From changing cognitions to changing the context: a dual-route model of behaviour change

Discussion paper 2009/04

June 2009
From Changing Cognitions to Changing the Context:

A Dual-Route Model of Behaviour Change

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Abstract

Existing theories of behaviour change in psychology and behavioural economics rely mostly on changing cognitions and incentives as a route to altering behavioural responses. We propose a more general reflective-automatic model (RAM), which postulates that, in addition to cognitive change, interventions can also rely exclusively on contextual change as an alternative route to behaviour change. RAM is a dual-process model which assumes that these two routes rely predominantly on different information processing systems – the reflective system is in charge of changing cognitions and the automatic system responds to changing the context. We also identify four processes: salience, norms, affect, and priming (SNAP), which can bring about behaviour change by relying mainly on the automatic system. The SNAP processes might be important targets for population-wide behaviour change initiatives and have important implications for psychological research, health promotion and policy analysis.

Key words: behaviour change, dual-process theory, population-wide intervention, behavioural economics, health psychology.

Acknowledgements: The authors would like to thank David Halpern, Robert Metcalfe, Paschal Sheeran, Jane Wardle, and Mathew White for their valuable comments and suggestions on previous versions of this manuscript.
“I made up my mind . . . that I would never try to reform man—that’s much too difficult.
What I would do was to try to modify the environment in such a way as to get man moving in preferred directions.” (The New Yorker, 1966)

Buckminster Fuller (American architect, author, designer and inventor)

Many domains of life require concepts and techniques to achieve specific behavioural goals for individual well-being and social good. This may include encouraging people not to smoke, asking them to improve their diet, making them exercise more, convince them to practice safe sex, requiring them to use seat belts and follow speed limits, and so on. In addition, many of the important questions of public policy in the 21st Century relate to how individuals respond to various kinds of information and incentives aimed to prompt changes in individual behaviour in relation to health. Therefore, a better understanding of how best to bring about desired behaviour change is vital if health is to be improved.

In the health field, for example, over the last 50 years, behavioural medicine and behavioural epidemiology have evolved to identify, explain, and address personal risk factors (Davidson et al., 2003; Heller & Page, 2003; Rychetnik, Frommer, Howe, & Shiell, 2002). For example, there has been a massive accumulation of evidence that supports the premise that sedentary lifestyles are a primary cause of cardiovascular disease, cancer at certain important sites and numerous other morbidities (Blair et al., 1995; Broman, 1995; Pate et al., 1995). Similar evidence has been accumulated for other risk factors (lifestyle practices of individuals) like dieting, smoking, alcohol consumption, sexual hygiene, medical self-examination, and so on. Therefore, substantial health losses are attributable to lifestyle, particularly amongst the least well-off in society (Barr, 1987; Uitenbroek et al., 1996) and significant gains in health could be achieved by relatively small changes in the choices people make (Department of Health, 2004). So, despite these five decades of research on how to
change behaviour-related risk factors, health care professionals are still faced with a short supply of generalisable, effective, and sustainable interventions that have been translated into health promotion practice (Glasgow et al., 2004). Thus, more evidence is needed on how to change behaviours on a grand scale across the population.

We identify two reasons why new models of such behaviour change are needed. First, existing theories and methods (including education and policy) leave a substantial proportion of the variance in behaviour, beyond the effect of intentions (conscious motivation), to be explained (Sheeran, 2002; Webb & Sheeran, 2006). Second, there has been recent accumulation of evidence, particularly in behavioural economics, but also in social and cognitive psychology, that human behaviour is very susceptible to various subtle changes in the environment (Ariely, 2008; Thaler & Sunstein, 2008). Traditional models of behaviour change have not fully integrated this evidence yet, even though it promises to improve the effectiveness of population wide interventions. Our article is a step in these two directions.

Two Routes to Behaviour Change

Two very general paradigms for population-wide behaviour change have emerged in recent years – models and interventions that aim to change cognitions (e.g., beliefs and goals), and models that change the context (environment or situation) within which the person acts. Most traditional interventions, in some way or another, prompt changes in cognitions to bring about behaviour change. In contrast, the second route relies on mostly on contextual changes to bring about behaviour change without change in cognitions. The

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1 Sheeran (2002) report a meta-analysis of 422 studies, which implied that changing intentions would account for 28% of the variance in behaviour change ($r = .53$). Meta-analyses of correlations between intentions and specific health behaviours have found similar effects in studies of condom use (Sheeran, Abraham, & Orbell, 1999) and exercise behaviour (Hausenblas, Caron, & Mack, 1997). However, when Webb and Sheeran (2006) based their meta-analysis only on (47) experimental (i.e., causal, not correlational) studies, the estimated intention-behaviour correlation dropped to .18 (i.e., accounting for ~3% of the variance).

2 Such ‘contextual’ influences on human choices of action are often beyond intentional control. This is probably why they have been neglected by traditional models in health psychology, which focus mainly on changing explicit (conscious, ‘rational’) intentions as a route to behaviour change (Webb & Sheeran, 2006).
second route has received relatively less attention from researchers on behaviour change than the first.³

To describe how the two paradigms accomplish behaviour change, we first need to explain the underlying psychological mechanisms causing the overt change in behaviour. The two routes accomplish behavioural change relying, to various degrees, on two different types of mental processes. Psychologists and neuroscientists have recently converged on a description of brain functioning that is based on two types of cognitive processes, also interpreted as two distinct systems (or sets of systems): evolutionarily older ‘System 1’ processes described as automatic, uncontrolled, effortless, associative, fast, unconscious and affective, and more recent, characteristically human ‘System 2’ processes described as reflective, controlled, effortful, rule-based, slow, conscious and rational (see Chaiken & Trope, 1999; Evans, 2008; Slovic et al., 2002; for surveys of the research on dual-process theories in psychology). For example, the conscious mind is effortful and limited in capacity, whereas the automatic mind processes many things simultaneously and independently of each other, which is often, but not necessarily, outside of conscious awareness (e.g., walking and eating a sandwich is automatic, while having a conversation with somebody is conscious and reflective). The two systems also differ in the depth of cognitive processing of information – one system is more ‘superficial’ and heuristic, while the other system provides more systematic and ‘deeper’ analysis. These principles are also reflected in popular views of the mind as an information processing system, such as Anderson’s (1993) influential ACT theory of cognition, which distinguishes between learning and automatic production rules (that map external stimuli to behavioural responses that have been adaptive in the past). This

³ We emphasise that this is true for population-wide behaviour change approaches (see Norman, Abraham, & Conner, 2000; Shumaker et al., 2008); not for individual (face-to-face) therapies like classical behaviour therapy, or cognitive behavioural therapy, which focus on underlying learning processes, reinforcement and skills (Clark & Fairburn, 1997; Wolpe, 1990). Thus, the focus of our analysis in this article is population-level behaviour change, not individual-level psychotherapies.
framework is also in line with earlier theories by Shiffrin and Schneider (1977) postulating that automatic (as opposite to controlled) processes develop by consistent and frequent mapping of stimuli to responses, which reflect the regularities of life.

The historical foundations of the dual-process theories can be traced back to William James. He believed that there were two different kinds of thinking: associative and true reasoning (Sloman, 1996). Nowadays dual process theories can be found in social, personality, cognitive, and clinical psychology. In cognitive psychology, attention and working memory have also been conceptualised as relying on two distinct processes (Barrett, Tugade, & Engle, 2004). Dual process models are very common in the study of social psychological variables, such as attitude change. Social psychologists also often explain the fact that people behave differently at different times by positing these two inner processes that are activated by different stimuli (e.g., general vs. specific, symbolic vs. pictorial, physical vs. social, and so on). For example, the heuristic-systematic model (Chaiken, Liberman, & Eagly, 1989), the elaboration likelihood model (Petty & Cacioppo, 1986), the mood as information model (Schwarz, 1990), and the self-evaluation maintenance model (Tesser, 1986) are just a few of the well-known social-psychological models that use dual-process frameworks to explain the behavioural variety of individuals. In each case, people are assumed to behave in a different way on different occasions, because they are on all occasions inhabited by two qualitative distinct processes, which are simultaneously activated by the situation. Thus, the system’s behaviour may be understood as the join function of both processes (but on some occasions, a given stimulus may activate only one process while the other is dormant).

We employ the dual-process paradigm as a unified framework for population-wide behaviour change, which can account for numerous existing theories and intervention methods. We label the two types of processing as reflective vs. automatic respectively,
because these adjectives most closely describe the mediating effect on behaviour change. In essence, the reflective processes change behaviour through reflective, conscious changes in cognition, as a response to arguments (for and against a specific behaviour), or after receiving an advice; while automatic processes change behavioural responses as a result of an automatic reaction to cues in the context within which action choices are made. Thus, the automatic route to behaviour change holds that people are often more influenced by external, contextual cues (i.e., situational, ‘bottom-up’ factors) than by internal, ‘top-down’ factors like cognitions or motivations. Thus, ‘once triggered by environmental features, preconscious automatic processes run to completion without any conscious monitoring’ (Todorov & Bargh, 2002, p. 53).

At a neurobiological level, the second, contextual route to behaviour change is motivated by knowledge about the existence of separate brain modules for automatic processing of different kinds information like perceptual processing, mechanisms for emotional reactions, memory retrieval, and motor actions (Anderson et al., 2004; Meyer & Kieras, 1997). According to Fodor (1983), the information in these modules is largely encapsulated and they communicate only through the information they produce as their outputs. The coordination in the behaviour of these modules is achieved through a central executive control (reflective) system, which is not sensitive to most of the (automatic) activity of these modules, but rather can only respond to a limited amount of information that these modules generate as their output. For instance, people are not aware of all the information in the visual field but only the object they are currently attending to. Similarly, people are not aware of all the information in long-term memory but only the fact currently retrieved. These ‘peripheral’ modules can be the underlying psychological drivers and carriers of behavioural change, which represent the automatic system, and interventions can be targeted at triggering the automated processing within such modules.
The distinction between behaviours resulting from internally cued, reflective, and intentional changes versus behaviours resulting from externally cued, automatic and reactive changes is well summarised by Bargh and Chartrand’s (1999, p. 463) review of theories of self-regulation: ‘Fortunately, contemporary psychology for the most part has moved away from doctrinaire either-or positions concerning the locus of control of psychological phenomena, to an acknowledgment that they are determined jointly by processes set into motion directly by one's environment and by processes instigated by acts of conscious choice and will. Such dual-process models, in which the phenomenon in question is said to be influenced simultaneously by conscious (control) and non-conscious (automatic) processes, are now the norm in the study of attention and encoding, memory, emotional appraisal, emotional disorders, attitudes and persuasion, and social perception and judgment. Thus, the mainstream of psychology accepts both the fact of conscious or willed causation of mental and behavioural processes and the fact of automatic or environmentally triggered processes.’

This fundamental distinction is ‘integrated’ in our reflective-automatic model (RAM) of how cognitive and contextual interventions cause behavioural change via activating different processing systems (see Figure 1 for a schematic illustration). Thus, according to RAM, there are three general types of intervention stimuli for behaviour change (the inputs at the top of the diagram) – cognitive cues, incentives, and contextual cues.

Most traditional population-wide behaviour change interventions rely on using cognitive cues, such as arguments and advice (or reasons in general), to provoke reflective mental processing, and as a result to change certain cognitions (beliefs and goals) which can have a direct effect on behavioural responses (e.g., choosing a new course of action congruent with new behavioural goals emerging as a result of updated beliefs about health risks). For example, most research on health-related choices involves persuasion using

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4 We stress here that our model is for behaviour change not understanding behaviour per se.
messages that contain arguments describing either the benefits of adopting a healthy
behaviour (e.g., physical wellness) or costs (risks) of unhealthy behaviours (e.g., heart
disease) (Gray, 2008). Such ‘traditional’ interventions attempt to persuade (or educate)
decision makers to adopt a specific behaviour. Thus, cognitive cues lead to explicit appraisals
of costs/risks and benefits related to different behaviours, and ultimately change beliefs about
such behaviours.

People also respond to incentives, which usually tend to activate both reflective and
automatic processing (e.g., people rationally respond to prices and costs, while they still
overreact to losses relative to gains with an equal magnitude, Kahneman & Tversky, 1979).
As such, behavioural economics has been mostly concerned with how people respond to
incentives. More recently, behavioural economics began to integrate insights from research
on the psychology of decision making into more elaborate explanations of everyday
economic behaviour (see Thaler & Sunstein, 2008). Such research has focused on identifying
a host of systematic biases, many of which are evident in the everyday economic decisions
that many people take (see Kahneman & Tversky, 2000).

RAM also postulates that people respond to various contextual cues which tend to
trigger predominantly the automatic processing systems and thus have a direct effect on
responses (not mediated by changes in cognitions like beliefs and goals). We identify four
types of contextual cues (stimuli), which either activate different mental contents — normative
vs. affective, or differ in the way information is brought to mind — consciously via salient
cues vs. subconsciously via priming cues (these cue types are discussed in detail later on).
We also assume role for habitual responses which are automatically triggered by salient
contextual cues (in the next section we discuss evidence how habits can be changed via
‘reflective’ change in goals).
As a note of precaution, while much is known about the two processing modes, still less is known about how they are distributed over the stimuli that people have to process. However, RAM’s mapping of cues to processing is supported by the literature – i.e. that some intervention stimuli always activate more, but not exclusively, one type of processing than the other. For example, (reflective) arguments might be more effective if presented by someone trusted (automatic processing). However, an argument, as such, does not trigger the automatic system. What triggers it is some ‘irrelevant’ (to the logic of the argument) contextual cue (e.g., a badge on his/her while coat) indicating that the person is an expert. Or, contextual cues might work better if the individual has already introjected goals – i.e. goals favouring a particular action will facilitate that action when it is triggered by a contextual cue, but such goals do not need to work via the automatic system.

