in China. *Asia Pacific J. Tourism Res.* 22 (12), 1221–1237.
- Chatterjee, K., Chng, S., Clark, B., Davis, A., De Vos, J., Ettema, D., Handy, S., Martin, A., Reardon, L., 2020. Commuting and wellbeing: a critical overview of the literature with implications for policy and future research. *Transp. Rev.* 40 (1), 5–34.
- Chen, F., Chen, Z., 2023. High-Speed Rail and Happiness. *Transp. Res. A Policy Pract.* 170, 103635.
- Chen, C.-L., Hall, P., 2015. High-speed trains and spatial-economic impacts: A British-French comparison on two scales: Intra- and inter-regional. In: R. Hickman, M. Givoni, D. Bonilla & D. Banister (eds.). *International Handbook on Transport and Development*. London: Edward Elgar, pp. 301–317.
- Chen, C.-L., Wei, B., 2013. High-speed rail and urban transformation in China: The case of Hangzhou East Rail Station. *Built Environ.* 39 (3), 385–398.
- Chen, C.-L., Hickman, R., Saxena, S., 2015. *Improving interchanges - Developing Multimodal passenger rail hubs - An illustrated guide for the People's Republic of China*. Asian Development Bank, Manila.
- Chen, H., Sun, D., Zhu, Z., Zeng, J., 2016. The impact of high-speed rail on residents' travel behavior and household mobility: A case study of the Beijing-Shanghai Line, China. *Sustainability* 8 (11), 1187.
- Chen, C.-L., 2015. Peter Hall: Inspirer and Innovator of Railways and Regions. *Built Environ.* 41 (1), 112–128.
- Chidambaram, B., Scheiner, J., 2021. Work-trip mode choice in Germany-Affected by individual constraints or by partner interaction? *Travel Behav. Soc.* 24, 231–244.
- Chung, H., Yang, Y., Chen, C.-L., Vickerman, R., 2020. Exploring the Association of the Built Environment, Accessibility and Commuting Frequency with the Travel Times of High-Speed Rail Commuters: Evidence from China. *Built Environ.* 46 (3), 342–361.
- Church, A., Frost, M., Sullivan, K., 2000. Transport and social exclusion in London. *Transp. Policy* 7 (3), 195–205.
- Clark, W.A., Yi, D., Huang, Y., 2019. Subjective well-being in China's changing society. *Proc. Natl. Acad. Sci.* 116 (34), 16799–16804.
- Cresswell, T., 2001. The production of mobilities. *New Formations* 43, 11–25.
- Dai, G., 2015. The impact of policy networks on the urbanisation around High-Speed Railway stations in China: the case of Wuhan. *Environment and Planning C-Government and Policy* 33 (3), 533–551.
- Dauth, W., Haller, P., 2020. Is there loss aversion in the trade-off between wages and commuting distances? *Reg. Sci. Urban Econ.* 83, 103527.
- De Ureña, J.M., 2012. *Territorial implications of high speed rail: A Spanish perspective*. London: Routledge.
- Diao, M., Zhu, Y., Zhu, J., 2017. Intra-city access to inter-city transport nodes: The implications of high-speed-rail station locations for the urban development of Chinese cities. *Urban Stud.* 54 (10), 2249–2267.
- Dobruszkes, F., Chen, C.-L., Moyano, A., Pagliara, F., Endemann, P., 2022. Is high-speed rail socially exclusive? An evidence-based worldwide analysis. *Travel Behav. Soc.* 26, 96–107.
- Flamm, M., Kaufmann, V., 2006. Operationalising the Concept of Motility: A Qualitative Study. *Mobilities* 1 (2), 167–189.
- Garg, A., Gupta, S., 2021. A Descriptive Analysis of Risk Management with Specific Reference to High Speed Rail (HSR) in India. *Water Energy Int.* 64 (8), 37–44.
- Geng, B., Bao, H., Liang, Y., 2015. A study of the effect of a high-speed rail station on spatial variations in housing price based on the hedonic model. *Habitat Int.* 49, 333–339.
- Golub, A., Marcantonio, R.A., Sanchez, T.W., 2013. Race, space, and struggles for mobility: Transportation impacts on African Americans in Oakland and the East Bay. *Urban Geogr.* 34 (5), 699–728.
- Grebler, L., 1964. *Urban renewal in European countries: its emergence and potentials*. University of Pennsylvania Press.
