

Ivo Vlaev, Dominic King, [Paul Dolan](#) and Ara Darzi  
The theory and practice of “nudging”:  
changing health behaviors

Article (Accepted version)  
(Refereed)

**Original citation:** Vlaev, Ivo, King, Dominic, Dolan, Paul and Darzi, Ara (2016) *The theory and practice of “nudging”: changing health behaviors*. [Public Administration Review](#), 76 (4). pp. 550-561. ISSN 0033-3352

DOI: [10.1111/puar.12564](https://doi.org/10.1111/puar.12564)

© 2016 by [The American Society for Public Administration](#)

This version available at: <http://eprints.lse.ac.uk/67963/>

Available in LSE Research Online: October 2016

LSE has developed LSE Research Online so that users may access research output of the School. Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. Users may download and/or print one copy of any article(s) in LSE Research Online to facilitate their private study or for non-commercial research. You may not engage in further distribution of the material or use it for any profit-making activities or any commercial gain. You may freely distribute the URL (<http://eprints.lse.ac.uk>) of the LSE Research Online website.

This document is the author’s final accepted version of the journal article. There may be differences between this version and the published version. You are advised to consult the publisher’s version if you wish to cite from it.

Theory to Practice  
Hal G. Rainey, Editor

## **The Theory and Practice of ‘Nudging’: Changing Health Behaviors**

Ivo Vlaev<sup>1\*</sup>, Dominic King<sup>2\*</sup>, Paul Dolan<sup>3</sup>, Ara Darzi<sup>4</sup>

<sup>1</sup> Warwick Business School, University of Warwick

<sup>2</sup> Centre for Health Policy, Imperial College London

<sup>3</sup> Department of Social Policy, London School of Economics

<sup>4</sup> Centre for Health Policy, Imperial College London

\*Corresponding author: Ivo Vlaev ([ivo.vlaev@wbs.ac.uk](mailto:ivo.vlaev@wbs.ac.uk)) and Dominic King  
([dominic.king@imperial.ac.uk](mailto:dominic.king@imperial.ac.uk))

**Abstract:** Many of the most significant challenges in healthcare - such as smoking, overeating and poor adherence to evidence-based guidelines - will only be resolved if we can influence behaviour. The traditional policy tools used when thinking about influencing behaviour include legislation, regulation and information provision. Recently, policy analysts have shown interest in policies that 'nudge' people in particular directions - drawing on advances in understanding that behaviour is strongly influenced in largely automatic ways by the context within which it is placed. This article considers the theoretical basis for why nudges might work and reviews the evidence in health behaviour change. The evidence is structured according to the Mindspace framework for behaviour change. The conclusion is that insights from behavioural economics offer powerful policy tools for influencing behaviour in healthcare. This article provides public administration practitioners with an accessible summary of this literature, putting these insights into practical use.

### **Practitioners Points**

- Policy makers need to better recognise that we are being influenced and influencing others all the time.
- New approaches to health policy incorporating the latest insights from the behavioral sciences offer a potentially powerful set of new tools to influence decision making.
- Mindspace is a widely used framework for policy that can support policy makers in developing more effective interventions.
- There is an increasing body of evidence supporting the application of behavioral insights in health policy, which is increasingly being drawn from large field studies.
  - Policy makers need to recognise that 'nudge' type interventions are controversial and may provoke public and political concern.

A significant part of the years of healthy life now lost worldwide are due to ‘lifestyle’ factors such as smoking, alcohol misuse and poor diet, with roughly one half of all deaths in the United States attributable to personal behaviors (Mokdad et al., 2004; WHO, 2009; Lozano et al., 2012). Health losses as a consequence of lifestyle are particularly prevalent among the least well off in society (Mackenbach et al., 2008), and significant gains in population health may be achieved by relatively small changes in the choices people make.

Human decision making also contributes to substantial provider side challenges faced by health systems in improving clinical outcomes and controlling healthcare expenditure. Many patient encounters fail to follow evidence-based recommendations (Grol, 2001; Grol & Grimshaw, 2003) and overutilization of expensive healthcare resources is a problem across many health systems (Emanuel & Fuchs 2008). Behavioral insights can help explain why such problems are so pervasive and difficult to counter (Darzi et al., 2011).

Traditionally, behavior change policies and interventions in healthcare have tended to focus on providing new *information*, which seek to change the way people think about their behavior, or which seek to provide different [financial or legal] *incentives* that change the consequences of behavior (Cecchini et al., 2010). Many existing interventions targeted at health-related behaviors rely on influencing the way people consciously think about their behavior. These interventions draw on the assumption that people change behavior accordingly when motivations and intentions are changed (see Shumaker, Schron, Ockene, & McBee, 2008).

The problem is that a substantial proportion of the variance in behavior is not explained by intentions. Several meta-analyses imply that changing intentions would account for less than one-third of the variance in behavior change, and estimates based on experimental or causal studies report explained variance as low as 3% (Sheeran, 2002; Webb & Sheeran, 2006).

In contrast to economic models of rational choice suggesting that we respond to information and price signals, insights from across the behavioral sciences suggest that human behavior is actually led by our very human, emotional and fallible brain, and influenced greatly by the context or environment within which many of our decisions are taken (Kahneman, 2011; Thaler & Sunstein, 2008). In other words, behavior is not so much thought about; it simply comes about. The human brain uses a number of heuristics to simplify decision making, but these ‘rules of thumb’ can also lead people into predictable systematic biases and errors (Kahneman, 2003; Kahneman & Tversky, 2000).

A more comprehensive understanding of human decision-making provides us with opportunities to influence choices that take better account of how people actually respond to the context within which their decisions are made – the so called ‘choice architecture’ (Thaler & Sunstein, 2008). The same errors that trip people up can also be used to help them make better choices (Loewenstein, Brennan, & Volpp, 2007).