Finally, RAM postulates that change in responses can lead to reflective change in attitudes and goals, because people can form beliefs, attitudes and other internal mental states by observing their own behaviour and concluding what cognitions must have caused them. This way behaviour change can also lead to ingrained cognitive change, which can further strengthen and perpetuate the change itself.

Figure 1 also shows the position of the various intervention stimuli for behaviour change (i.e., cognitive cues, incentives, and contextual cues) on a spectrum between total intentional control over behaviour on one side and situational control on the other side (here the stimulus is considered to be parts intervention that brings about the behaviour change). This continuum is an important element of RAM as it indicates the ultimate cause for behaviour change. The continuum illustrates the assumption that whatever the input stimuli, there is always a mix of processes (reflective and automatic) involved in causing behavioural responses. Thus, people are neither in a position of total deliberative (rational) control over their behaviour, nor their behaviour is completely automatic and unconscious.
This view of the interaction between the two processing modes, as a continuum representing the gradual decrease of the power of intentional control over automatic reactions, is also supported by recent models of effortful control of automatic, implicit processing. In particular, MacDonald (2008) presents evidence that such effortful control mechanisms are associated with the ventromedial prefrontal cortex and the ventral anterior cingulated cortex. These mechanisms (which are separate from mechanisms of cognitive/executive control and working memory) enable effortful control of behaviour in the service of long range goals. Such control is most prominent when individuals confront nonroutine tasks that require flexible responses, and plan future courses of action. MacDonald also presents research showing that individuals differ in effortful control of automatic processing in the areas of social behaviour (e.g., aggression, ethnocentrism, sexuality), reward seeking, and emotion regulation. The limited control over automatic processes also speaks about the adaptedness of the automatic responses, even for features like aggression (Daly & Wilson, 1997) and impulsivity (MacDonald, 1995), which are both detrimental in extreme case.

MacDonald (2008) presents evidence that the power of intentional control also varies depending on attention, working memory resources, and reciprocal inhibition from brain areas involved in automatic reactions. For example, there is reciprocal inhibitory interaction between prefrontal cortex (location of control processes associated with reflective processing) and amygdala, which contributes to the regulation of cognition and affect. Motivation is another factor affecting control (e.g., see Petty & Cacioppo, 1986) as well as is opportunity (Fazio, 1990) (e.g., time constraints restrict the slow reflective system). Our novel contribution is in showing that the reflective-automatic balance depends on the ‘intervention stimulus’ and we explicitly describe the inputs that may shift the balance along the continuum
(e.g., affective and/or normative cues will cause stronger automatic reaction when there are no arguments against doing so).

Next we present each of the elements of RAM in more detail and discuss evidence in the literature that supports our assumptions and claims. In the following section, we review the most influential traditional models of behaviour change in order to demonstrate that such models rely on the reflective cognitive system to bring about behaviour change. In our review of this literature, we group the models according to what aspects of individual psychology (mental state) is changed and show that even though these numerous (often complex) traditional models may look different from each other in some fundamental way, they actually, in their own way, effect changes of several mental states. In the subsequent sections, we show how changing the incentives and the context can bring about sustainable behaviour change. Finally, we explain how automatic responses can lead to reflective cognitive change (i.e., the recurrent link from responses back to reflective processing).

Reflective Cognitive Change

Almost five decades of research aimed at changing cognitions in order to engender behaviour change, have been embodied in dozens of theories and documented in hundreds of publications. The domains of application cover most maladaptive and problematic behaviours, which have been the focus of public policy concern. Such topical behaviours include (just to name a few) condom use, use of dental tablets, testicular self-examination, parent-child communication, smoking, skin examination, course enrolment, sunscreen use, visiting an internet site, low fat diet, contraceptive use, exercise, indoor tanning, donating behaviour, sun protective, sexual behaviour, breast self-examination, seat belt use, cycle helmet use, study behaviour, AIDS-risk behaviour, smoking, HIV-preventive behaviour, calcium intake, and others (see Webb & Sheeran, 2006, for a recent review of traditional psychological models and their application).
Such interventions mainly differ in terms of the theoretical basis of the intervention, which all rely mostly on the reflective cognitive system to bring about behaviour change. We group the models according to what aspects of individual psychology is changed, which aims to demonstrate that even though these numerous (often complex) traditional models may look different from each other in some fundamental way, they attempt to change one or more of three psychological variables: beliefs, goals, and habits. We now review the traditional models according to the psychological constructs underlying the theoretical basis of the intervention.

**Changing Beliefs**

The richest cluster of models comprises numerous theories in social and health psychology, which assume that changing various beliefs (cognitions such as knowledge, motivation, intention, perception of threat, outcome expectancy, and perceived behavioural control) produces intentions to change one’s behaviour and these in turn affect behaviour.

*Behavioural Beliefs.* Behaviour change models based on attitude change such as the theory of reasoned action (Fishbein, 1980; Fishbein & Ajzen, 1975), the theory of planned behaviour (Ajzen, 1985, 1991), and the model of interpersonal behaviour (Triandis, 1977) each postulate that behaviour is changed by changes in various beliefs linking the behaviour of interest to expected outcomes (which is the subjective probability that the behaviour will produce a given outcome). It is assumed that these beliefs in combination with the subjective values of the expected outcomes determine the attitude toward the behaviour.\(^5\) Patient-

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\(^5\) Recently, some social psychologists distinguish between explicit and implicit attitudes; the latter are assumed to operate not only as conscious contents but also outside of consciousness (e.g., Gawronski & Bodenhausen, 2006). Some theorists argue that implicit measures (e.g., reaction time) identify implicit attitudes (e.g., Wilson et al., 2000; assuming faster responses to categories associated in memory); others prefer to view the measure itself as implicit, but not the attitude (Fazio & Olson, 2003). We agree with Strack and Deutsch (2004, p. 239) that terms explicit versus implicit should refer to psychological processes but not to mental contents, and that an attitude is ‘a belief following from an evaluative decision that follows from reflection about what is good or bad’, while implicit measures tap into automatic responses that express evaluations (‘action tendencies associated with the evaluative features of the attitude object’).
provider communication theory (Roter & Hall, 1997) also posits that people change beliefs as a reaction to social interaction – in this case it is the effective interactions with a health care provider trying to develop an enhanced relationship with the patient by seeking to understand patient beliefs and values regarding the unhealthy behaviour. To test this model, Coday et al. (2002) trained health-care providers in the field of physical activity to deliver regular contacts with participants, which involved the four communication processes: interpersonal interaction, conflict resolution and negotiation, information and cognition processing, and social influence.

**Normative Beliefs.** Other beliefs (not only attitudinal ones) are also proposed to play role in these theories, which came as an answer to Wicker’s (1969) discouraging finding that behaviours are weakly predicted by general attitudes (e.g., dieting is good/bad). Thus, the theories based on attitude change also suggest that in order to predict and change behaviour, researchers should study what other factors affect behavioural intentions. For example, the theory of reasoned action (Fishbein & Ajzen, 1975) proposes that changing attitudes may not result into behavioural change because of normative (social) beliefs about the perceived behavioural expectations from significant others (e.g., spouse, family, friends, teacher, doctor, boss and co-workers, who may be against the behaviour). It is assumed that these normative beliefs – in combination with the person's motivation to comply with the different significant others – determine the prevailing subjective norm. Therefore, measures of social beliefs (e.g., ‘My friends think that I should/should not do exercise.’) should be an additional factor changing one’s decision to act. Thus, the theory of reasoned action is based on two belief-based independent predictors – attitudes (based on behavioural beliefs) and subjective norms (based on social beliefs). Conversely, the theory assumes that in order to provoke behaviour change, a proper intervention needs to change both behavioural and normative
beliefs (other factors like personality and demographic characteristics are also assumed to affect the intention to act but they are considered as variables external to the theory).

Control Beliefs. In the 80s, researchers realised that many behaviours require more than a good-will, because people may also need opportunities, certain skills, resources, or cooperation from others in order to execute their intentions successfully (Liska, 1984). As a result, people may not intend to change behaviours unless they either believe that the required action is under their own control, or they possess real control over the behaviour in question. This observation gave birth to a new factor – perceived behaviour control (Ajzen, 1985), which is determined by the total set of accessible control beliefs about the presence of factors that may facilitate or impede performance of the behaviour. This new factor transformed the theory of reasoned action into the theory of planned behaviour (Ajzen, 1991). The latter assumed that interventions need to change control beliefs (e.g., For me dieting would be easy/difficult) in addition to behavioural beliefs (attitudes) and normative beliefs (subjective norms) in order to successfully affect intentions to act. The theory also suggests that when perceived control is an accurate reflection of the actual control over the behaviour, then changes in perceived behavioural control can directly affect behaviour and also moderate the relation between goals (intentions) and behaviour (Ajzen & Madden, 1986).

Social-cognitive theory (Bandura, 1977) postulates related concept – self-efficacy beliefs, which are perceptions of personal abilities to perform actions and to achieve outcomes (goals/intentions are assumed to mediate the impact of self-efficacy beliefs on self-regulatory responses). Therefore, increasing self-efficacy should result in behaviour change. The relationships between beliefs, goals and behavioural response are depicted in Figure 1. In this respect, the model of interpersonal behaviour (Triandis, 1977) also assumes that successful realisation of an intended behaviour requires control over the behaviour (or appropriate “facilitating conditions”).
Control beliefs are also targeted in some ‘sociological’ models of behaviour change. Social support theory (Heaney & Israel, 1997) suggests that social contacts influence health behaviour by providing four types of social support – emotional, instrumental, informational, and appraisal, which are provided while engaging in a variety of personal and/or group contacts. For example, peer intervention can enhance perceived behavioural control by fostering participation in decision making about adopting a particular behaviour (e.g., physical activity) and by minimizing environmental barriers and stressors through supportive peer modelling of the target behaviours. For example, modelling of activity by others and direct social support from others appear to be related to physical activity participation (Sallis & Hovell, 1990). And social isolation and lack of social support are influential in predicting physical inactivity (Sallis et al., 1987; Eyler et al., 1999; Steptoe et al., 2003).

Health Beliefs. Changing beliefs about behaviours, control, and social expectations are essential components in only subset of the belief-based models. There are number of models specifically designed to explain health behaviours, which also assume that health related beliefs are main cause of behaviour change. One of the earliest and most prominent model is the health belief model (also known as the health action model), which postulates that individuals will alter health-related behaviour according to the perceived severity of the threat to their health (Chen & Land 1986). The original health belief model, constructed by Rosenstock (1966), was based on four constructs of the core beliefs of individuals based on their perceptions: perceived susceptibility (subjective assessment of the risk of getting the health condition); perceived severity (subjective assessment of the seriousness of the health condition, and its possible consequences); perceived barriers (subjective assessment of the factors that facilitate or prevent adoption of the promoted behaviour); perceived benefits (subjective assessment of the positive consequences of adopting the behaviour). A variant of
the model includes the perceived costs of adhering to prescribed behaviour as one of the core beliefs.

Several other models of health behaviour also assume that beliefs are the ultimate cause of behaviour. *Protection motivation theory* (Rogers, 1983) proposes that two processes determine protective behaviour – threat appraisal and coping appraisal. Threat appraisal refers to beliefs about one’s vulnerability to a disease and about the severity of a disease, whereas coping appraisal refers to beliefs about the efficacy and costs of a recommended response. The theory assumes that this set of beliefs influences the person’s protection motivation (also defined as the intention to perform the recommended behaviour), which is considered the direct predictor of health behaviours (Rippetoe & Rogers, 1987; Rogers, 1983). Beliefs play similar role in progressions through phases of stage models such as the *precaution adoption process model* (Weinstein, 1988; Weinstein & Sandman, 1992). It is worth mentioning that in terms of effectiveness and popularity, protection-motivation theory has shown be best results so far amongst most theories discussed here (with the theory of planed behaviour coming second) as revealed by a recent meta-analysis (Webb & Sheeran, 2006).

*Self-concept beliefs.* Other theoretical models emphasize that people try to behave consistently with beliefs about their self-image (which is invested with meaning and symbolic value). For example, the *prototype-willingness model* (Gibbons, Gerrard, Blanton, & Russell, 1998) posits two routes to behaviour. The first route is similar to belief changing models and suggests that health-protective behaviours are determined by attitudes, social norms, and past behaviour. The second route is model of how social situations provoke engagement in risky behaviours that might overwhelm other goals. This route assumes that people may not intend to perform certain unhealthy behaviours (e.g., smoking and drinking) but might be motivated
to do so if the social circumstances allow them to express their self-image – identification with a worldview that endorses beliefs that, for example, “drinking/smoking is cool”.

Therefore, one’s self-esteem depends on engaging in such ‘cool’ behaviours. Thus, the prototype-willingness model assumes that behaviour change interventions should change beliefs about the behaviours in question in order to discourage health-risk behaviours. There are some documented efforts in this direction. For example, health promotion interventions highlight the costs of risky behaviour for one’s self-esteem by inducing beliefs that ‘smoking causes bad breath, ugly teeth, and impotence’, ‘tanning causes wrinkles’, and ‘exercise leads to an attractive physique’ (see Gibbons et al., 2005, for evidence supporting the effectiveness of such interventions). Changing such beliefs also leads to adopting new goals that protect the integrity and value of the self.

**Changing Goals**

Many traditional models assume that behaviour is not so much driven by immediate stimulation from the environment, but guided by intentional states representing short- and long-term goals. The goal construct, defined usually as internal representations of desired states, is central to theories of self-regulation (see Austin & Vancouver, 1996, for definitions and reviews of the literature), and hence changing goals is assumed to result in behaviour change.