- Guirao, B., Campa, J.L., Casado-Sanz, N., 2018. Labour mobility between cities and metropolitan integration: The role of high speed rail commuting in Spain. *Cities* 78, 140–154.
- Haas, A., Osland, L., 2014. Commuting, Migration, Housing and Labour Markets: Complex Interactions. *Urban Stud.* 51 (3), 463–476.
- Harman, R., 2006. *High Speed Trains and the Development and Regeneration of Cities*. London: Greengauge 21.
- Havet, N., Bayart, C., Bonnel, P., 2021. Why do gender differences in daily mobility behaviours persist among workers? *Transp. Res. A Policy Pract.* 145, 34–48.
- Heuermann, D.F., Schmieder, J.F., 2019. The effect of infrastructure on worker mobility: evidence from high-speed rail expansion in Germany. *J. Econ. Geogr.* 19 (2), 335–372.
- Hickman, R., Chen, C.-L., Chow, A., Saxena, S., 2015. Improving interchanges in China: the experiential phenomena. *J. Transp. Geogr.* 42, 175–186.
- Holden, E., 2007. *Achieving sustainable mobility: everyday and leisure-time travel in the EU*. London: Routledge.
- Hu, L., Schneider, R.J., 2017. Different ways to get to the same workplace: How does workplace location relate to commuting by different income groups? *Transp. Policy* 59, 106–115.
- Islam, M.R., Saphores, J.-D.-M., 2022. An LA story: The impact of housing costs on commuting. *J. Transp. Geogr.* 98, 103266.
- Jansen, G.R., 1993. Commuting: home sprawl, job sprawl, traffic jams. In: Salomon, I., Bovy, P., Orfeuil, J.-P. (Eds.), *A Billion Trips a Day*. Springer, Dordrecht, pp. 101–127.
- Kaufmann, V., Bergman, M.M., Joye, D., 2004. Motility: mobility as capital. *Int. J. Urban Reg. Res.* 28 (4), 745–756.
- Kaufmann, V., 2002. *Re-thinking Mobility*. Aldershot: Ashgate.
- Kaufmann, V., 2011. *Rethinking the City: Urban Dynamics and Motility*. Lausanne: EPFL Press.
- Kesselring, S., 2006. Pioneering mobilities: New patterns of movement and motility in a mobile world. *Environ Plan A* 38 (2), 269–279.
- Künn-Nelen, A., 2016. Does commuting affect health? *Health Econ.* 25 (8), 984–1004.
- Lawrence, M., Bullock, R., Liu, Z., 2019. China's high-speed rail development. International development in focus. World Bank, Washington DC. <http://hdl.handle.net/10986/31801>.
- Li, Z., Niu, X., 2022. Exploring Spatial Nonstationarity in Determinants of Intercity Commuting Flows: A Case Study of Suzhou-Shanghai, China. *ISPRS Int. J. Geo-Information* 11 (6), 335.
- Li, H., Wei, Y.D., Wu, Y., Tian, G., 2019. Analyzing housing prices in Shanghai with open data: Amenity, accessibility and urban structure. *Cities* 91, 165–179.
- Li, N., Lu, H., Lv, Y., 2022. High-Speed Railway Facilities, Intercity Accessibility and Urban Innovation Level – Evidence from Cities in Three Chinese Megacity Regions. *Land* 11 (8), 1132.
- Liu, Q., Lucas, K., Marsden, G., Liu, Y., 2019. Egalitarianism and public perception of social inequities: A case study of Beijing congestion charge. *Transp. Policy* 74, 47–62.
- Long, F., Zheng, L., Song, Z., 2018. High-speed rail and urban expansion: An empirical study using a time series of nighttime light satellite data in China. *J. Transp. Geogr.* 72, 106–118.
- Lyons, G., Chatterjee, K., 2008. A human perspective on the daily commute: costs, benefits and trade-offs. *Transp. Rev.* 28 (2), 181–198.
- Moyano, A., Martínez, H.S., Coronado, J.M., 2018. From network to services: A comparative accessibility analysis of the Spanish high-speed rail system. *Transp. Policy* 63, 51–60.
- Moyano, A., 2016. High speed rail commuting: Efficiency analysis of the Spanish HSR links. *Transp. Res. Procedia* 18, 212–219.
- Mu, X., Yeh, A.-G.-O., 2020. Regional delineation of China based on commuting flows. *Environ. Planning A: Econ. Space* 52 (3), 478–482.