Policies that change the context or ‘nudge’ people in particular directions have captured the imagination of policymakers at the same time as the limitations of traditional approaches have become apparent (see Hofmann, Friese, & Wiers, 2008; Shafir, 2012).<sup>1</sup> Popularised in Richard Thaler and Cass Sunstein’s book *Nudge*, the theory underpinning many of the policy suggestions is built on decades of research in the behavioral sciences, and particularly the growing field of ‘behavioral economics’, by academics such as Robert Cialdini, Amos Tversky and the Nobel Laureate Daniel Kahneman (Cialdini, 2007; Kahneman, 2003; Kahneman & Tversky, 2000). As the subtitle of the Nudge book goes “Improving decisions about health, wealth and happiness” (Thaler & Sunstein, 2008), behavioral economics is the ‘descriptive’ science of human decision making (i.e., studying how humans actually make decisions). Behavioral economics, which combines insights from economics and psychology, provides new ways to think about the barriers and drivers to a range of behaviors including

health insurance take-up and coverage and tendency to contribute to retirement savings (Baicker, Congdon, & Mullainathan, 2012; Madrian & Shea, 2001). The attractiveness of using insights from behavioral economics has been in part due to the perceived potential to offer ‘low cost, unobtrusive’ solutions to societal challenges in an era of fiscal austerity (Loewenstein et al., 2012; Shafir, 2012).

The literature on nudging, however, has not been specific about the definition of nudging and how it differs from other public health tools. Thaler and Sunstein’s (2008) definition of a ‘nudge’ as “any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any options or significantly changing their economic incentives” does not provide a precise operational definition of the applied meaning of those terms. The term ‘choice architecture’ is defined as the environments within which people make choices (Marteau et al., 2011; Thaler & Sunstein, 2008). Hollands et al. (2013) systematically review the evidence base for nudge (choice architecture) interventions, and propose the following, more precise, operational definition of such interventions:

*Interventions that involve altering the properties or placement of objects or stimuli within micro-environments with the intention of changing health-related behaviour. Such interventions are implemented within the same micro-environment as that in which the target behaviour is performed, typically require minimal conscious engagement, can in principle influence the behaviour of many people simultaneously, and are not targeted or tailored to specific individuals.*

This definition specifically reflects the focus in nudge theory on automatic processes, hence why minimal conscious engagement is required, but does not exclude conscious and reflective processes. This definition also includes physical and social dimensions of micro-environments, i.e. the focus is on the specific context, namely interventions that involve altering small-scale physical and social environments (e.g., spaces such as restaurants,

workplaces, homes and shops). In contrast to nudge interventions, conventional public health tools usually include dissemination of information, warning labels, menus with calorie counts listed, and alterations to the physical environment (e.g., more nearby parks and sidewalks to help fight obesity). An essential feature of those ‘reflective’ strategies is their appeal to reflective mental processes in order to provoke informed choice. Crucially, such tools are not usually designed to fulfill the operational definition of choice architecture interventions (of course, some conventional interventions such as warning labels for example, might, unintentionally, prompt automatic nudge-like effects on behavior).

Not everyone shares the current enthusiasm for integrating ‘nudges’ into public policy, with commentators citing a lack of evidence to support a shift to their use (Horton, 2011; Marteau et al., 2011). Such perspectives are in part a consequence of the lack of a robust framework to use when thinking about interventions designed to influence behavior in nudge-like ways. Different disciplines will have different theories and perspectives on how best to model behavior and its contextual determinants and, as with most issues, disciplinary and multi-disciplinary research is required. But more than that, and perhaps even more so in the design of choice architectures, a practical framework is required to enable practitioners to apply the insights from the behavioral sciences.

At the request of the Cabinet Office (a department of the UK Government responsible for supporting the Prime Minister and the Cabinet), a group of behavioral and social scientists were tasked with developing a framework that could be used practically by policymakers and also act as a focus for further exploration of the evidence base and appropriateness of using nudge type interventions. The framework developed was Mindspace (Dolan et al., 2010), which served as the initial operating framework for work of the Behavioral Insights Team (Behavioral Insights Team, 2011; Cabinet Office, 2011), the world’s first government institution dedicated to the application of behavioral science to better policy making.

Established in 2010, the BIT was tasked by the UK Prime Minister with delivering “innovative ways of encouraging, enabling and supporting people to make better choices for themselves.” Subsequently spun out from government, BIT is now a social purpose company with over 70 staff and international offices in Australia and New York (Behavioral Insights Team, 2015).

MindSPACE is a summary categorisation of a body of largely automatic and contextual effects on behavior that have been found in experimental settings in the laboratory and in the field. This framework has already been exposed to conventional academic scrutiny (Dolan et al., 2012), but this paper seeks to stimulate discussion about the evidence base and appropriateness of behavior change interventions using MindSPACE in the health domain. The importance of behavior change in healthcare is substantial both in terms of morbidity and mortality as well as cost (Darzi et al., 2011). Once again the UK government has been at the forefront of taking a behavioral approach with the UK Department of Health stating that they will explore “nudging people in the right direction rather than banning or significantly restricting their choices” and that “there is significant scope to use approaches that harness the latest techniques of behavioral science” to enable people to make healthier choices (Department of Health, 2010).

So, although MindSPACE has already been applied to various behavioral issues and domains in public policy (see Dolan et al., 2012), by selectively sampling evidence in health behavior change and summarising it in terms of the MindSPACE framework, our purpose is twofold – practical and theoretical. The practical aim is to reveal how recent insights from behavioural economics, such as the ‘nudge’ approach, could provide a powerful set of new and refined policy tools to use when trying to influence behaviours in health. This objective is achieved by providing convincing examples of nudge effects on behaviour change in health, which are systematised in a framework (MindSPACE) that provides a useful 'checklist' for



policy makers and practitioners. The theoretical aim is to demonstrate how those seemingly very diverse types of nudge effects can still be explained in terms of a small set of underlying theoretical mechanisms for action, which are derived from recent advances in behavioral economics. Therefore, even though there will be more nudge phenomena to be discovered and added to the Mindspace list, the proposed underlying mechanisms and their explanatory power may continue to guide future theorising and intervention design. Before achieving the practical aim – exploring each of the elements of Mindspace, we first achieve the theoretical aim by setting out in the next section a conceptual model that serves to ground Mindspace in behavioral science.

## **Understanding Behavior**

This article offers a theory explaining how nudges cause behavior change, before providing convincing examples of nudging health behavior change.

### *Mechanisms of Action*

The ‘dual process’ model has been proposed as a theoretical basis for understanding health behaviors (Hofmann et al., 2008; Marteau et al., 2011; Marteau, Hollands, & Fletcher, 2012; Sheeran, Gollwitzer, & Bargh, 2013). In particular, 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; Strack & Deutsch, 2004).

Neurobiological evidence of separate brain structures for automatic processing of information provides substantial support to this model (Anderson et al., 2004). Note, however, that even though the idea that automatic decisions play a role in health behavior is not new (e.g., see

Hofmann et al., 2008; Sheeran, Gollwitzer, & Bargh, 2013), such accounts predominantly argue that impulsive/automatic decisions should be controlled and modified ('rewired') by training and intervention.