According to *control theory* (Carver & Scheier, 1982, 1998), self-regulation is an ongoing process of comparing one’s performance with a goal (desired state) and adjusting behaviour as a result. According to the theory, there is a hierarchical structure of goals with self-related goals (e.g., be a healthy person) at the top of the hierarchy, abstract action goals (e.g., eat healthy food) in the middle, and courses of action (e.g., eat only salads and fruits for lunch three times per week) at the bottom (Carver & Scheier, 1998; Kruglanski et al., 2002 proposes similar theory of goal-systems). Thus, according to Carver and Scheier (1998),
setting a reference value for performance is the key determinant of subsequent behaviour change, and successful behaviour change interventions involve changing several types of goals – the abstract endpoints (self-related goals) as well as the means (courses of action) of reaching those endpoints.

Similar assumptions are made by the theory of goal setting (Locke & Latham, 1990; Mento, Steel, & Karren, 1987), according to which behaviour changes a result of carrying out specific behavioural tasks as a way to achieve a more general goal. Behavioural goals also play role in the social-cognitive theory (Bandura, 1977, 1998) as a mediator of the impact of self-efficacy beliefs (perceptions of one’s capability of performing certain actions to attain specific goals) in self-regulation.

Interesting approach to self-regulation is proposed by the model of action phases (Heckhausen & Gollwitzer, 1987), which emphasises the temporal aspect (‘phases’) of goal pursuit. Thus, the predecisional phase is the first step in behavioural change, in which the individual contemplates the feasibility and desirability of various goals and selects the one(s) to pursue. In a similar vein, the transtheoretical model (Prochaska & Di-Clemente, 1984) posits that goals should change adaptively according to the person’s motivational readiness for change. The model describes five stages of change through which people progress and in the pursuit and attainment of short and long term goals. The five stages are precontemplation (not thinking about the behaviour), contemplation (deliberating about changing behaviour), preparation (prepare oneself and one’s environment to make behavioural changes), action (initiating the behaviour), and maintenance (continuing to perform the behaviour). Goals play similar role in progressions through key phases of other stage models such as the health action process approach (Schwarzer, 1999). Interestingly, however, most stages-of-change models note the importance of environmental barriers and contingencies in being able to actually change behaviour. These are clearly external cues in the environment affecting
internal cognitions, but such interventions still tend to rely on reflective processes, and hence differ from our framework based on automatic reactions to external cues.

Sociological models also emphasize the importance of changing goals in behaviour change. Social action theory (Ewart, 1991) emphasizes social interdependence and interaction in personal control of health-endangering behaviours and proposes mechanisms by which environmental structures influence cognitive action schemas, self-goals, and problem-solving activities critical to sustained behavioural change. Social action theory also clarifies relationships between social and personal empowerment and helps explain stages of self-change. For example, according to social action theory, supportive patient–peer mentoring may be superior to enhanced patient–provider communication as an intervention model for behaviour change.

In summary, there is no really an optimal level of specificity with goals, as it is good to form goals at all levels of abstraction (as in the hierarchical structure of goals proposed by control theory, Carver & Scheier, 1982, 1998), but as a rule of thumb, more specific goals are better for behavioural attainment. Finally, even though goal-setting is a popular and powerful method for behaviour change, there are still certain challenges involved in altering one’s behaviour to meet a desired new goal. Such obstacles are ego-depletion (which is a lack of cognitive resources to plan, control and suppress unwanted impulses, Baumeister, Bratslavsky, Muraven, & Tice, 1998), delay of gratification (which causes discounting of the value in attaining the immediate goals, Metcalfe & Mischel, 1999), and attentional myopia (limitations on attention can lead to loss of control by focusing on the most salient cue, Mann & Ward, 2007).

Changing Habits

This type of behavioural change interventions are best exemplified by models of habit development and habit change (e.g., see Wood & Neal, 2007). An implicit goal of many
behaviour change programmes – including those to treat obesity – is that the new behaviours should become habits, that is, become automatic and no longer require conscious effort. Habits have been defined as ‘behavioural dispositions to repeat well-practiced actions given recurring circumstances’ (Wood, Tam, & Witt, 2005) and are assumed to develop through repetition of the behaviour (e.g., smoking or reading the news) in the presence of consistent stimuli (e.g., coffee, home), environment, or context (Neal, Wood, & Quinn, 2006), which leads to habits being automatically cued by environment and easier to perform over time. For example, simply repeatedly eating or exercising in the same context can result in increased automaticity when the contextual stimuli are present. Wood and Neal, (2007) argue that habits are usually the consequence of past goal pursuit and they arise when people repeatedly use a particular behaviour (e.g., drinking) in particular contexts (e.g., dinner table) to pursue their goals (e.g., relaxation and socialising). However, once acquired, habits are performed without mediation of a goal to achieve a particular outcome, and they can be triggered just by relevant context cues (e.g., sight and taste of food provokes desire to drink without the purpose of social relaxation). But then habits start to impede the achievement of new goals (e.g., healthy diet). In this respect habits more act as constraints on behaviour change, not as mechanisms for behaviour change.

An important characteristic of habits is their resistance to change, even when they are in opposition to intentions (Neal, Wood, & Quinn, 2006; Oullette & Wood, 1998) and behaviour change interventions are less successful at changing habitual behaviours (those performed frequently in consistent contexts) than non-habitual behaviours (Webb & Sheeran, 2006). Thus, frequency of behaviour and stability of the context of behaviour can both affect the power of intentions over behaviour change, because these circumstances are conducive to habit formation, which is also confirmed by research on skill acquisition and automaticity (Wood, Quinn, & Kashy, 2002).
In other words, habits are particularly hard to change in frequent behaviours in stable environments (e.g., seat-belt use), but easier to change in irregular behaviours and new environments (course enrolment). Interventions providing information against bad habits (like various models of health behaviour) may not be very efficient also because people pay less attention to information about their habits and are therefore less likely to form intentions in opposition to them even when the information provided is convincing (Aarts, Verplanken, & van Knippenberg, 1997; Verplanken, Aarts, & van Knippenberg, 1997).

Because of their power over behaviour, habits also play a role in some conventional models of behaviour. For example, the model of interpersonal behaviour (Triandis, 1977) assumes two moderators of the behavioural realisation of an intention – one is the person’s actual control over the behaviour, and the second is the degree to which the behaviour is habitual. Thus, the impact of beliefs, intentions and goals on behavioural change is reduced if a particular behaviour is frequently performed, because in this case habits are likely to take control.

Wood and Neal (2007) argue that the most effective behavioural interventions for habit change involve two main objectives. First is the control of habit cuing, which involves a) removing or avoiding people, places, and other cuing stimuli, b) effortful suppressing habitual response when cued (which also requires to pay attention and be vigilant whenever in habit triggering contexts), and c) associating the triggering cue with an incompatible response. Second key objective is to learn a new desired response to an environmental cue that usually triggers unwanted habitual response.

Behavioural interventions can also be used to develop certain habits that are good for the individual (e.g., healthy habits). Such behaviour change is accomplished by using the process of context-dependent repetition. Lally, Chipperfield and Wardle (2008) successfully used such behavioural intervention – delivered as advice on weight control, which was
underpinned by a theory related to habit formation (this is the first and only study, so far, demonstrating development of health habits). Their advice on context-dependent repetition (“Try to eat roughly at the same times.”; “Plan ahead to find ways to incorporate the behaviour into daily routines.”) relied on both automatic systems (repetition) and reflective systems (planning). Healthy habit formation might also be accelerated by forming implementation intentions (Gollwitzer & Brandstatter, 1997), which are plans that specify when, where and how the behaviour will be performed (i.e., something like specific elaborated goals).

In this respect, Wood and Neal (2007) explain that personal goals can guide the formation of habit-cue associations, but when habits and goals are both present to guide behaviour, then under some circumstances people respond habitually and under others they exert regulatory control to inhibit the cued response (and may even perform a more desired one). Wood and Neal (2007) also allude that the habit-goal interaction might be explained by dual-processing theories that hypothesize a specific interaction between automatic associative processes and controlled rule-based processes (Chaiken & Trope, 1999; Smith & DeCoster, 2000).

Because of their automatic nature, habits may be interpreted as belonging to the category of behaviour change models that rely on the automatic system. However, habit development and habit change require conscious repetitive efforts and goal change, which is not required by our approach based on changing the context (e.g., the person may not even want to change her behaviour – she is just facilitated in selecting the right action). In summary, habit change requires reflective conscious goals (e.g., I have to hide the cigarettes away before I sit down to have my morning coffee. I also have to make plans how to avoid provoking situations and how to suppress responses.). Wood and Neil (2007) propose a precise model of the interaction between goals and habits interact and how that may lead to
habit suppression and extinction. Thus, habit change does not involve triggering automatic mental processes as a result of changing the choice context. Thus, the example of habit change is a good way of distinguishing between cognitive change (via establishing new goals, see Figure 1) and contextual change, as it indicates that RAM relates to behaviour change and not to explaining behaviour per se.

The Role of Context in Explaining Behaviour Change

All traditional models, discussed so far, focus on changing internal psychological variables in order to provoke behavioural change, which is consistent with the general focus of modern psychology (and economics) on explaining behaviour as caused by internal mental constructs (as opposed to situational factors). However, Webb and Sheeran (2006) provide evidence that whenever considered, environmental (contextual) change can produce effects comparable to standard interventions, which is based on a systematic review of experimental studies of the impact of changing peoples’ intentions on subsequent behaviour change.

In particular, Webb and Sheeran (2006) rank the traditional behaviour change theories according to their effectiveness (see Table 4 on p. 259). Belief change models (discussed here) seem to be the most frequent and most successful theoretic basis for interventions. However, whenever the environment is considered, as in interventions based on ‘gain versus loss framed messages’ and the elaboration likelihood model (Petty & Cacioppo, 1986), this has produced effect sizes comparable to other traditional models.

For example, ‘gain versus loss framed messages’ (i.e., framing messages in terms of benefits or detriments) comes out third in the theory ranking; and this intervention strategy relies on automatic cognitive evaluation of information, which is triggered by particular ‘framing’ of the choice environment. Such framing manipulations (first discovered by

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6 Apart from interventions aiming at habit change, which, in addition to changing goals, also rely on externally cued repetitions (Lally, Chipperfield, & Wardle, 2008).
Kahneman & Tversky, 1979) can influence whether people encode the choice information in terms of gains or losses relative to some psychological reference point, such as current health. As an example, Banks et al. (1995) demonstrate that, due to loss-aversion, loss-framed persuasive messages emphasizing the risks of not obtaining mammography have stronger impact on behaviour promotion (mammography) than gain-framed messages emphasizing the benefits of obtaining mammography, even though both messages are factually equivalent. Webb & Sheeran (2006) review similar interventions promoting sunscreen use, exercising, breast self-examination, and cancer self-examination (but, admittedly, there have been few effective interventions which use this approach, and it is still in the domain of psychological theorising). In general, gain-framed health messages have been found to elicit greater behavioural intention for prevention (health-promoting) behaviours while loss-framed messages have been found to elicit greater behavioural intention for health-detecting behaviours (see McCormick & McElroy, 2009).

In the elaboration-likelihood model (Petty & Cacioppo, 1986), there are two routes to persuasion (and social judgment) – the central route is involved in elaborate information processing, while the peripheral (heuristic) route relies on contextual characteristics of the message, like, for example, the perceived credibility of the source, quality of the presentation, and the attractiveness of the source.

Contextual change has a powerful effect even when considered as a separate method without being part of some theoretical framework (in general, interventions use behaviour change methods independently of their theoretical basis). Webb and Sheeran (2006, p. 259) estimated the success (in terms of effect sizes) of the behaviour change methods used, which refer to the specific strategies used in the intervention to promote behavioural intentions. At the top of the ranking are interventions that incorporate incentives (usually offering some financial reward) for behaving or remaining in the program and social encouragement or
support, which tend to have medium effects on behaviour. In the middle of the effectiveness range are the environmental interventions alongside interventions that provided information regarding behaviour and outcome that specified a goal or target, included questions on the material, persuasive communication, modelling or demonstration by others, efforts to increase relevant skills, a personalized message, or risk awareness material.

In addition, contextual change interventions also involve other elements like building infrastructure, incentives (e.g., changing prices), introducing rules (legislation, regulation) involving sanctions (e.g., smoking ban, compulsory seatbelts), which have also proven as very effective in behaviour change (Chaloupka & Grossman, 1996; Chaloupka, Grossman, & Saffer, 2002; Manning, Blumberg, & Moulton, 1995). For example, recent reviews reporting comparative estimates of the cost-effectiveness of behaviour change interventions support our conjecture that environmental interventions are at least as effective as tradition interventions. Müller-Riemenschneider, Reinhold and Willich (2009) evaluated the cost-effectiveness of eight physical activity interventions targeted at healthy adults and tried to identify cost-effective intervention components. The really interesting result is that environmental interventions have the potential to be substantially more cost-effective than more tradition behavioural interventions (e.g., phone delivered or mailed intervention messages/materials, center-based behavioural skill training, consultation with exercise development officer, counselling sessions, advise by General Practitioners). Thus, the environmental intervention that came out on top of the cost-effectiveness ranking was an intervention conducted by Wang et al. (2004) included the development of four bicycle and pedestrian trails as a way to promote health behaviour (although this study is not based on some underlying psychological model explaining the effects of the environmental change).