- National Bureau of Statistics. (2021). *Residents' income and consumption expenditures in 2020*. National Bureau of Statistics. Retrieved 27 July 2022 from [http://www.stats.gov.cn/tjsj/zxfb/202101/t20210118\\_1812425.html](http://www.stats.gov.cn/tjsj/zxfb/202101/t20210118_1812425.html).
- Pagliara, F., Biggiero, L., 2017. Some evidence on the relationship between social exclusion and high speed rail systems. *HKIE Transact.* 24 (1), 17–23.
- Pagliara, F., Hayashi, Y., Ram, K.S., 2022. High-Speed Rail, Equity and Inclusion. *Sustainability*, 14 (11), 6710.
- Ren, X., Wang, F., Wang, C., Du, Z., Chen, Z., Wang, J., Dan, T., 2019. Impact of high-speed rail on intercity travel behavior change. *J. Transp. Land Use* 12 (1), 265–285.
- Ren, X., Chen, Z., Wang, F., Dan, T., Wang, W., Guo, X., Liu, C., 2020. Impact of high-speed rail on social equity in China: Evidence from a mode choice survey. *Transp. Res. A Policy Pract.* 138, 422–441.
- Ren, T., Huang, H.-J., Luo, S.-D., Nie, Y.M., 2023. High-speed rail in China: Implications for intercity commuting and urban spatial structure. *Sustain. Cities Soc.* 97, 104719.
- Rennie, D. *Intercity commuters are a puzzle for Chinese officials*, Chaguan Column on "The Economist" on the web, 25 February 2021. <<https://www.economist.com/china/2021/02/25/intercity-commuters-are-a-puzzle-for-chinese-officials>>.
- Seligman, M.E., 2011. *Flourish: A visionary new understanding of happiness and well-being*. New York: Free Press.
- Shliselberg, R., Givoni, M., 2018. Motility as a policy objective. *Transp. Rev.* 38 (3), 279–297.
- Shliselberg, R., Givoni, M., 2019. Operationalising motility for transport policy in A *Companion to Transport, Space and Equity*. Edward Elgar Publishing, pp. 271–282.
- Simón, H., Casado-Díaz, J.M., Lillo-Bañuls, A., 2020. Exploring the effects of commuting on workers' satisfaction: evidence for Spain. *Reg. Stud.* 54 (4), 550–562.
- Song, Y., 2014. What should economists know about the current Chinese hukou system? *China Econ. Rev.* 29, 200–212.
- Statista. (2021). *High-speed lines under construction worldwide as of June 2021, by country*. <https://www.statista.com/statistics/1243095/high-speed-lines-under-construction-worldwide/>.
- Sánchez, M.I.O., González, E.M., 2016. Gender differences in commuting behavior: Women's greater sensitivity. *Transp. Res. Procedia* 18, 66–72.
- Tian, G., Wei, Y.D., Li, H., 2017. Effects of accessibility and environmental health risk on housing prices: A case of Salt Lake County, Utah. *Appl. Geogr.* 89, 12–21.
- Verma, A., Sudhira, H., Rathi, S., King, R., Dash, N., 2013. Sustainable urbanization using high speed rail (HSR) in Karnataka. India. *Research in Transportation Economics* 38 (1), 67–77.
- Viry, G., Kaufmann, V., 2015. *High mobility in Europe: work and personal life*. London: Palgrave Macmillan.
- Wang, J.J., Xu, J., He, J., 2013. Spatial impacts of high-speed railways in China: a total-travel-time approach. *Environment and Planning Part A: Economy and Space* 45 (9), 2261–2280.
- Wang, L., Zhang, S., Sun, W., Chen, C.-L., 2020. Exploring the physical and mental health of high-speed rail commuters: Suzhou-Shanghai inter-city commuting. *J. Transp. Health* 18, 100902.
- White, M.D., Marsh, E.E., 2006. Content analysis: A flexible methodology. *Libr. Trends* 55 (1), 22–45.

Wu, J., Nash, C., Wang, D., 2014. Is high speed rail an appropriate solution to China's rail capacity problems? *J. Transp. Geogr.* 40, 100–111.

Zhao, P., Howden-Chapman, P., 2010. Social inequalities in mobility: the impact of the hukou system on migrants' job accessibility and commuting costs in Beijing. *Int. Dev. Plan. Rev.* 32 (3–4), 363–385.

Zhao, P., Lü, B., De Roo, G., 2011. Impact of the jobs-housing balance on urban commuting in Beijing in the transformation era. *J. Transp. Geogr.* 19 (1), 59–69.