In contrast, although the 'dual process' model is also proposed as a theoretical basis for nudge theory, the nudge approach uniquely proposes that automatic decisions can be systematically triggered to improve health outcomes (Marteano et al., 2011; Marteano, Hollands, & Fletcher, 2012). In other words, nudge theory goes-with-the-grain of human nature, instead of trying to change it.

Similarly, our proposed theoretical framework also employs the dual-process paradigm as a unified framework for behavior change, but, in addition, we provide a more nuanced account of how the automatic systems control behavior and how impulsive decisions are influenced by nudges. This new account is based on very recently developments within behavioral economics and cognitive neuroscience (see Glimcher, Camerer, Fehr, & Poldrack 2009). This evidence converges on the view that multiple decision-making systems in the brain compute such choice/action values, which leads to plethora of effects on behavior reported in the literature (see Rolls, 2014).

Research has shown that there are three core brain systems for behavioral decision making, which generate specific psychological processes (thoughts; drives and emotions; mental and motor habits) that independently cause behavior change (see Vlaev & Dolan, 2015, for a description of those brain structures and review of the evidence). Figure 1 presents those self-regulatory processes involved in behavioral change. The idea that the brain contains such multiple, separate decision systems is ubiquitous in cognitive and behavioral neuroscience (Balleine, 2005; Church et al., 2009; Rangel, Camerer, & Montague, 2008). In particular, reflective thought is embodied in the *goal-directed system*, which engages in model-based reasoning to calculate action-outcome contingencies and predict the sequences

of actions required to achieve valuable outcomes.

Researchers have also distinguished two separate systems for automatic behavioral control. The *habit system* is responsible for adaptive stimulus-action associations. The habit system is centered on learning through repeated practice in a stable environment, to assign values to a variety of actions proportionally to the rewards and punishments received as a result of executing those actions (Verplanken et al., 2007; Wood & Neal 2007). Later the environment alone is enough to cue the habitual response. The assumption that habit systems generate *motor habits* as well as *mental habits* (such as heuristics) is well supported in the literature (Bargh & Chartrand 1999; Gigerenzer & Goldstein, 1996; Gigerenzer, Hoffrage, & Goldstein 2008; Orbell & Verplanken, 2010). The *impulsive system* associates evolutionarily acquired affective states (e.g., belonging, attraction, comfort, disgust, fear, nurture, status, self-worth, trusting)<sup>2</sup> to specific stimuli (e.g., food, money, social groups) (Curtis, Danquah, and Aunger 2009; Fiske 2010; Rolls 2014; Tybur & Griskevicius, 2013). As a result, those stimuli trigger innate automatic behaviors broadly described as ‘approach’ and ‘avoidance’. The impulsive system can influence (enhance or suppress) the actions computed in the goal-directed and habit systems.

### **Behavior Change Techniques**

Designing effective behavior change interventions should start with understanding the behaviors in question, and the drivers and barriers of the desired and/or maladaptive behaviors (Abraham & Michie, 2008; Fishbein et al., 2001; Michie et al., 2011; Shumaker et al., 2008). Only after knowing that a particular behavior is driven by specific type of goal, impulse or habit (see Figure 1), we can determine what *behavior change techniques* (BCTs) are most effective in the specific circumstances (see Table 1). As an example, a recent meta-analysis of interventions aiming to promote hygiene behavior in 11 developing countries allowed the interventions to be assigned to the three categories of underlying behavior (Curtis, Danquah,

& Aunger, 2009). These results were used to develop messages, which are a class of BCTs, aimed at increasing hand washing in restrooms in the developed world. The most effective messages turned out to be based on automatic motivational mechanisms; e.g. the most effective messages used social norms to cue the belonging impulse (“Is the person next to you washing with soap?”), which increased hand-washing by around 12% relative to the control condition.

There has been a recent initiative within health psychology, which attempts to develop a comprehensive taxonomy of BCTs used in interventions (Abraham & Michie, 2008; Michie et al., 2013). This is important, because thus we can develop a common language describing the ‘active ingredients’ of complex interventions, which in turn can facilitate theory development (see Michie et al., 2011). Those taxonomies of BCTs, derived from systematic reviews of the available evidence, differentially engage the behavioral control systems (regulatory processes). Vlaev and Dolan (2015) describe how traditional BCTs (e.g., Abraham & Michie, 2008) target the goal-directed system, and are supposed to persuade or train recipients to adopt a specific behavior. Typical such techniques are ‘provide information about behavior-health link’, ‘provide information on consequences’, ‘plan social support’, ‘relapse prevention’, ‘prompt intention formation’, ‘prompt specific goal setting’, ‘prompt review of behavioral goals’. Economists and psychologists have also convincingly demonstrated that people respond to ‘incentives’ which usually activate reflective thinking and motivation by changing the evaluation of the available courses of action (e.g., people rationally respond to changes in prices and costs). In contrast, nudge theory, and the Mindspace framework in particular, provide a list of BCTs that target the automatic decision processes. Mindspace is a mnemonic representing an elaborated and extended version of the nudge approach, which outlines the nine most powerful contextual influences on automatic behavior. In summary, different BCTs influence distinct components of our framework; but

because our objective here is to discuss the theory and practice of nudging health behaviors, Mindspace is the focus of this article.

## **Understanding Nudges – The Mindspace Way**

Mindspace is a mnemonic that reflects an attempt by the group who developed it to gather up the most robust effects on behavior that operate largely through automatic neurobiological systems and psychological processes. Mindspace elements - Messenger, Incentives, Norms, Defaults, Salience, Priming, Affect, Commitment and Ego – have demonstrable evidence supporting their use as behavior change techniques (Dolan et al., 2012). In Table 1, we summarise these effects (BCTs) alongside the main brain system (third column) and psychological processes (fourth column) generated by those brain systems which are involved in generating behavior; and thus can explain the Mindspace techniques and the examples discussed below. We do not claim that this is the only system in operation but rather to highlight the system that is likely to do most of the ‘heavy lifting’ (in this respect, we note that Messenger, Incentives, Norms and Commitment could also be implemented in ways that involved reflective motivation although in most cases they would be focusing on automatic processes). We focus on illustrating the workings of nudge theory, while acknowledging that some nudge interventions are better explained by different combinations of these underlying mechanisms.