In summary, the results presented in this section demonstrate that basic environmental changes, often classified as ‘behavioural facilitations’ or ‘supportive
environments’ (e.g., when providing more opportunities for exercise and for healthier food choices, Caballero et al., 1998), can have impact comparable to other more commonly used approaches. RAM’s cognitive and contextual routes to behaviour change offer the possibility to ground such environmental interventions on the underlying psychological principles (which also offer the possibility to develop new and even more powerful interventions). In the next section, we discuss behavioural economics and the role of incentives, which is the intermediate case on the reflective-automatic continuum, and as such, provides an opportunity to explain some of the existing environmental interventions.

Incentives for Behaviour Change

Behavioural economics integrates economic theories with knowledge from psychological research on human decision making. Most of the research in behavioural economics, so far, has focused on identifying a host of systematic biases many of which are evident in the everyday economic decisions that many people take. As such, behavioural economics has been mostly concerned, broadly, with how people respond to incentives – and the landmark model in this field, prospect theory (Kahneman & Tversky, 1979), describes how people actually make risky financial decisions. More recently, behavioural economics also seeks to integrate insights from experimental work on decision making into richer explanations (distinct from standard economic and psychological accounts) of economic and social phenomena (e.g., Kagel & Roth, 1995; Sheffrin, 1999; Simon, 1992) and even everyday human behaviour (see Thaler & Sunstein, 2008; Ariely, 2008).

The evidence shows that most people do not act as fully rational individuals who behave in their self-interest. Instead, our everyday decisions are affected by our physical and emotional states, by our habits, by the decisions of others, by inertia, by problems of self-control, and by a range of heuristics and framing effects, including ordering effects and biases in favour of the status quo (see Kahneman & Tversky, 2000). All these effects are caused by
automatic mental processes, which are often activated by characteristics of the decision environment (i.e., our health or other behaviours are affected by a range of contextual factors). However, there also might be very good considered reasons for behaving in these ways (e.g., people may be consciously loss averse to avoid future regret, Zeelenberg, 1999) and therefore incentives can also operate on the reflective processes. Thus, rational calculation is also a useful benchmark as far as standard economic factors, such as risk-aversion and discounting, explain part of human rational behaviour. As such, according to RAM, behavioural economics (incentives) is subject to both reflective (rational) and automatic psychological processes.

Not surprisingly, the automatic psychological mechanisms causing the various biases seem fairly resistant, for example, to conventional information-based education and advice (see Benartzi & Thaler, 2007, for such evidence in the financial domain). One approach to help people is to learn about the biases, introduce regulations that recognise their presence and offset their effects in the least intrusive fashion possible. Another is to utilise these biases in order to ‘lead’ people into making the choices that maximise their welfare (e.g., Thaler & Sunstein, 2008). Next we consider two such incentive-based interventions: the use of economics incentives and commitment devices (commitment involves choice of a future state that requires some action and imposes some cost, i.e. incentive, otherwise).

**Economic Incentives**

We respond to prices and costs. Some of these responses are rational and reflective in nature. For example, most demand curves – the graph depicting the relationship between the price of a certain commodity and the amount of it that consumers are willing to purchase at that given price, slope downwards from left to right (Kreps, 1990). In other words, higher cost reduces our desire to consume (e.g., for health related consumption see Chaloupka, Grossman, & Saffer, 2002; Colman, Grossman, & Joyce, 2003; Manning, Blumberg, &
Moulton, 1995). However, the subjective perception and evaluation of such incentives can also result from automatic process. Consider, for example, phenomena like loss aversion (Kahneman & Tversky, 1979), which shows that losses and gains of equal magnitude do not have equal effect on people (contrary to what rational deliberation should conclude), and instead losses are twice more psychologically powerful than gains. For example, most people reject a gamble that offers 50/50 chance to win $100 and lose 100$, which offers an expected value of zero (actually, most people will reject a win $150/lose 100 gamble and accept to play this bet only if they can win around $250). Such a response is often caused by automatic emotional responses in the brain (De Martino, Kumaran, Seymour, & Dolan, 2006; see also Kahneman & Frederick, 2007, for arguments supporting this interpretation of loss aversion). However, loss aversion can also be a ‘rational’ considered response, if, for example, people have explicit reasons to avoid future losses – for example, because they wish to avoid future regret (Zeelenberg, 1999), social/family blame when incurring a loss, or due to lack of resources to afford it. In other words, often it is the interpretation of economic incentives what matters not the incentives per se. In summary, economic factors are shown to influence behaviour (even though their impact is a function of various psychological processes) and incentives can be used as drivers of behaviour change.

Many of the important questions of public policy relate to how individuals respond to various kinds of incentives like price (cost) and benefits. Thornton (2008) reports an example of economic incentives at work in a field study conducted in Malawi. The behaviour problem, however, is that many of those tested for HIV/AIDS do not pick up their result (note that half of the spending on HIV/AIDS prevention in Africa is on “know your status” campaigns). Thornton demonstrates that offering small incentive can get people to pick up their HIV result. The key observation is that the biggest jump is between zero and very small incentive – 10-20 cents which is about one-tenth of a day’s wage is enough to increase take up by 50%
(but if it takes about an hour to pick the test up then this is about equal to the wage rate – so actually the incentive may not be small at all). Offering more money further affects behaviour but to a much less degree. Thus, the interesting result is the jump between zero and 'something', which does not have any effect on one’s total wealth; but this result demonstrates the psychological principle (first shown by Kahneman & Tversky, 1979) that people’s reference points change depending on the context (in this case the reference is zero since nobody has ever been paid to pick up a test result).

Similar effects of small incentives is reported by Duflo, Kremer, and Robinson (2009) in field study in Kenya, which showed that small time-limited reductions in the cost of purchasing fertilizer at the time of harvest induce substantial increases in fertilizer use, as much as considerably larger price cuts later in the season. This intervention was based on a modelling of farmers’ decisions as present-biased (over-discounting their future utility) and partially naive (underestimating the odds that they will be impatient in the future), which leads to procrastination and postponing purchasing fertilizer until proceeds from the harvest are spent. Thus, known behavioural biases in the way people react to economic incentives can be used to improve human welfare.

Commitment

We act on costly or public pre-commitments. Asking people to pre-commit is useful because we tend to procrastinate when we delay taking an action in spite of being aware that prompt action would be better. Most people are even aware of their will-power weaknesses (e.g., tendency to procrastinate or overspend) and look for commitment devices which bind them to the ‘right’ course of action. Commitment is making a choice of a future state of the world that requires some action and imposes some cost otherwise.

The decision to pre-commit is rational and reflective – one realises her weak behavioural control and tried to find ways to enforce behavioural change. However,
commitment relies on several automatic psychological processes too. The most general process, which plays role in all commitment devices, is the non-linear (hyperbolic) discounting of the future – people tend to overvalue the present and undervalue the future consequences including costs and benefits (Frederick, Loewenstein, & O'Donoghue, 2001). There are existing models of consumption over time, which often incorporate such hyperbolic or quasi-hyperbolic preferences in order to predict that individuals are more impatient for immediate trade-offs (immediate vs. delayed reward) than for future trade-offs (between two delayed rewards) (Laibson 1997; O’Donoghue & Rabin 1999; Frederick, Loewenstein, & O’Donoghue 2001). Such models are also supported by experimental evidence for preferences having approximately hyperbolic shape, which require a high discount rate in the immediate future and a lower rate between intervals that are farther away (Loewenstein & Prelec, 1992). Thus, present or immediate costs/benefits are unduly salient or vivid in comparison to future costs/benefits. For example, adopting new (e.g., healthy) behaviours require a delay of immediate rewards for greater future rewards and is thus considered particularly difficult for individuals who have such hyperbolic preferences or self-control problems.7 Note that such automatic cognitive reactions are not something most individuals are fully aware of, nor are they able to predict they will succumb to it. As a result, people are happy to accept the possibility for future costs for both the action (e.g., dieting or exercise) and the cost otherwise (e.g., paying a fine if not losing weight).

In addition, commitment devices can be grouped depending on the type of cost imposed for not doing the chosen action. So far, there are three major types of costs that have been documented in the literature – economic, social, and physical costs, the reaction to which is both reflective and automatic in nature.

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7 Such variability between individuals in terms of discounting function implies that interventionists can identify individuals (by measuring their time preferences) who are at risk of developing behaviour related health problems (e.g., obesity).
Economic cost is imposed when an individual incurs a financial lost as a result of not fulfilling one’s commitments. Imposing costs has an effect on people because imposing financial loss automatically trigger loss aversion (Kahneman & Tversky, 1979). Therefore, charging people if they fail to do something will be more motivating than rewarding them with the same amount if they do by a factor of two. For example, people may impose on themselves penalties for failing to act according to their long-term goals (Trope & Fishbach, 2000). Such penalties serve as external deterrents against failure to keep up with long-term plans (e.g., paying a cancellation fee for missing a medical check-up). Ariely and Wertenbroch (2001) also report that students are willing to self-impose costly deadlines to help them overcome procrastination. The loss-gain asymmetry has interesting policy implications about the effectiveness of tax credits – reducing the tax owed alleviates the income loss, which should have stronger impact on behaviour than direct benefits. But rewards can also be used, if the person is made aware that she will lose the reward if failing to act. Brickman (1987) suggests that instead of receiving a reward unconditionally, another way to precommit is by making incentives contingent on acting according to one's long-term interests (i.e., only if one acts according to his or hers long-term interests). For example, Trope and Fishbach (2000, p. 494) suggest that “people may prefer to receive a bonus for actually completing a painful medical checkup than for merely agreeing to do it”.

Social cost is imposed when the individual commits by publicly promising to undertake a particular course of action. Making public promises also has an automatic psychological effect, because breaking such promises can lead to reputation loss, which endangers one’s self-image and people instinctively (and automatically) strive to achieve and maintain positive self-image – the main axiom of the celebrated social identity theory (Tajfel & Turner, 1986). For example, when people are assigned to a group, any group, they automatically think of that group, as an in-group for them, as better than the alternative, an
out-group for them, and do so basically because they are motivated to achieve and maintain a positive self-image. Tesser's (1986) *self-evaluation maintenance model* makes similar predictions about the often automatic nature of the social comparison process and a person’s attempts to maintain or increase his/her own self-evaluation. Loss of reputation may also prompt existing beliefs that one will be rejected, disliked, or will not be trusted, if he/she does not keep such promises. Failure to stick to social norms (e.g., to keep one’s promises) can also result in real punishments, the most feared of which is exclusion from the group (Bicchieri, 2006).

Physical costs are imposed when people put some barrier to some action they want to avoid (and overcoming this barrier in not impossible but requires some effort). For example, to avoid overspending people like saving in non-interest bearing Christmas clubs which do not allow withdrawals for a certain period (Wertenbroch, 1998). Other studies suggest that people may also pre-commit themselves by eliminating action alternatives, which makes a decision in favour of long-term interests irreversible (e.g., see Thaler, 1994). Another commitment strategy is to have separate ‘mental accounts’ for example for ‘money to spend’ versus ‘money to invest’ (Shefrin & Thaler, 1988). Thaler and Benartzi (2004) discuss the results of a ‘save more tomorrow’ plan which allows employees to pre-commit to increase their contribution (savings) rate in a 401(k) pension plan whenever they get a pay raise (but other factors also play a role here, such as delaying the salient immediate cost of foregoing current consumption). After two years, participants in this scheme had nearly quadrupled their saving rate.

More recently, Ashraf, Karlan and Yin (2006) provided empirical evidence in the developing world, which suggests that individuals identified as having hyperbolic preferences also desire commitment devices (express a preference for commitment). In particular, this study designed a commitment savings product for a Philippine bank, which was intended for
individuals who want to commit now to restrict access to their savings. It turned out that
women (who are traditionally responsible for household finances and in need of finding
solutions to temptation problems) exhibited impatience over near-term trade-offs, but
patience over trade-offs between longer-term outcomes (so they were more willing to wait
longer to receive the higher benefit when the two time points were further in the future), and
they were significantly more likely to open the commitment savings account.

In summary, incentives can be both financial and psychological, and can offer
powerful tools for behaviour change, because they trigger, to some large extent, both
processing systems. As such, incentives involve both cognitive and contextual change. So far,
the effects of incentives on behaviour are studied mainly within the domain of behaviour
economics, which has relied mostly on experimental evidence and to a lesser degree on field
studies (but see DellaVigna, 2009, for a recent review of field evidence). In this respect, there
are some limitations of applying results of behavioural economics to population behaviour
change (e.g., in health) as there are few long terms studies and randomised controlled trials,
and few process studies. Therefore, future research should target these limitations in order to
provide solid evidence for population-wide interventions and public health policy.

Contextual Cues for Automatic Change: SNAP decision-making

Behaviour change through the reflective system – through changes of the individual
‗psychology‘ – is clearly important and we recognise that the most effective changes in
behaviour will come about when reflective and automatic systems work together in some
sense. We also recognise that external cues in the environment affect internal cognitions that
are mediated by reflection; for example when our spontaneous thoughts, associations, drives,
and desires determine our next course of action (though these are arguably much less
amenable to change). Our main claim is that population-wide interventions for behaviour
change, which operate mainly through the automatic processes, have been relatively
neglected in psychological theories and models of change. This alternative route to behaviour change is embodied in RAM (Figure 1).

Thus, as part of RAM, we propose a new framework that has important implications for interventions aimed at changing behaviour. Our main proposition is that the choice context (i.e., the environment/situation within which an individual acts and makes choices) triggers automatic cognitive processes that influence action. Our framework is based on four principles (concepts) in human behaviour, discovered by researchers in psychology, which, when developed as methods for behaviour change, can have powerful effect on choice of action. The framework is called SNAP, which is an acronym for the following four principles: Salience, Norms, Affect and Priming. SNAP also means being impulsive, spontaneous, instant, spur-of-the-moment, the antonym of being considered and reflective, which is exactly what the automatic system represents.

These four concepts point to behaviour change methods that are somewhat different from the existing methods in much of psychology and behavioural economics, and thus represent an alternative, novel and coherent approach to behaviour change. None of these methods require any change of cognitions, but instead represent aspects of the choice environment, which trigger already existing cognitive processes that, in turn, produce choice of actions beneficial for the individual. The four methods governing behaviour work in the following way:

*Salience* – we attend and respond to information that is novel and salient

*Norms* – we take cues from what others do and society approves

*Affect* – we behave according to feelings

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8 Note that a substantial share of research on individual behaviour change in clinical psychology is based on learning theory – classical conditioning and instrumental conditioning, which are both automatic processes (Dickinson & Balleine, 2002; Mackintosh, 1983). However, this is not true of population level behaviour change research in psychology, which mainly uses ‘persuasion’ (or education) campaigns that rely on rational/reflective processing of the provided information (see Norman, Abraham, & Conner, 2000; Shumaker et al., 2008).
A Dual-Route Model of Behaviour Change

**Priming** – we respond subconsciously to stimuli

According to RAM, these four principles are part of the automatic processing system of the brain. Thus, instead of changing mental states, SNAP offers principles that interventions can use to trigger existing psychological forces. Here we describe in more detail the meaning of each principle and provide some evidence on how these psychological forces have been used to change behaviour in laboratory and field settings.

**Salience**

The salience of a stimulus – be it an object, a person, etc. – is its state or quality of standing out relative to neighbouring stimuli. Salience detection is considered to be a key attentional mechanism that facilitates learning and survival by enabling organisms to focus their limited perceptual and cognitive resources on the most pertinent subset of the available sensory data. Thus, attention processes make people to respond to things that are novel and salient and thus can lead to behaviour change. Note that attention can either be voluntarily controlled, or, it can be captured by some external event. The former type of control mechanism is referred to as endogenous, top-down, or goal driven attention (Arvidson, 2003; Posner, 1980; Yantis, 1998). An example of endogenous attentional mechanism is the attention we are paying to the traffic light at a crossroad. The latter type of mechanism is referred to as exogenous, bottom-up, or stimulus-driven. An example of this would be the attention shift from our driving due to a sudden noise. These two mechanisms have different characteristics: endogenous attention is voluntary, effortful, and has a slow, time course, while exogenous attention draws attention automatically and has a rapid time course (Chun & Wolfe, 2001). The interaction between the two types of attention leads to different degrees of focusing on something – for example, we can try to concentrate harder on some characteristics of the road than on others – hopefully to good effect, but perhaps sometimes we focus on these characteristics simply because they ‘grab’ our attention.
The latter ‘bottom-up’ type of attention is relevant for behavioural change interventions, because it is triggered by salient cues in the environment and has an automatic effect on the mind and behaviour. This suggestion is supported by evidence that the salience principle is implemented as a separate neurophysiological mechanism in the brain. Zink et al. (2004) present evidence that the striatum processes salient events in general (when an attentional switch or behavioural switch is elicited). In particular, Zink et al. (2003) demonstrated striatal responses to the salience of neutral events, while Zink et al. (2004) show that the dorsal and ventral striatum’s involvement in reward processing depends on the salience associated with reward, rather than value or hedonic feelings.

*Salient attributes guide decisions.* Because of these automatic effects on attention, salience can focus attention on the most important (relevant) dimension for judgment, which can simplify the information in choice environments. This can have a dramatic effect on behaviour, because of the problems people usually have with making direct comparisons between items that vary on multiple dimensions. There is evidence that when people try to compare complex (multidimensional) items, they can reliable do so only after constructing reasons (i.e., qualitative arguments or justifications) that allow them to put the items on the same scale (i.e., on a single dimension). The evidence for this comes from studies showing that people automatically tend to make judgments one attribute at a time (starting from the most important one); as in Simon's (1956) notion of ‘satisficing’, Tversky’s (1972) ‘elimination by aspects’ theory, and Gigerenzer and Goldstein’s (1996) ‘fast-and-frugal’ family of algorithms, which all involve such sequential application of one reason at a time to eliminate unsatisfactory choice alternatives. In all these models, there is no integration but rather an automatic substitution of pieces of information, which is corroborated by earlier evidence by Shepard (1967) who reviewed experimental tests showing that teachers, physicians, and other professionals who claim that they use seven or so criteria to make
judgments (e.g., when grading papers or making a differential diagnosis) in fact often used only one criterion.

Focusing on one dimension at a time is well exemplified in studies asking people to predict their life satisfaction. Schkade and Kahneman (1998) found that people tend to focus on a single salient difference between two areas in US, California and Midwest, such as climate, which strongly influenced judgments of residents’ life satisfaction in these states. In particular, while residents in each state (California and Midwest) reported the same level of personal life satisfaction, when they were asked to rate the life satisfaction of a resident in the other state, both groups rated Californians as having greater life satisfaction.

Simplifying the information in choice environments is also necessary because complexity, or having many options to choose from, and the subsequent confusion may lead people to inaction or wrong choices. This phenomenon of ‘choice overload’ has been documented by Schwartz (2005) and other researchers. Madrian and Shea (2001) provide evidence that people procrastinate when they have to make complex decisions. Iyengar and Lepper (2000) showed that 3% of consumers bought jam when there were 24 flavours on display whereas 30% did when there were 6 flavours on display (even though 60% sampled the jams in the former and 40% in the latter condition). Perhaps consumers lack the confidence to decide because the cognitive overload of considering a large number of possible choices might lead them to make mistakes (Diehl, 2005). Another illustration of the perils of ‘too much choice’ is that of the Medicare Prescription Drug Plan in US which offers various drug discount cards that differ in monthly premiums and deductibles. Enrolment in the plan is low since most senior citizens find the task of choosing a card overwhelming and fear selecting the wrong card (Botti & Iyengar, 2006). In summary, if confusion is a reason for procrastination, then making the important information salient might be effective in enabling people to make the right choices.
Some of these issues caused by complexity, and solved by salience, are illustrated by Dupas’ (2009) field experiment testing whether information on HIV risk can change sexual behaviour among teenagers in Kenya. Providing information on the relative risk of HIV infection by partner's age group led to a 28% decrease in teen pregnancy (and 61% decrease in the incidence of pregnancies with older, riskier partners). Self-reports also suggested increase in protected sex with same-age partners. In contrast, the national HIV education curriculum provided general information about the risk of HIV and did not inform of the risk distribution in the population, which had no impact on teen pregnancy. These results suggest that teenagers are responsive to risk information that would enable them to reduce the intensity of their exposure to risk while remaining active. This study illustrates the effectiveness of the salience method, because choosing between partners is a complex multidimensional choice subject to various social and situational factors (e.g., adult men may have a financial advantage over teenage boys in negotiating for unprotected sex), which leads to inaction or wrong choices. By making the age of partner salient, the intervention reduced a complex situation to a decision along a single attribute, which enabled the teenagers to select behaviours that improve their welfare.

Salience causes narrow focusing. People have limited attention span, and choice is affected by anything that falls within this focus. In this respect, the popular term ‘paying attention’ properly epitomizes this mental property – we must ‘pay for it’ by not attending to something else. Researchers have shown how the relevance/importance of choice attributes (or alternatives) is affected by errors in focusing, which lead some relevant information to be out of focus to individuals when they form judgments. In other words, relevant information is taken into account only if it is in focus. For example, Mann and Ward (2007) show that when attentional resources are restricted, individuals can focus only on the most salient behavioural cues and neglect more distal stimuli, which leads to actions that are under motivational
influence of those silent cues. In particular, people respond to health-relevant messages and exhibit successful self-control when salient cues suggest restraint in the domains of eating, smoking, and aggression.

Wilson et al. (2000) found evidence that the focusing bias produces errors in affective forecasting. Specifically, football fans tend to overestimate how long their happiness will be affected by the outcome of a game because they focus only on the event in question and ignore other events that can also affect their well-being. In line with the focusing hypothesis, Jones, Frisch, Yurak, and Kim (1998) show a framing effect distinguishing between decisions defined as ‘choices’ (e.g., Should I move to New York or stay in Chicago?), which make people pay equal attention to each of the available options, and, those defined as ‘opportunities’ (i.e. Should I move to New York?), which make people focus their attention on the single option that is explicitly represented and ignore other possible alternatives (which are represented only implicitly).

Idson et al. (2004) showed that in competitive situations, focusing failures represent a tendency to overweight one’s own perspective, and underweight perspectives of others and external forces; and as a result the decisions of other players and the rules of the game tend to be out of focus, which leads to systematic errors in judgment. This results suggests that McCaffrey and Baron (2004) demonstrated that people evaluated tax related choice-problems on the basis of the social norm (e.g., “help children,” and “expect the rich to pay more than the not-rich”) made most salient by the formal description, ignoring the other norms. Thus, this study showed that focusing on the salient norm leads to preference reversals in an area (taxation judgments) where independently attractive goals are often in conflict (or incompatible).

Finally, some interventions have already used salient cues to promote healthy eating by positioning the healthy foods at the beginning of the queue in canteens and at the most
visible place, while less healthy foods are positioned last and at the least visible places (Thaler & Sunstein, 2008, pp. 1-3, report a successful application of this principle). This example also illustrates how interventionists can modify salience in the health behaviour context – bringing something under attentional focus is often a good ‘reason’ for people to select it over (otherwise more preferable) items that are out of focus (possibly due to short-term memory capacity being limited to around four items (Cowen, 2001), which leaves unattended items out of the consideration set). This bottom-up approach to produce salience is contrasted with top-down approaches that rely on provoking enhanced sensitivity to, or active attentional search for, certain cues in the environment. For example, a reminder of someone who has died of cervical cancer could increase the salience of information on cancer screening.

**Norms**

Social and cultural norms are the behavioural expectations, or rules, within a society (or group), which are used by the latter to control for appropriate and inappropriate values, beliefs, attitudes and behaviours (Bicchieri, 2006). These rules may be explicit (publicly declared) or implicit (unspoken), conscious or unconscious. Social norms inform people what behavioural options are acceptable and desirable by others. Decades of research have firmly established that social norms guide action in direct and meaningful ways (Aarts & Dijksterhuis, 2003; Cialdini, Kallgren, & Reno, 1991). The rationale for the power of social-norms in changing behaviour is based on the fact that people take their cues from what others do and use their perceptions of peer norms as a standard against which to compare their own behaviours (e.g., Clapp & McDonell, 2000; Perkins & Berkowitz, 1986). According to the focus theory of normative conduct (Cialdini, Kallgren, & Reno, 1991), *descriptive norms* refer to perceptions of what is commonly done in a given situation, *injunctive norms* refer to perceptions of what is commonly approved or disapproved within the culture. Focus theory
predicts that if only one of the two types of norms is prominent in an individual’s consciousness, it will exert the stronger influence on behaviour (Cialdini & Goldstein, 2004).

Goldstein, Cialdini, and Griskevicius (in press) tested whether a hotel-towel reuse sign conveying information about social norms might be more persuasive than a sign widely adopted throughout the hotel industry. One sign was designed to reflect the basic environmental-protection message asking guests to help to save the environment and show their respect for nature by participating in the programme. A second sign utilised the social-norm information with the truthful message that most guests at the hotel recycled their towels at least once during their stay. The descriptive-norms message made customers 26% more likely to recycle their towels than those who saw the basic environmental-protection message. A third type of message conveyed that most previous occupants of the room had reused towels at some point during their stay, which had even stronger effect on recycling behaviour, producing 33% increase compared with the standard environmental appeal. Obviously, we often unconsciously and automatically want to conform to what others, with whom we have something in common, usually do or imply we should do.

Conveying certain social norms may automatically provoke detrimental behaviours too. Cialdini (2003) placed a pair of signs in different areas of a national park. The first sign urged visitors not to take wood and depicted a scene showing three thieves stealing wood, which resulted in visitors (after seeing that sign) becoming over twice as likely to steal than before. What made visitors half as likely to take wood was a sign depicting a single thief – indicating that stealing is definitely not a social/collective norm. Schultz, Nolan, Cialdini, Goldstein, and Griskevicius (2007) demonstrate that this lesson applies to other forms of environmentally harmful behaviour such as energy wastage – descriptive normative message describing average energy usage in the neighbourhood, combined with conveying social approval or disapproval, produced desirable energy savings. The implication of these results
is that social norms have powerful automatic effect on behaviour and interventionists should be careful not to validate the harmful actions by making them appear the norm rather than the exception.

Automatic effects of norms were beneficially utilised by Waterkeyn and Cairncross (2005) in an intervention in Zimbabwe, which was designed to develop community cohesion and a ‘culture of health’ within the target population, with the aim to create a demand for sanitation and improved hygiene practices within the home. Community cohesion was promoted through the establishment of Community Health Clubs, which are voluntary organisations, open to everybody, free of charge. The approach was to change beliefs and health norms within such cohesive groups by exposing people to health messages delivered and repeated by peers as well as by authority. As a result, club members’ hygiene was significantly different from a control group across 17 key hygiene practices including hand washing, showing that hygiene behaviours are likely to improve when peer pressure influences members to conform to desired social norms.

Rivis and Sheeran (2004) report the first study to quantify the relationship between descriptive norms and behavioural intentions in relation to health, using meta-analysis of twenty-one studies. This review found a medium to strong correlation between descriptive norms and intention for health-risk behaviours (smoking, drug use, binge drinking, condom use, extradyadic sex, gambling) and health-promoting behaviours (healthy eating, dieting, physical exercise). Also, descriptive norms were stronger predictor of intention than subjective norms, which suggests that observing the behaviour of others is more important in health-related decision making than social pressure from others. According to Rivis and Sheeran, possible implications are that interventions can promote healthy intentions by organizing groups where majority of people are abstaining from unhealthy behaviours (e.g.,
Trafimow, 1994) and by using peers as role models for reducing health-risk behaviours (e.g., Cottler et al., 1999).