## **Mindspace in Action**

The evidence is structured according the Mindspace framework (see Table 1), which was originally developed using a mixed methods study design incorporating an extensive literature review. We refined our ideas after testing them with expert panels and interviews with senior policy makers and behavioral scientists. We provide examples of how each of the Mindspace elements – messenger, incentives, norms, defaults, salience, priming, affect, commitment and ego – has been applied to address specific challenges in healthcare (the

behavioral interventions cited under each Mindspace element address some of the most prominent challenges).

### **Messenger**

We are heavily influenced by who communicates information to us. The weight we give to information depends greatly on the reactions we have to the source of that information. For example, we are influenced by both the perceived authority of the messenger and also the feelings we have for the source of the message – often discarding information from people we do not like (Cialdini, 2007; Webb & Sheeran, 2006). So we see that physicians are significantly more likely to trust guidelines from their own professional organizations compared to the same guidelines delivered by insurance companies (Tunis et al. 1994). Similarly, while 76% of parents had confidence in the advice on vaccinations provided by their child's paediatrician, just 23% endorsed the advice of government experts or officials (Freed et al., 2011).

Effective communication is an integral part of health promotion strategies and messages are more likely to create an impact if they use a credible source for the population being targeted (Glik, 2007). A meta-analysis of 166 HIV-prevention interventions found expert interventionists produced greater behavior change than non-experts and the demographic and behavioral similarity between the interventionist and recipients facilitated behavior change (Durantini et al., 2006). Policy makers appear to be taking note of people's impulsive tendency to trust or distrust advice depending on who the information is received from with the UK government thinking about who the messenger is in interventions around reducing levels of obesity and teenage pregnancies (Behavioral Insights Team, 2011).

### **Incentives**

Our responses to incentives are often shaped by impulsive but predictable mental shortcuts and insights from behavioral economics can be used to 'supercharge' incentive

schemes (Volpp et al., 2011). For example, it is known that we strongly prefer avoiding losses more than we like gains of the same amount – a tendency known as loss aversion (Kahneman & Tversky, 1979). Such impulsive avoidance is triggered by automatic fear responses in the brain (De Martino et al., 2006). A randomised trial of incentives for encouraging weight loss found they could be effective – at least in the short term – when people risked losing money (Volpp et al., 2008), in contrast to a previous systematic review that found little effect on weight loss by offering a standard financial incentive (Paul-Ebhohimhen & Avenell, 2008). Incorporating insights from behavioral economics into incentive design are being increasingly incorporated in interventions targeting health related behaviors including medication adherence and health screening opportunities (Mantzari et al., 2015).

## **Norms**

We are strongly influenced by what others do. Because of innate impulses to belong and seek affiliation with groups and similar others, the influence of what others around us are doing can be a powerful driver of our own behavior (Fiske, 2010). Two main forms of social influence can be distinguished: informational (telling people what is commonly done) and normative social influence (informing them what is widely approved) (Deutsch & Gerard, 1955). Using norms as cues for behavior change is often reported in the literature and is usually based on telling people what others are doing in a similar situation (Burger & Shelton, 2011; Cialdini 2003, 2007).

Conformity with local social norms has been seen to be a powerful driver of preventative behaviors – and has been shown to be effective in interventions encouraging hygiene behaviors, healthy food choice, exercise and alcohol misuse (Burger et al., 2010; Burger & Shelton, 2011; Curtis, Danquah, & Aunger, 2009; Perkins & Craig, 2006). The Behavioral Insights Team in the UK have supported a social norms approach to reducing harmful drinking at British universities that the Team is soon to report (Murphy, Moore,

Williams, & Moore, 2012).

It is important also to recognize that providing *norms* information can also have negative effects on behavior. Providing information about low participation in cancer screening actually demotivated the intention of members of the public to take up screening opportunities compared to control groups (Sieverding, Decker, & Zimmermann, 2010). Norms also help to explain ‘contagious behavior’ through large interconnected social networks e.g. people are more likely to be obese or smoke if others around them share these characteristics or behaviors (Christakis & Fowler, 2007, 2008).

### **Defaults**

We tend to ‘go with the flow’ of pre-set options. Defaults are the options that are preselected if an individual does not make an active choice. The key feature of default options is that they can have a powerful impact on behavior without necessarily restricting choice (Sunstein & Thaler, 2003). This is because losing the default might loom larger than gaining the alternative option (De Martino et al., 2006), or due to impulsive overvaluation of immediate, and undervaluation of delayed, rewards/costs (McClure et al., 2004). The most powerful example of the use of defaults in public policy is the impact of automatic pension enrollment where an opt-out default has been seen significantly to improve participation (Madrian & Shea, 2001). In healthcare, powerful effects of defaults on behavior have also been observed in organ donation decisions and employees’ contributions to healthcare flexible-spending accounts (Johnson & Goldstein 2003; Schweitzer, Hershey, & Asch, 1996). With this knowledge, many countries are now wrestling with how to best choose health-related defaults – particularly in relation to organ transplant register (Moseley & Stoker, 2015).

All too frequently, default settings are chosen on the basis of natural ordering or convenience rather than to promote welfare. As people often lack established preferences



regarding their choices in healthcare, Halpern, Ubel, and Asch (2007) suggest that those setting defaults should use them where they can to improve outcomes rather than worsen them. In an intensive care setting, dramatic improvements in outcomes have been seen when lung-protective settings and breaks in sedation for ventilated patients were ordered unless otherwise indicated by a physician (ARDSN, 2000; Kress et al., 2000).

### **Saliency**

Our attention is drawn to what is novel and seems relevant to us. As humans have limited perceptual and cognitive resources, choices tend to be affected by anything that falls within the focus of our limited attention span (Kahneman & Thaler, 2006). It is also known that people automatically use mental habits such as heuristics that make decisions only on the basis of a single most salient or important criterion at a time and ignore other relevant information (Gigerenzer, Hoffrage, & Goldstein, 2008; Seymour, Singer, & Dolan, 2007). This is applied in a field intervention testing whether information on HIV risk can change sexual behavior among teenagers in Kenya (Dupas, 2011). Providing information about a single criterion – 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. In contrast, there was no significant decrease in teen pregnancy after the introduction of a very costly national HIV education curriculum, which provided information about the risk of HIV and did not focus the message on the risk distribution in the population.