Affect

Zajonc (1980) argued that affective reactions are faster and more automatic than cognitive reactions and showed that people can experience an affective reaction to a stimulus before they realise what it is they are reacting to; which suggests that affective reactions are part of the automatic system. For example, sudden and unexpected noises can cause fear before people figure out the source of the noise. There is a recent increase of research on the role of emotions in decision making. Cohen, Pham, and Andrade (2008) argue that judgments that are evoked by subjective feelings and moods (for example, sadness or disgust) are influenced by the affect heuristic. Hsee and Kunreuther (2000) found that affect influences decisions about whether to purchase insurance – people are willing to pay twice as much to insure a beloved antique clock against loss in shipment than to insure a similar clock for which “one does not have any special feeling” (in the event of loss, the insurance paid $100 in both scenarios). Slovic, Finucane, Peters and McGregor (2002) also consider the affect heuristic at work if subconscious emotional evaluations are used as the basis of decisions although they occur even before cognitive evaluation takes place (Kahneman, 2003).

Other studies have also found that general moods also affect cognitive processes and choices. For example people in good moods make unrealistically optimistic judgments and that people in bad moods make unrealistically pessimistic judgments (see Loewenstein et al. 2001, for an overview). There is also evidence that people in “hot” (emotional, moody, aroused) states tend to overestimate how long those states will last, which is known as projection bias (Loewenstein, O’Donoghue, & Rabin, 2003). In general, Loewenstein (2000; p. 427) suggest that affects like negative emotions, (e.g., anger, fear), drive states (e.g., hunger, thirst, sexual desire), and feeling states (e.g., pain) are more important in individual
daily lives than higher level cognitive processes (that are often presumed by researchers to underlie decision-making).

Finally, some ‘standard’ economic theories, like regret theory (Loomes & Sugden, 1982; Bell, 1982) also assume that the emotional consequences of decisions, such as regret, are expected and taken into consideration when making decisions. In order to prevent future regrets, people avoid situations where they might appear to have made the wrong decision even if the decision was the correct one given the information available before the outcome was known. For example, Loomes and Sugden (1982) show how their theory explains why many people simultaneously gamble and purchase insurance.

Provoking affect can have powerful effects on behaviour change compared to traditional behaviour change models relying on providing health information alone, as shown by Curtis, Garbrah-Aidoo and Scott (2007) in the context of promoting hygiene related behaviours like hand-washing with soap around African countries. In particular, Curtis, Garbrah-Aidoo and Scott describe that in Ghana the drive to use soap for mothers was generally high because removing dirty matter from hands make people feel good, refreshed, caring for their children, and even enhancing their social status. However, in Ghana, people tend to use most of the soap for cleaning clothes, washing dishes, and bathing instead of hand washing. Thus, only 3% of mothers washed hands with soap after toilet use, even though 75% claimed that they did so (another 32% washed their hands with water only). Studying hundreds of mothers and their children revealed that previous health campaigns had failed to change behaviour, because mothers often viewed symptoms like diarrhea as a normal aspect of childhood (rather than abnormal disease). The studies also revealed that Ghanaians used soap when they felt that their hands were dirty (e.g., after cooking or travelling), that hand-washing was provoked by feelings of disgust, and that parents felt deep concerns about exposing their children to anything disgusting.
As a result, the intervention campaign (television commercials) was designed not to suggest that it promotes soap use and tried to provoke disgust instead. For example, soapy hand washing was shown only for 4 seconds in one 55-second video clip, but there was a clear message that toilet prompts worries of contamination, disgust, and requires soap. This campaign was a completely different approach from most public health campaigns because it did not mention of sickness (and hence it did not try to educate and change health related beliefs). Instead, the campaign just provoked an innate emotional reaction of disgust (see also Curtis, Aunger, & Rabie, 2004, for evidence that disgust evolved to protect from risk of disease), which resulted in a 13% increase in the use of soap after the toilet and 41% increase in reported soap use before eating.

Effects of similar type were observed by Karlan et al. (in press) in a direct-mail field experiment in South Africa, which varied the price and creative content of actual loan offers made to former clients of a subprime consumer lender. Karlan et al. found that advertising content had statistically significant effects on take-up and these content effects were economically large relative to price effects. In particular, smiling female photo on the letter significantly increases demand by at least as much as a 25% reduction in the loan’s interest rate (and this effect is as strong as other more economically ‘relevant’ features like example tables and “no specific loan use mentioned”). This result shows that affective (as opposed to deliberative) responses to stimuli drive decisions in many contexts. Presenting a smiley face provokes certain emotions that influence our responses to other things – we tend to like everything better if the smiley face has been presented.

In a similar domain, Gibson (2008) show that consumer brand choice can be changed by evaluative conditioning – repeated pairing of positive or negative stimuli (e.g., words such as ‘amazing’ and ‘dreadful’, or images of a smiling older couple, a mother holding child, a person in a contamination suit, people at a grave site) with a brand (Coke, Pepsi). Such a
change in evaluative associations is produced by activating different parts of a more complex (associative) knowledge structure, which results in the activation of a more positive construct.

**Priming**

Priming activates (cues) knowledge in memory in order to enhance processing of aspects of the choice environment (and to suppress processing of other conceptually unrelated aspects). This happens because recent priming or activation of any sort of knowledge makes it more accessible and therefore more influential in processing new stimuli. In recent years, a number of studies have shown how a prior stimulus ("prime") can enhance the processing of subsequent stimuli for example, speeding such processes as lexical decision-making or completing fragments of words and pictures (see Richardson-Klavehn & Bjork, 1988, for review of such work). Thus, there is a close relation between top down expectations and priming. Arvidson (2003, pp. 116-117) defines the prime as "any stimulus or condition that facilitates or interferes the processing of the target stimulus. The prime is not what the subject is directed toward by the experimenter, but affects the target stimulus of attention anyway."

Attentional centers involved in higher-order modes of selection such as semantic priming are being identified through altered patterns of cerebral blood flow during various cognitive tasks (e.g. LaBerge & Buchsbaum, 1990; Posner & Petersen 1990).

In fact, there is even evidence of negative priming. Tipper and Driver (1988) presented participants with a series of overlapping red and green forms, with instructions to identify forms of one colour while ignoring those of the other colour. They found that if a specific form was the to-be-ignored colour on one trial and the to-be-identified colour on the next trial, the identification response was slowed. It was as if the form’s appearance in the to-be-ignored colour had produced an inhibition of the form’s identification on the next trial, which is a sort of negative priming. Also, note that negative priming is an effect by which "it is more difficult to select a stimulus, belonging to a given category, for the control of action,
if that same category of object was actively ignored on the preceding trial” (Allport, 1989, p. 659).

Priming people into certain forms of behaviour (e.g., for the purpose of behaviour change) can occur by offering either directly relevant cues or apparently irrelevant cues. Directly cueing behaviours can occur by simply measuring people’s intentions. Thus, when asking what people intend to do, they are likely to act in line with their answers. Levav and Fitzsimons (2006) demonstrated that if people are asked whether they intend to eat certain foods, to diet, or to exercise, their answers to the questions will affect their behaviour (e.g., asking about intentions to consume fatty foods in the next week, reduces the consumption of such foods).

Indirectly cueing (priming) behaviour can occur at many levels and the literature is abundant with examples. For example, just to mention a few, object characteristic of business environments, such as briefcases and boardroom tables, make people less cooperative and less generous in terms of the amount of money they propose to retain for themselves in the ultimatum game, while the presence of a backpack prompts more cooperative behaviour (Kay, Wheeler, Bargh, & Ross, 2004). Vohs, Mead, and Goode (2006) report related evidence that participants primed with money (e.g., by a stack of Monopoly money in their visual periphery, or by screensavers showing money, which prompt rational economic exchange) are less willing to volunteer to help another person (to code data or pick up pencils from the floor), and donate less. In the same study, screensavers and posters showing money were used to prime self-sufficiency – choosing to work alone and selecting more individually focused leisure experiences (personal cooking lessons instead of dinner for four).

In a related context, priming Chinese people with many first-person singular (‘I, me’) pronouns can cause them to endorse more Western values like individualism, while priming North Americans with first-person plural (‘we, us’) pronouns caused them to endorse more
Asian values like collectivism (Gardner, Gabriel, & Lee, 1999). According to Trafimow (1998), this research is relevant to health psychology, because the findings imply that people with an accessible collective self are more likely to be under normative control. This is supported by Ybarra and Trafimow’s (1997) demonstration that priming the private self (by first asking people what makes them unique) makes attitudes the strongest predictor of intentions towards using a condom during sex, while priming the collective self (by asking respondents what they have in common with their family and friends) makes subjective norms the strongest predictor (this study also shows that priming can increase the effectiveness of traditional interventions). In a similar vein, Wiekens and Stapel (2008) showed that people conformed to the public norm in the presence of a mirror which primes public self-aspects, compared to when only private self-aspects were activated by “I-priming” (this result suggests that seeing yourself could increase honesty for most people).

Another powerful intervention is social stereotype priming (e.g., messages conveying pre-existing stereotypes). Bargh, Chen, and Burrows (1996) primed young adults with an elderly stereotype, which made them walking more slowly. Priming social representations of one’s relationship partners (e.g., mother) can influence an individual’s goal-directed behaviour by activating the goals and standards of the other person (Shah & Kruglanski, 2003). In a health related application, Levy (1996) improved older adults’ memory performance by priming them with positive age stereotypes.

Physical sensations can also prime perceptions and behaviour. Williams and Bargh (2008) demonstrated that experiences of physical warmth (or coldness) would increase feelings of interpersonal warmth (or coldness), without the person’s awareness of this influence. In one study, participants who briefly held a cup of hot (versus iced) coffee judged a target person as having a “warmer” personality (generous, caring). In a second study, participants holding a hot (versus cold) therapeutic pad were more likely to choose a gift for a
friend instead of for themselves. Williams and Bargh explain such priming effects by referring to recent research in humans, which points to the involvement of specific brain region, the insula, in the processing of both physical temperature and interpersonal warmth (trust) information. Holland, Hendriks and Aarts (2005) show that physical sensations like smells can change behaviour too: mere exposure to the scent of an all-purpose cleaner makes people keep their table cleaner while they eat. Similar research on consumer behaviour suggests that odours increase gambling in casinos (Hirsch, 1995) and intentions to visit a store (Spangenberg, Crowley, & Henderson, 1996).

Field studies using priming also abound in the literature. Exposing people to pictures of a library causes them to speak more quietly (Aarts & Dijksterhuis, 2003). Bateson, Nettle and Roberts (2006) conducted a priming study in a more naturalistic setting, in which they placed a poster above an honesty box where people can get their coffee or tea and pay suggested prices without being supervised. There were two sets of posters alternated weekly – one was of eyes (reminding you that there are eyes looking at you) and the other was of flowers. People paid nearly three times as much for their drinks under the eyes’ watch, which demonstrates the power of priming in a real-world context.

In the health field, Wryobeck and Chen (2003) used priming of healthy lifestyle schema (by asking participants to make a sentence out of scrambled words such as fit, lean, active, athletic) to facilitate physical activity – using stairs, instead of elevators. Wryobeck and Chen suggest that interventions can achieve greater behaviour change by using an unconscious, effortless method of assisting people to behave in the way that they are intentionally trying to behave (e.g., by using situational cues such as walking shoes and runner’s magazine to prime a “healthy lifestyle” schema, which would activate a response tendency of being more active).
There is also evidence in the health domain that interventions that alter simple priming cues in eating situations have been found successful in control of habits to overeat. Sobal and Wansink (2007) demonstrated that the amounts of food and drink that people serve and consume decrease with smaller sizes of plates, spoons, and glasses. Thus, by using small plates and utensils, behavioural change interventions could take advantage of the fact that people’s choices for serving size are automatically, and unconsciously, cued in relation to container size (Wansink & Cheney, 2005). Smaller plates lead to lesser food intake, because people tend to consume around 92% of what they serve themselves (Wansink & van Ittersum, 2008). For example, if the 12 inch plates are reduced to 10 inch plates, this would result in 22% reduction of calories per serving, which is not drastic enough to provoke frustration and desire to refill the plate. Thus, if a typical dinner has 800 calories, a smaller plate would cause a weight loss of around 8 kilograms per year for an average size adult. This example shows how contextual cues unconsciously affect our judgments and prime our (eating) preferences.

It is difficult to understand how a single concept can have such dramatic influence over behaviour, especially when often there is only weak semantic relation between prime and dependent measure. To solve this issue, Bargh (2006) argues that priming manipulations are usually priming entire (rich and complex) conceptual structures that correspond to internalized perspectives or stances on the world, which are similar to complex metaphors that are usually grounded in our physical experience of the world (Lakoff & Johnson, 1980). Such mechanisms can also be described as a characteristic of parallel processing models. The cue or prime automatically activates behaviours, feelings and thoughts that have a history of association (see Rumelhart, McClelland, & the PDP Research Group, 1986); which is also true for other elements activating the automatic processing system.

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9 See also Strack and Deutsch (2004) for an illustrative model of how such associative semantic representations can generate behavioural decisions when activated in priming situations.
Some researchers are still concerned, however, that priming has only short-lived effects on behaviour and only affects behaviours that have little cost. For example, Macrae and Johnston (1998) show that automatic behavioural priming effects (in this case priming to help picking up pens from the floor) are eliminated when inhibitory cues are present in the environment (when the pens were leaking), or perceivers have a competing goal in mind (to leave the room as the session was running late). This example demonstrates that there are limits to the power of priming (which is also true for other methods) and interventions should try to eliminate environmental factors that are in conflict with the target behaviour.

From Automatic Response to Reflective Cognitive Change

RAM also postulates a recurrent link from responses back to reflective processing of one’s actions (Figure 1). Thus, there is a causal relationship between the various constructs in RAM’s contextual and cognitive routes. In this respect, cognitive variables like control beliefs may still change as a result of the behaviour triggered by the context, because people may suddenly discover that they can behave in ways they previous believed to be beyond their control. Thus, RAM (and specifically SNAP) has the added value of showing how contextual (environmental) interventions can produce behaviours that in turn may change control beliefs. We can also change habits by contextual interventions relying on automatic processes and responses triggered by commitment and affect (e.g., making habits with commitment and breaking them with affect), which is different from standard interventions asking people to intentionally avoid habit triggering cues and suppress habitual responses. Analogously, commitment can create goals, affect can also change attitudes (as well and habits), social norms can change subjective norms (beliefs about how others will view our behaviour), economic incentives can change coping appraisal (as in protection motivation theory, Rogers, 1983) by affecting perceptions of the costs of a response, and so on.
So, behavioural change can lead to a change in cognitions in and of itself. That is, an alternative way of changing cognitions is to get people to change their behaviour first. This aspect of RAM incorporates Bem's (1967) self-perception theory, which proposed exactly this – we form our attitudes, opinions, and other internal states by observing our behaviour and concluding what attitudes must have caused them. Self-perception theory was proposed as an alternative to ‘introspection’ based theories of attitude change, and therefore, it implies that we can manipulate people's behaviour we can manipulate how they see themselves. The theory suggests that people induce attitudes without accessing internal cognitions and moods, which is done by reasoning about one’s own overt behaviours rationally in the same way a person attempts to explain others’ behaviours (Robak, Ward, & Ostolaza, 2005).

Other models have subsequently built on self-perception theory in explaining a person’s assessment of her own personality traits (Tice, 1993) and feelings – corresponding emotions (e.g., liking, disliking, happiness, anger, etc.) were reported following from overt behaviours which had been manipulated by the experimenters. In psychotherapy, this approach predicts that people attribute maladjusted behaviours to their poor adapting abilities, which often causes low self-esteem and psychological suffering (Bem, 1972). Another application is to persuasive techniques (e.g., in marketing) – for example, the foot-in-the-door technique (Burger, 1999) asks people to comply with a small request (e.g. filling in a short questionnaire for free), which changes their self image and subsequently gives reasons for agreeing with related more substantial request (e.g. buying a related product, because they infer they must have a preference for such products). In summary, self-perception theory suggests that feelings are the perceptions of our actions and the contexts in which they are performed, which provides, externally cued, route to cognitive change.

In this respect, the contextual route in RAM is similar in spirit to self-perception theory, but offers three novel contributions. First, we describe specific psychological
mechanisms (the dual-route processing framework) that underlie changes in attitudes (and other cognitions) observed in tests of self-perception theory. Thus, attitudes can change either as a result of reflection over our observed actions, or in response to automatic processes (e.g., the same information framed as gains or losses can change our attitudes towards the behaviour, as we discussed before). Second, we provide specific principles for behaviour change (the SNAP framework), which do not require changing cognitions, while self-perception theory does not specify about how behaviour can be affected. Third, RAM contains a feedback loop from behaviour back to the underlying cognitions, which is not explicitly discussed in traditional methods (e.g., theory of planed behaviour, or the health belief model, are one-directional in terms of causality that flows only from cognitions to behaviours).

In summary, self-perception theory has not been explicitly applied to any of the traditional population-level behaviour change theories (nor any of the traditional models have incorporated principles of self-perception); probably because self-perception is not a theory of behaviour change as such (i.e., it is not developed to support actual interventions). However, there is quite a literature on behaviour affecting cognitions (e.g. increasing skills to increase self-efficacy, Bandura, 1989). Behaviour therapy (Wolpe, 1990) also uses behavioural interventions to modify affect or cognitions (‘just do it and later you will feel like doing it’). Also, Strack and Deutsch (2004) propose a detailed processing account of the behaviour-cognition link within a dual-process framework. Accordingly, we do not claim that the response-cognition connection is a novel idea, but we included it in RAM for completeness of the model. Thus, RAM is a step towards a unified causal model of cognitions and behaviour, because it offers a clearer conception of how various constructs link together.

Relationship with Other Models and Theories
Relationship with Models of Behaviour Change

First, we would like to stress that our focus on contextual change aims to provide a complement, not an alternative, to theories assuming that changing cognitions is the way to provoke behaviour change – and the most effective policies will be ones when these two routes (probably reinforced by cultural changes) work together (e.g., like in campaigns against drunk-driving). For example, in health prevention task, McCormick & McElroy (2009) show that increasing the number of arguments increased behavioural intentions for persuasive health messages when subjects were cued, via negative affect (evoked by a background picture), to be attentive to the message; which demonstrates how cognitive and contextual cues can work in combination. Alternatively, an intervention could start with contextual cues in order to initiate behaviour change which is then consolidated using incentives and traditional methods that change individual psychology.

RAM also indicates how the contextual/automatic route can be contrasted from traditional models and methods. For example, our application of economic incentives may be similar to the way this method is used in traditional interventions, but the ultimate purpose is different – encouraging psychological change (e.g., by giving incentives for remaining in a program that aims to change attitudes and teach new skills) vs. contextual change that provokes pre-existing behavioural reactions (e.g., changing costs affects consumption without usually having an effect on attitudes). Also, salience is different from providing risk awareness materials, because the former aims to keep certain (often already known) information prominent in mind when behaviour choices are made, while the latter often aims to change beliefs about behaviour and their consequences. Salient cues may provide information regarding behaviour and outcome, but ‘traditional’ psychological interventions do so without taking into account cognitive limitations (and with the purpose of changing beliefs and attitudes, while encoding often just enables people to make better choices without
changing their attitudes). Similar arguments apply to the other methods on both sides of the
dual-route RAM proposed here (e.g., persuasive communication may provoke affects, but
that is more like a side effect, while the key aim is changing beliefs trough personal
reflection).

Might many of the salience and norm interventions be mediated by (explicit)
cognitive changes? Even though salience and norm interventions may well lead to some
cognitive changes (as most information enters both systems), such cognitive change is not
required for salience and norms for have an effect on behaviour. This view is supported by
studies where relevant manipulations changed behaviour but did not change cognitions. For
example, making the healthy foods salient (Thaler & Sunstein, 2008) and eating from a
smaller plate (Wansink & van Ittersum, 2008) do not change beliefs (attitudes) about healthy
eating. Also, it is unlikely that knowing that everybody in your hotel room recycled should
change your attitudes towards environmental protection more than knowing that everybody in
the hotel recycled (Goldstein, Cialdini, & Griskevicius, in press). Surely, new information
has been learned, but this is not what constitutes cognitive change according to standard
theories of behaviour change (i.e., people doing what they believe is good, because they, as
rational creatures, are capable of recognizing the value or utility of their actions).

There are also some overlaps, however, between the SNAP principles (and methods)
and existing, more traditional, behaviour change methods. For example, Gollwitzer’s (1993,
1999) method of implementation intentions promotes goal attainment by specifying when,
where and how to perform goal-directed behaviours (e.g., during my lunch break on Tuesday,
I will go in the canteen and eat one salad and two fruits). Implementation intentions are also
described as specific plans of action and usually take the form of if-then rules – if situation x,
then I will perform behaviour y, which rely on memory association between behaviour and
cues via cognitive rehearsal (Gollwitzer, 1993; Sheeran, Webb, & Gollwitzer, 2005). As
result, implementation intentions are hypothesised to improve self-regulation during
behavioural change by relying on situational cues that elicit behaviour automatically (often
even without conscious decision making). For example, people are usually advised to do the
intended behaviour after something they do regularly like taking a tablet in the bedroom just
after teeth brushing. Thus, implementation intentions is akin to some elements of RAM, and
more specifically to commitment (in terms of making a promise and imposing a deadline) and
priming (in terms of cueing behaviours by asking what people intend to do, as in Levav &
Fitzsimons, 2006).

Relationship with Behavioural Economics

Some of the contextual methods in our SNAP framework overlap with Thaler and
Sunstein’s (2008, pp. 81-100) six principles of good choice architecture: incentives,
understanding mapping (from choice to welfare), defaults, give feedback, expect error, and
structure complex choices (or nudges); which can improve the outcomes for human
decisions. Clearly, incentives are represented in RAM too. Four other principles
(understanding mapping, give feedback, expect error, and structure complex choices) fall
under salience, because they all aim to ‘translate’ choice related information into a format
that is manageable by a cognitive system with a limited capacity for information processing
and representation (we already discussed the constraints on this capacity). For example,
‘understanding mapping’ in choice between medical treatments involves transforming
information about various possible health outcomes (associated with each treatment) into
units that translate more easily into actual use (or as Thaler and Sunstein illustrate this
principle, when buying apple to make apple cider, it helps to know that three apples make one
glass of cider). The same applies for market products – translating a product attribute (e.g.,
camera’s megapixels) into what consumers care about.
All these examples illustrate aspects of salience. ‘Giving feedback’ involves, for example, salient warning signs in a way that gives information when people are doing well and when they are making errors. Or take ‘expecting errors’, which involves examples like avoiding omission to take pills would require making the pill-intake something like (automatic) everyday habit by either taking placebo pills for the days without a pill, or by taking the pill after some regular daily activity (similarly to formulation of implementation intentions). These are different ways to present the salient attributes in a task without changing the task per se. Similarly, ‘structuring complex choices’ involves choosing between multi-attribute alternatives by using Tversky’s (1972) elimination-by-aspects strategy to decide sequentially according to one attribute at a time starting with the most important one (while other simplifying strategies involve ordering alternatives, e.g., like colours, by similarity); which are all aspects of the salience principle. Analysis of how the salience principle relates to all examples illustrating these four ‘nudges’ is beyond the scope of this article, but in a nutshell, they all reflect how our limited cognition is defeated by information complexity (dealing with which is the purpose of the salience method).

Relationship to defaults. Defaults are options that are assumed as preselected if the individual does not make an active choice of another available alternative. Defaults are perhaps the most widely known and publicised application of the elements of Thaler and Sunstein’s (2008) Nudge. If a choice environment has a no-action default, then a condition is imposed when an individual fails to make a decision. There is evidence that most of the time maintaining the status quo does not involve (mental) activity and the easiest option is therefore to stick with the status quo and procrastinate, for example by keeping savings where they are (Thaler & Benartzi, 2004). This is precisely why setting the ‘right’ default options, e.g. for pension plans, is such a powerful tool. Defaults remove the immediate cost of mental torment involved in decision making, and it is therefore not surprising that they have
significant effects on choices, even if people believe they are arbitrarily chosen and if opting out of the default is easy (i.e., not costly).

When employees are by default enrolled in their 401(k) plan, only a very small proportion opt out and about three-quarters of participants under automatic enrolment tend to retain both the default contribution rate and the default asset allocation. At the same time, switching from a non-participation default to a participation default (automatic enrolment) can increase 401(k) participation rates among new employees by more than 50%. But when they have to make a choice to enrol, during their first year of employment less than half do (Madrian & Shea, 2001; Choi, Laibson, Madrian, & Metrick, 2002, 2003).

Such powerful effect of defaults on behaviour has been observed in a wide range of other settings like organ donation decisions (Johnson & Goldstein 2003; Abadie & Gay, 2004), choice of car insurance plan (Johnson, Hershey, Meszaros, & Kunreuther, 1993), car option purchases (Park, Yun, & MacInnis, 2000), and consent to receive e-mail marketing (Johnson, Bellman, & Lohse, 2002). Defaults have powerful effect even when it is obvious that the default option is suboptimal. For example, Choi, Laibson, and Madrian (2007) show that many employees remain at the non-participation default (in firms without automatic enrolment) even when this results in missing out substantial arbitrage opportunities. In health care setting, employees' contributions to health care flexible-spending accounts are mostly determined by default options (Schweitzer, Hershey, & Asch, 1996). Furthermore, Halpern, Ubel and Asch (2007) suggest various ways (supported by data) in which default options can quickly improve the quality of health care (e.g., an opt-out policy of routine pneumococcal vaccination of hospitalized patients, routine HIV testing for all patients, annual influenza vaccination for all health care workers, removal of indwelling urinary catheters after 72 hours unless physicians or nurses document a reason for maintaining them, etc.).
Johnson and Goldstein (2003) propose a more comprehensive list of possible explanations of the effects of defaults, which is based on the assumption that preferences are constructed rather than pre-existing as in classical economics (Payne, Bettman, & Johnson, 1992; Slovic, 1995). According to this view, defaults can influence choices in three ways:

a) Decision-makers might believe that defaults are suggestions (guidelines) by the policy-maker, which imply a recommended action (Johnson & Goldstein, 2003).

b) Making a decision often involves effort (i.e., cost of some kind), whereas accepting the default is effortless. For example, physical effort such as filling out a form may also increase acceptance of the default (Samuelson & Zeckhauser, 1988). Carroll, Choi, Laibson, Madrian, and Metrick (in press) propose an economic model in which defaults matter because opting out of the default may be more or less costly at different times, which creates gives people a reason to wait for a low-cost time to take action. Also, agents with (hyperbolic) preferences that overvalue the present (Laibson 1997; O’Donoghue & Rabin, 1999) may procrastinate in their decision to opt out of the default, because such agents avoid current costs but are happier to incur future opt-out costs.

c) Defaults often represent the existing state or status quo, and change usually involves a trade-off between giving up the existing state (option) in order to gain an alternative option. Psychologists have shown that giving up the status quo option triggers loss aversion (Kahneman & Tversky, 1991), which makes losses (the default) to loom larger than the equivalent gains (alternative options). Also, similar to status quo bias is the omission bias – people avoid making an active decision (and keep the default), because of a greater fear of choosing a bad option (commission error) than not selecting a better option (omission error) (Baron & Ritov, 1994).