### **Priming**

Our behaviour is influenced by sub-conscious cues. Priming cues send excitatory signals between perceptual features and motor programs that have been frequently executed in connection with such features, which are known as behavioral schemata or motor habits (Strack & Deutsch, 2004). An individual's subsequent behavior can be altered if they are first exposed to certain environmental influences like words, sights and smells. For example,

exposing people to words such as *fit*, *lean*, *active*, and *athletic*, makes them more likely to use stairs instead of elevators (Wryobeck & Chen, 2003). Priming is perhaps the least understood and explored element of Mindspace, but evidence does exist supporting the practical impact of such ‘primes’. When children were exposed to food advertisements, they appeared to be ‘primed’ to significantly increase their total food intake (Halford et al., 2007). It has also been demonstrated that the amounts of food people serve and consume can vary depending on the size of food containers used. Participants in an experimental study served themselves 53% more calories and consumed 56% more calories than those taking food from a smaller bowl (Wansink & Cheney, 2005). Our research team have recently demonstrated that the hand hygiene of visitors to a surgical intensive care unit was significantly enhanced through specific olfactory and visual primes (King, Vlaev et al. 2015).

### **Affect**

Our emotional associations can powerfully shape our actions. Emotion is a powerful automatic force in decision-making and can powerfully shape actions. Cues evoking disgust have been seen to have a powerful effect on behavior compared to traditional behavior change models relying on providing health information alone. The failure to wash hands after toilet use was identified as a major public health issue in Ghana. It was found that Ghanaians tend to wash their hands when they were felt to be dirty, and previous approaches that had attempted to inform and change health behaviors had been unsuccessful. An intervention campaign including a widely seen television commercial, focused on provoking disgust at not washing hands rather than just simply promoting soap use. This resulted in a 13% increase in the use of soap after the toilet and 41% increase in reported use before eating (Curtis, Garbrah-Aidoo, & Scott 2007).

### **Commitment**

We seek to be consistent with our public promises. People deliberately make

commitments, as they are all too aware of their impulsive weaknesses and tendency to procrastinate. The power of commitments was aptly demonstrated by the *save more for tomorrow plan* where a pre-commitment to increasing savings contributions with pay rises led to the average savings rate for the participants increasing from 3.5% to 11.6% (Thaler & Benartzi, 2004). People wishing to stop smoking or exercise more have long used commitment devices and there is some limited evidence of their effectiveness (Bosch-Capblanch et al., 2007). A randomised controlled trial showed that African American women signing a behavioral contract, were significantly more likely to reach their exercise goals than a control group where no commitment was made (Williams et al. 2006). The Behavioral Insights Team are trialling commitment devices in areas including smoking cessation and physical activity (Behavior Insights Team 2011).

It may be that commitment contracts are made more effective if there is more than just a reputational loss at stake. A commitment contract (known as CARES) for smoking cessation asked people to make a voluntary commitment to stop smoking. In addition they pledged their own money that they would pass a urine test for nicotine metabolites six months later. If it was negative they would have the money returned to them [without interest], but if they failed the money was donated to charity. Those signing up to the CARES contract were more likely to pass the 6-month test as well as a surprise test at 12 months than a control group, indicating that such a scheme could produce lasting smoking cessation (Gine, Karlan, & Zinman, 2008).

## **Ego**

We act in ways that make us feel better about ourselves. We behave in ways that support the impression of a positive and consistent self-image, which is caused by innate impulses to behave in ways that enhance our social status (Bateson, Nettle, & Roberts 2006; Curtis, Danquah, & Aunger, 2009; Haley & Fessler, 2005). A number of studies have demonstrated that unfavourable social images of the type of person who engages in specific

risk behavior (e.g., the “typical” smoker or drinker) are associated with less willingness to engage in such behaviors, including unprotected sex (Gibbons, Gerrard, & McCoy, 1995), drinking (Gerrard et al., 2002), driving under the influence (Gibbons et al., 2002) and smoking (e.g., smokers with negative images of smokers are more likely to be successful at quitting) (Gerrard et al., 2005). Also, individuals exposed to a manipulation with favourable characteristics of images of people who exercise (e.g., appearance, general health, energy level, attitude toward life, achievements, social relationships) increased their exercise behavior (Ouellette et al., 2005).

## **Discussion**

Traditional ways of changing behavior, such as legislation, regulation, and incentives, can be very effective. Behavioral economics does not attempt to replace these methods. Rather, it extends and enhances them, adding new dimensions that reflect fundamental, but often neglected, influences on behavior. This article reveals how recent insights from behavioral economics, such as the ‘nudge’ approach, could provide a powerful set of new and refined policy tools to use when trying to influence behaviors in health (Allcott & Mullainathan, 2010; Marteau, Hollands, & Fletcher, 2012). To date the use of such insights have been hindered by the lack of a coherent theory explaining their mechanisms of action and also by the lack of a practical framework for designing interventions. The purpose of this article is twofold. First is to offer a novel theory explaining how nudges cause behavior change, which is based on recent advances in cognitive neuroscience (especially the distinction between the (motor and mental) habit system and the impulsive system generating specific motivational states). The practical aim is to reveal how recent insights from behavioural economics, such as the ‘nudge’ approach, could provide a powerful set of new and refined policy tools to use when trying to influence behaviours in health. This objective is achieved by providing convincing examples of nudge effects on behaviour change in health,

which are systematised in a framework (MindSpace) that provides a useful 'checklist' for policy makers and practitioners. The examples also provide suggestive evidence to develop future interventions guided by these elements and behavioral economics. Thus, given the lack of sufficient evidence of behavioral economics intervention at the population health level, this article would contribute to increasing such research.

### **Ethics of Nudging**

The potential impact of the 'choice architecture' on health related behavior change (Thaler & Sunstein, 2008) does raise questions about who decides on this architecture and on what basis. Many people dislike the thought of government intruding into areas of personal responsibility, though they also realize that the state should have a role in behavior change, especially when one person's behavior has consequences for other people. This is not just relevant to health related behaviors, but across public policies where interventions utilising MindSpace interventions are being applied.

So before policy-makers consider how they can apply new insights, they need to determine whether they should be attempting to change behavior in the first place. In this respect, it is vital that where possible the public's views are taken into account, and permission sought, when introducing interventions. The legitimacy of government and health policy practitioners rests on the fact that they represent and serve the people, and therefore it may be useful for 'choice architects' to engage better with citizens to explore what is and is not acceptable.

The wellbeing consequences of nudges come in various guises. We can distinguish between three broad accounts of well-being: objective lists – wellbeing improves when getting more of the things that others decide are good for everybody; preference satisfaction – wellbeing improves when individuals are able to satisfy more of their desires; and mental states – wellbeing improves with better thoughts and feelings about life and one's experiences

(Parfit, 1984). Differentiation between preferences and feelings resonates with recent neurobiological evidence dissociating psychological components of reward (Berridge, Robinson, & Aldridge, 2009).

Public policy has principally been about an ‘objective list’ account – ensuring that people get better health and education, for example, often irrespective of whether they want or like it. The private sector constantly nudges consumers to buy more goods and services, and markets work reasonably well to satisfy revealed preferences. Public sector nudges can be assessed according to the degree to which they show up in all accounts of wellbeing, including the ‘liking’ account – do individuals report feeling happier after they have been nudged in a particular direction? The liking account will also be important a cause of behavior change as well as a consequence e.g. satisfaction (wellbeing) and behavior maintenance go hand-in-hand in weight loss and smoking cessation (Baldwin et al., 2006; Finch et al., 2005; Hertel et al., 2008).

Of course public acceptability should not be the only reason for going forward with behavior change. Consider, for example, the shifts in attitude of the public following the introduction of daily charges for drivers entering central London, where support grew considerably following its introduction (Knott, 2008). The role of experiences on preferences is an under researched area (Berridge, Robinson, & Aldridge, 2009), and it could be that what people want before a policy is different to what they want after it. Here we propose that better theoretical modelling of shifts in preferences or opinion and also changes in wellbeing (Dolan & White, 2007), given the expected impact of an intervention, could provide enhanced permission for intervention.

Our perspective on whether policy makers should be using ‘nudge’ type tools follows closely that of ‘libertarian paternalists’, who argue that it is ‘both possible and legitimate for private and public institutions to affect behavior while also respecting freedom of choice’

(Sunstein & Thaler, 2003). The simple fact is that individuals are constantly being influenced, and influencing others. The choice environment is rarely neutral and ‘choice architects’ will always be shaping decisions whether people like it or not. We would argue that where possible, policy-makers should be doing what they can to construct the choice environment in a way that is more likely to improve health and wellbeing rather than worsen it.

### **Intervention Design**

Intervention design usually begins with a comprehensive analysis of the behavioral problem or goal. This analysis usually involves mixed methods approach (Creswell & Plano Clark, 2011) employing surveys, interviews and/or observations of the populations in question in order to understand the underlying barriers preventing, and enablers driving, the target behavior. Thus after understanding that a specific behavior can be potentially driven by goals, impulses and habits (Figure 1), the framework presented in Table 1 can also be used in analysis of the barriers and potential drivers of behavior change (i.e., the Mindspace nudges that are likely to be effective in specific circumstances). In this way, our comprehensive theoretical framework for understanding behavior ensures that the most appropriate intervention is implemented once we have better understanding of the role of various determinants in health behaviors. For example, some people may not be reflectively motivated to do physical activity, while others may be rationally motivated but their social circle is not, i.e., the behavior is not a norm. For the former individuals, the intervention could contain reflective motivational techniques such as ‘providing information on consequences’, ‘prompting barrier identification’, ‘prompting specific goal setting’, and ‘prompting review of behavioral goals’ (see Abraham & Michie, 2008; Michie et al., 2013); while for the latter group, providing information about ‘social norms’, such as testimonials from people most similar to the target audience, should have powerful, yet automatic influence on motivation (i.e., it is important to inform people that they are not only behaving in ways that are

desirable, but continue to be similar to others just like them). Similarly, establishing respondents' need to 'belong' and their desire to behave like people-like-them, would reveal whether providing cues signaling 'social norms' is the appropriate intervention technique. Policy makers or health practitioners who are attempting to influence behavior should be aware of these effects and understand how they can be used.

We certainly do not suggest that Mindspace offers answers to all the challenges individuals face. We support the use of conventional policy tools such as legislation and price changes when and where they work. In the case of alcohol, for example, evidence suggests that increasing the price of drinks may be a powerful motivator of reducing alcohol consumption (Purshouse et al., 2010), and we should certainly not ignore these methods. This example is classic economic use of the 'I' of Mindspace. Incentives, norms and salience could all be used to help to make existing laws about not serving alcohol inappropriately work better – at the moment, there is little incentive to enforce the law, no norm behavior and the law is surely far from being salient to many bar staff serving alcohol. In addition, defaults of smaller measures of alcohol could be used or social marketing campaigns informing people of the true consumption levels of relevant others.

### **Future Directions**

There is still much unknown about the Mindspace elements and the nudge approach in general. There remains uncertainty over how long the nudge effects last and how well they work in different segments of the population, health conditions and behavioral domains (Marteano et al., 2011; Marteano, Hollands, & Fletcher, 2012; Sheeran, Gollwitzer, & Bargh, 2013). Recent work identify two types of interventions – either most effective soon after they are administered, or those that induce lasting changes (Rogers & Frey, 2015). For example, defaults, salience and priming are more likely to affect behavior when they are associated with short intervention-behavior lags (the nudging stimulus is delivered just before the



decision to act or not); while correcting inaccurate but important beliefs can help interventions have longer impact. We also do not yet have a full understanding of the potential impact of such policies on status inequalities – the association between socioeconomic status (education and income) and health; although tools acting on the automatic system may be less likely to be dependent on education and income and therefore a more equitable way of influencing behavior. Anti-smoking advertisements that contained highly emotional elements were found to have greater impact on people with low- and mid-socioeconomic status than among high-socioeconomic status groups (Durkin, Biener, & Wakefield, 2009). We need to remain vigilant of compensating behaviors and spill-over effects that can result from behavioral interventions. The finding that most people put weight on following successful attempts to quit smoking or that high levels of exercise may result in compensatory mechanisms – such as overeating – suggest the need for joined up thinking, and clarity about the over-arching objectives of policy (Church et al., 2009; Parsons et al., 2009).