These three distinct effects of defaults can be related to two elements in RAM. Thus, ‘norms’ explain (a) (plus defaults signal the declarative norm), while (b) and (c) are about
incentives as both change the costs and benefits of action; which demonstrates that elements in our model can be combined to produce effective and sustained behaviour change (as the documented evidence convincingly suggests that changes in the default may result in a lasting change of choice and behaviour).

In summary, the set of behaviour change principles included in RAM represent a more general and systematised framework than the six nudges offered by Thaler and Sunstein (2008), which also explains ‘why’ and ‘how’ these nudges work.

Relationship with Other Dual-Process Models

Several dual-process models have been developed in social psychology to explain various phenomena in social cognition (attitude change), person perception (e.g., impression formation, attribution), stereotyping, persuasion, action control, affective processing, group perception and others (see Chen & Chaiken, 1999). The similarities and differences between these models and RAM are discussed in this section.

In the elaboration-likelihood model of attitude change (Petty & Cacioppo, 1986), cognitive processing is the central route involved in an elaborate cognitive processing of information, and affective/emotion processing is associated with the peripheral route that relies on contextual cues (perceived credibility and attractiveness), which do not involve elaboration of the message through extensive cognitive processing. The elaboration-likelihood model assumes that as cognitive capacity and/or motivation increase, peripheral mechanisms become less influential determinants of attitude judgment. This model differs from RAM in the degree to which the two processing modes are assumed to be exclusive. RAM’s continuum of causes and effects (Figure 1) implies that at any moment the two processes influence behaviour to different extend, which is independent of cognitive capacity and motivation. A typical example is the role of incentives – for example, as prices change people can rationally reflect on their consumption decisions and consciously obey the law of
demand, while they can still be biased by loss aversion and hyperbolic discounting (or even just automatically mistake the cue of price for value indicator).

In the **heuristic-systematic model** (Chaiken, Liberman, & Eagly, 1989), information is either processed in a high-involvement and high-effort systematic (analytic) way, or information is processed through shortcuts known as heuristics (affect heuristics, feelings and gut-feeling reactions are often used as shortcuts) which are unconsciously activated (by specific experiences) and applied (heuristics are considered learned procedural or declarative knowledge stored in memory). In this model, the heuristic routes do not involve extensive cognitive processing, and instead often rely on contextual characteristics of the message, like the perceived credibility of the source, quality of the presentation, the attractiveness of the source and so on. This model also assumes that systematic processing requires cognitive capacity and motivation, while heuristic processing can occur with little of either. Similarly to RAM, the heuristic-systematic model assumed that the two processes can co-occur and have equal impact on judgment even when ability and motivation for systematic analysis are high (e.g., thus the heuristic process may bias the judgments produced by the systematic process).

The MODE (motivation and opportunity as determinants) model (Fazio, 1990) explains how attitudes guide judgments and behaviour by assuming a combination of deliberative processes and spontaneous processes. A crucial characteristic of the model is the accessibility from memory of attitude information, as it increases bias that leads to attitude consistent behaviour. For example, a positive attitude that has been activated will direct attention to positive qualities of the object. Furthermore, according to Fazio and Towles-Schwen (1999, p. 98), ‘these immediate perceptions of the object, as well as any constructs regarding the situation itself that might be activated (e.g., norms), will influence the individual’s definition of the event that is occurring. If the attitude is not activated from
memory, immediate perceptions are likely to be based upon momentarily salient, and potentially unrepresentative, features of the attitude object even ones that are not necessarily compatible with the attitude.’ Thus, the MODE model seems to assume roles for priming, norms and salience that are similar to their role in RAM. However, while MODE model suggests that spontaneous processing occurs when motivation (and/or opportunity) to control responses is low, RAM does not assume a significant role of motivation in behaviour change. Second difference is that in spontaneous mode, only strong, chronically accessible attitudes are automatically activated, bias perception of the situation, and thus predict behaviour. RAM does not make such assumptions (e.g., the priming examples suggest that any concepts can be activated and have biasing effect on behaviour). Third difference is that MODE does not assume any role for control beliefs and goals, which are shown to have strong effect on behaviour change. MODE assumes that only (strong) attitudes reliably predict behaviour, which is not a complete account as we discussed earlier (see Liska, 1984; Wicker, 1969).

Some dual-process models of social judgment and attitude change are especially developed as accounts for the impact of affect (and in this respect they are similar to RAM). The affect infusion model (Forgas, 1995) postulates that affect influences social judgment in two ways: a) via heuristics processing where affect is used as a ‘shortcut’ to infer one’s evaluative reactions to a target (e.g., and may lead to prejudice); and b) via ‘substantive processing’ (equivalent to ‘reflective’ in our framework) where judgment (of another person) is influenced because affect influences other, more fundamental, cognitive functions like attention, encoding, memory retrieval and associative processing. In addition, automatic activation of affect, of the type proposed in our model, is consistent also with Epstein’s (2003) cognitive-experiential self-theory, which also postulates two processing systems: a rational (analytic) system and experiential system. The experiential (also described as
intuitive, holistic, and unconscious) system handles automatic affective reactions that are often outside of conscious awareness.

The *reflective-impulsive model* (Strack & Deutsch, 2004) is the latest and most elaborate dual-process theory of social behaviour, which extends previous models by integrating cognitive, motivational, and behavioural mechanisms (thus it is not limited to specific domains of mental functioning). We assume that RAM follows similar operating principles (mental processes that are described in much more detail than we do here), but there are some differences. While Strack and Deutsch focus on discussing in much detail the processing mechanisms, we integrated vast amount of evidence that supports our claims and serves as practical illustration of RAM’s principles. Also, the reflective-impulsive model does not postulate social norms and salience as determinants of behaviour (although top-down effects of attention directed by the impulsive system are discussed). Another missing element is the role of incentives (and behavioural economics) as input to both processing systems and separate driver of behaviour change.

*What makes RAM really unique?* Although RAM and existing dual-process theories describe similar underlying processes, there are also some important differences between RAM and these theories. First difference is the domain of application. All dual-process models are developed as social psychological theories of persuasion, attitude change, prejudice and social judgment, or as a theory of personality (e.g., Epstein, 2003), but none has been explicitly developed as a theoretical basis for behaviour change interventions (e.g. in health); while RAM is explicitly developed as an integrative model that aims to achieve this objective. For this reason, we incorporated the traditional behaviour change models within RAM, and position these models with respect to the contextual route to behaviour change (SNAP) as the two opposites on the reflective-automatic spectrum (or on the intentional-situational control continuum). In this respect, dual-process theories vary in how
broadly and generally they have been applied, although they often focus on a single domain such as persuasion (e.g., Petty & Cacioppo, 1986) or impression formation (e.g., Fiske & Neuberg’s [1990] continuum model of impression formation), and RAM is the first consistent application of the dual-process paradigm specifically to behaviour change interventions.

The second difference is that RAM combines under the automatic processing umbrella factors like incentives, attention (salience), norms, affect, and priming (accessibility of information), while other models tend to use a single factor as their main driver of the automatic processes (e.g., attributing automatic reactions to affect as in Epstein’s [2003] cognitive-experiential self-theory). Thus, another advantage of RAM is that it includes components that are not present in most models, like the distinct effects of incentives and norms for example.

The third key difference relates to our emphasis on utilising the potential of the automatic system as the main driver underlying behaviour change interventions (the SNAP framework), which also opens the question about the sustainability of behaviour change. In contrast, the key characteristic of the existing dual-process theories is the assumption that that only via central processing will you achieve long-term sustainable behavioural change. For example, both elaboration-likelihood and heuristic-systematic models assume that attitude change can result from peripheral/heuristic processes, as well as other ‘automatic’ and low-effort processes like classical conditioning (Staats & Staats, 1958; e.g., attractive source of advert information could produce positive affect that generalizes to the product) and self-perception (Bem, 1972) as we discussed before. However, such attitudes are postulated to be weaker (in terms being temporary, susceptible to counter-persuasion, and unpredictable of behaviour) compared to attitudes that are changed to the same extend as a result of reflective thought. Thus, only by changing cognitions will behavioural change continue, and this is the main reason why psychologists have focused on changing cognitions and not the
environment. In contrast, the ‘situational’ methods (SNAP) are based on the assumption that changing the person’s environment will result in sustained behaviour change without necessitating any change in cognitions. This assumption is supported by the powerful and sustainable effect of defaults – an intervention that relies only on situational changes and automatic processes (we already discussed evidence that changes in the default result in a lasting change of choice and behaviour). Defaults also demonstrate that elements in our model can be combined to produce effective and sustained behaviour change. RAM also allows cognitions to change as a result automatic/situational processes as we discussed before, but, in contrast to the most dual-process theories, such change is not considered the main determinant of behaviour change.

Concluding Remarks

This article makes two novel contributions to the literature on behaviour change. First, we review the literature on theories of behaviour change and present RAM as a new integrative model that has important implications for interventions aimed at changing behaviour at population level. RAM is a dual-route model for behaviour change, according to which changing cognitions and changing the context rely on different information processing systems – the reflective system in the former case and the automatic system in the latter. Traditional psychological theories rely on reflective changes in cognitions such as beliefs, goals, and habits, as the main drivers of behaviour change. Incentives (in the broadest sense) are the bread and butter of behavioural economics and work on both the automatic and reflective systems (and hence incentives can change both cognitions and the context). We also propose that salience, norms, affect and priming are SNAP responses cued by the context and working mostly on the automatic system.

The second contribution of this article is the SNAP framework, which consists of four types of contextual cues that (mediated by the automatic system) can affect behaviour
change; and we suggest some directions for the development of intervention using these approaches. A key assumption of SNAP is that changes in the choice context can significantly improve the quality of people’s decisions and behaviours, which can ultimately improve their well-being. Relying on the automaticity of higher mental processes is a novel framework for behaviour change, which is beyond behaviourism on one side (where there is no reference to cognitive processes at all), and intentional cognitive change on the other side of the spectrum (where predominantly reflective processes are considered). Thus, this article draws attention to what is arguably a new and promising framework for behaviour change, which also has important implications for psychological research into health behaviours, development of behaviour change interventions at a population level, and, potentially, for policy analysis.

We recognise, of course, that there are still some unresolved conceptual and empirical issues that require further research and we highlight three by way of conclusion.

The first issue relates to explanatory mechanisms for how people behave vs. how we might get people to change. The first we develop in detail, but the second is less developed yet. Of course, this is true of a lot of population level behaviour change research in psychology – it notes what we should change (e.g., attitudes, mood, norms), but not how we go about changing these things (Norman, Abraham, & Conner, 2000). This is less true in other areas of psychology (e.g., learning and memory) where processes of change are central components to theory (e.g., conditioning theory postulates how response learning changes as a function of the timing and frequencies of conditioned and unconditioned stimuli, Mackintosh, 1983). Behaviour therapy and cognitive behavioural therapy are examples of individual behaviour change methods where all the theory is about how to change behaviour and not about the correlates of behaviour (Clark & Fairburn, 1997). And these therapies have resulted in effective methods, which are now routine parts of health care. But developing
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process-of-change models is beyond the scope of this paper, because it would require developing a separate model for each element of SNAP. This enormous task could only be addressed in future research.\(^\text{10}\)

The second issue relates to the domain of application. The elements of SNAP can be applied in isolation or in combinations, which should depend on what intervention is effective in the specific circumstances. However, certain methods (e.g., social norms) may be more effective for specific behaviours (e.g., dieting, substance use). Therefore, future research should determine the relative effectiveness (and cost-effectiveness) of the four SNAP elements in different domains (e.g., health, environment, finance) and specific behaviours (e.g., smoking, recycling, saving).

The third issue relates to the sustainability of SNAP-based interventions – i.e. whether behaviour change is only short-term or long-lived. Some effects are likely to be long-term, because in reality, there are many recurring contexts and environments (e.g., jobs, schools, neighbourhoods, and culture in general), which can provide frequent sources of contextual influence (without relying on internal cognitive factors). Apart from defaults, there are many other instances of sustainable contextual interventions. For example, making the healthy foods salient in canteens leads to increased consumption of such foods (Thaler & Sunstein, 2008, p. 1). Another salience-based intervention succeeded in reducing driving speed on a dangerous S curves along Chicago’s Lake Shore Drive by painting a series of white stripes onto the road, which are initially evenly spaced but get closer together as drivers reach the most dangerous section of the curve (Thaler & Sunstein, 2008, p. 37). These salient contextual cues give the sensation that driving speed is increasing (even when the speed does not really change), because of the workings of automatic perceptual processes, which in turn

\(^{10}\) In population wide interventions, we cannot assume that the determinants of change will be discovered from studying individual differences (as in clinical psychology). But we might discover such determinants by studying how individuals change over time and RAM provides the elements driving such change.
triggers the driver’s natural instinct to slow down. Another sustainable contextual intervention demonstrated that smaller plates lead to lesser food intake, because serving size is cued in proportion to container (Wansink & van Ittersum, 2008). In summary, all these interventions rely on recurrent situations in life, and demonstrate that behaviour change produced by contextually triggered automatic processes can be sustainable.

We conclude, therefore, that there are many unresolved questions and many exciting avenues for future research but our RAM model and the SNAP framework within it provide a fresh perspective from which conceptual developments and empirical advances can be made.
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**Figure 1.** Schematic illustration of RAM: A reflective-automatic model of the process of action control in behaviour change.