All these questions will only be answered by the rigorous evaluation of interventions, ideally through field experiments. Indeed, there is an increasing number of studies from the field to draw evidence from – although much of it is outside the health domain (DellaVigna, 2009). More evidence should come from the explosion of interest in health-related behavior change, not least from the work of the UK Behavioral Insights Team. Future research should target these limitations in order to provide solid evidence for population-wide interventions and health policy. Future research should also determine the relative effectiveness of the various nudging techniques for different health behaviors. In so doing, we can develop basic behavioral science into evidence-based policy. In general, it is likely that the most effective and sustainable changes in behavior will come from the successful integration of different techniques. It is now time to more rigorously develop the specifics of interventions that join-

up interventions that seek to change behavior through more subtle nudges alongside the harder 'shoves' of legislation.

## Notes

1. 'Traditional' in the policy context have meant neoclassical economics, while traditional approaches in psychology encompass theories from social and health psychology developed in the last five decades or so, which have attempted to understand the determinants of health behavior. In psychology, health behavior was initially conceptualised in terms of theories from social psychology such as self-efficacy theory (Bandura, 1977), social-cognitive theory (Bandura, 1986), the theory of reasoned action (Fishbein & Ajzen, 1975) and the theory of planned behavior (Ajzen, 1991). The field was further developed theories from health psychology which specifically focused on health behaviour, such as protection motivation theory (Rogers, 1983), the health-belief model (Janz & Becker, 1984), and stage approaches (e.g., Prochaska, DiClemente, & Norcross, 1992; Schwarzer, 1992; Weinstein & Sandman, 1992). Those 'traditional' models commonly assume that 'health behavior is the result of cognitive appraisal processes of the (a) expectancy and value of potential health threats and (b) possible coping responses. From these appraisal processes, a behavioral decision to reduce the health threat may be formed' (Hofmann, Friese, & Wiers, 2008, p. 113).

2. Those emotions are specifically defined: *belonging* is seeking to conform so as to reap the benefits of social living; *attraction* is being attracted to, and wanting to attract, high-value mates; *comfort* is desire to place one's body in optimal physical and chemical conditions; *disgust* is provoked by, and brings desire to avoid, objects and situations carrying disease risk; *fear* is triggered by, and aims to avoid, objects and situations carrying risk of injury or death; *nurture* is a want to care for offspring; *status* is a rewarding state and ignites seeking to

Theory to Practice  
Hal G. Rainey, Editor

optimize social rank; *self-worth* is a need for viewing self as basically worthy or improvable; and *trusting* is a need for viewing others as basically benign (see Curtis, Danquah, & Anger, 2009; Fiske, 2010; Rolls, 2014).

## References

- Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*, 379-387.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.
- Allcott, H., & Mullainathan, S. (2010). Energy. Behavior and energy policy. *Science, 327*, 1204-1205.
- Anderson, J., Bothell, D., Byrne, M., Douglass, S., Lebiere, C., & Qin, Y. (2004). An integrated theory of the mind. *Psychological Review, 111*, 1036-1060.
- Acute Respiratory Distress Syndrome Network ARDSN (2000). Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *New England Journal of Medicine, 342*, 1301-1308.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191-215.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Baicker, K., Congdon, W. J., & Mullainathan, S. (2012). Health insurance coverage and take-up: lessons from behavioral economics. *Milbank Quarterly, 90*, 107-134.
- Baldwin, A. S., Rothman, A. J., Hertel, A. W., Linde, J. A., Jeffery, R.W., Finch, E.A., & Lando, H. A. (2006). Specifying the determinants of the initiation and maintenance of behavior change: an examination of self-efficacy, satisfaction, and smoking cessation. *Health Psychology, 25*, 626-634.
- Balleine, B. (2005). Neural bases of food-seeking: affect, arousal and reward in corticostriatolimbic circuits. *Physiology & Behavior, 86*, 717-730.
- Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American*

*Psychologist*, 54, 462-479.

Bateson, M., Nettle, D., & Roberts, G. (2006). Cues of being watched enhance cooperation in a real-world setting. *Biology Letters*, 2, 412-414.

Berridge, K. C., Robinson, T. E., & Aldridge, J. W. (2009). Dissecting components of reward: 'liking', 'wanting', and learning. *Current Opinion in Pharmacology*, 9, 65-73.

Behavior Insights Team (2011). *Applying behavioral insight to health*. London: Cabinet Office ([www.gov.uk/government/publications/applying-behavioral-insight-to-health-behavioral-insights-team-paper](http://www.gov.uk/government/publications/applying-behavioral-insight-to-health-behavioral-insights-team-paper)).

Behavior Insights Team (2015). *The Behavioral Insights Team Update 2013-2015*. London: Cabinet Office ([www.behavioralinsights.co.uk/publications/the-behavioral-insights-team-update-report-2013-2015/](http://www.behavioralinsights.co.uk/publications/the-behavioral-insights-team-update-report-2013-2015/)).

Bosch-Capblanch, X., Abba, K., Prictor, M., & Garner, P. (2007). Contracts between patients and healthcare practitioners for improving patients' adherence to treatment, prevention and health promotion activities. *Cochrane Database Systematic Reviews*, CD004808.

Burger, J., Bell, H., Harvey, K., Johnson, J., Stewart, C., Dorian, K., & Swedroe, M. (2010). Nutritious or delicious? The effect of descriptive norm information on food choice. *Journal of Social and Clinical Psychology*, 29, 228-242.

Burger, J., & Shelton, M. (2011). Changing everyday health behaviors through descriptive norm manipulations. *Social Influence*, 6, 69-77.

Cabinet Office. (2011). *Behavior change and energy use*. London: Cabinet Office.

Cecchini, M., F. Sassi, J.A. Lauer, Y.Y. Lee, V. Guajardo-Barron, and D. Chisholm (2010). Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *Lancet*, 376, 1775-1784.

Chaiken, S., & Trope, Y. (1999). *Dual-process theories in social psychology*. New York: Guilford Press.

- Christakis, N. A., & J. H. Fowler (2007). The spread of obesity in a large social network over 32 years. *New England Journal of Medicine*, 357, 370-379.
- Christakis, N. A., & J. H. Fowler (2008). The collective dynamics of smoking in a large social network. *New England Journal of Medicine*, 358, 2249-2258.
- Church, T. S., Martin, C. K., Thompson, A. M., Earnest, C. P., Mikus, C. R., & Blair, S. N. (2009). Changes in weight, waist circumference and compensatory responses with different doses of exercise among sedentary, overweight postmenopausal women. *Plos One*, 4, e4515.
- Cialdini, R. (2003). Crafting normative messages to protect the environment. *Current Directions in Psychological Science*, 12, 105-109.
- Cialdini, R. (2007). *Influence: The psychology of persuasion*. New York: Harper Business.
- Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research*. (2nd ed.). Thousand Oaks, CA: Sage.
- Curtis, V., Danquah, L., & Aunger, R. (2009). Planned, motivated and habitual hygiene behavior: an eleven country review. *Health Education Research*, 24, 655-673.
- Curtis, V.A., Garbrah-Aidoo, N., & Scott, B. (2007). Ethics in public health research: masters of marketing: bringing private sector skills to public health partnerships. *American Journal of Public Health*, 97, 634-641.
- Darzi A. (2008). High quality care for all: NHS Next Stage Review. London: Department of Health.
- Darzi, A., Beales, S., Hallsworth, M., King, D., Macdonnell, M., & Vlaev, I. (2011). The Five Bad Habits of Healthcare How New Thinking about Behavior Could Reduce Health Spending. *World Economic Forum Report*.
- De Martino, B., Kumaran, D., Seymour, B., & Dolan, R. J. (2006). Frames, biases, and rational decision-making in the human brain. *Science*, 313, 684-687.

- DellaVigna, S. (2009). Psychology and economics. Evidence from the field. *Journal of Economic Literature*, 47, 315-372.
- Department of Health (2010). Healthy lives, healthy people: our strategy for public health in England.
- Deutsch, M., & Gerard, H. (1955). A study of normative and informational social influences upon individual judgment. *Journal of Abnormal and Social Psychology*, 51, 629-636.
- Dolan, P., Hallsworth, M., Halpern, D., King, D., Metcalfe, R., & Vlaev, I. (2012). Influencing behavior: the mindspace way. *Journal of Economic Psychology*, 33, 264-277.
- Dolan, P., Hallsworth, M., Halpern, D., King, D., & Vlaev, I. (2010). *MINDSPACE: Influencing behavior through public policy*. London: Cabinet Office.
- Dolan, P., & White, M. (2007). How can measures of subjective well-being be used to inform public policy? *Perspectives on Psychological Science*, 2, 71-85.
- Dupas, P. (2011). Do teenagers respond to HIV risk information? Evidence from a field experiment in Kenya. *American Economic Journal: Applied Economics*, 3, 1-34.
- Durantini, M., Albarracín, D., Mitchell, A., Earl, A., & Gillette, J. (2006). Conceptualizing the Influence of Social Agents of Behavior Change: A Meta-Analysis of the Effectiveness of HIV-Prevention Interventionists for Different Groups. *Psychological Bulletin*, 132, 212-248.
- Durkin, S., Biener, L., & Wakefield, M. (2009). Effects of different types of antismoking ads on reducing disparities in smoking cessation among socioeconomic subgroups. *American Journal of Public Health*, 99, 2217-2223.
- Emanuel, E. J., & Fuchs, V. R. (2008). The perfect storm of overutilization. *Journal of the American Medical Association*, 299, 2789-2791.

Evans, J. (2008). Dual-processing accounts of reasoning, judgement, and social cognition.

*Annul Review of Psychology, 59, 255-278.*

Finch, E. A., Linde, J. A., Jeffery, R. W., Rothman, A. J., King, C. M., & Levy, R. L. (2005).

The effects of outcome expectations and satisfaction on weight loss and maintenance: correlational and experimental analyses--a randomized trial. *Health Psychology, 24, 608-616.*

Fishbein, M., & Ajzen, I. (Eds.). (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Fishbein, M., Triandis, H., Kanfer, F., Becker, M., Middlestadt, S., & Eichler, A. (2001).

Factors influencing behavior and behavior change, in *Handbook of Health Psychology*, Baum A, Revenson T, and Singer J., eds. Imahwah. NJ Lawrence Erlbaum Associates, 3-17.

Fiske, S. (2010). *Social beings: core motives in social psychology.* New York: Wiley.

Freed, G. L., Clark, S. J., Butchart, A. T., Singer, D. C., Davis, M. M. (2011). Sources and perceived credibility of vaccinesafety information for parents. *Pediatrics, 127, S17.*

Gallus, S., Schiaffino, A., La Vecchia, C., Townsend, J., & Fernandez, E. (2006). Price and cigarette consumption in Europe. *Tobacco Control, 15, 114-119.*

Gerrard, M., Gibbons, F., Lane, D., & Stock, M. (2005). Social comparison and smoking cessation: Comparison level predicts success. *Health Psychology, 24, 623-629.*

Gerrard, M., Gibbons, F., Reis-Bergan, M., Trudeau, L., Vande Lune, L., & Buunk, B.

(2002). Health cognitions and adolescent alcohol consumption: Inhibitory effects of drinker and non-drinker prototypes. *Health Psychology, 21, 601-609.*

Gibbons, E., Gerrard, M., & McCoy, C. (1995). Prototype perception predicts (lack of) pregnancy prevention. *Personality and Social Psychology Bulletin, 85-93.*



- Gibbons, F. X., Lane, D. J., Gerrard, M., Pomery, E. A., & Lautrup, C. L. (2002). Drinking and driving: A prospective assessment of the relation between risk cognitions and risk behavior. *Risk, Decision and Policy*, 7, 267–283.
- Gigerenzer, G., & Goldstein, D. G. (1996). Reasoning the fast and frugal way: Models of bounded rationality. *Psychological Review*, 103, 650–669.
- Gigerenzer, G., Hoffrage, U., & Goldstein, D. G. (2008). Fast and frugal heuristics are plausible models of cognition. *Psychological Review*, 115, 230–237.
- Gine, X., Karlan, D., & Zinman, J. (2008). *Put your money where your butt is: A commitment contract for smoking cessation*. World Bank Policy Research Working Paper 4985.
- Glik, D. C. (2007). Risk communication for public health emergencies. *Annual Review of Public Health*, 28, 33-54.
- Glimcher, P., Camerer, C., Fehr, E., & Poldrack, R. (2009). *Neuroeconomics: Decision making and brain*. New York: Academic Press.
- Grol, R. (2001). Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Milbank Quarterly*, 76, 517-563.
- Grol, R., & Grimshaw, J. (2003). From best evidence to best practice: effective implementation of change in patients' care. *Lancet*, 362, 1225-1230.
- Haley, K., & Fessler, D. (2005). Nobody's watching? Subtle cues affect generosity in an anonymous economic game. *Evolution and Human Behavior*, 26, 245-256.
- Halford, J.C., Boyland, E. J., Hughes, G., Oliveira, L. P., & Dovey, T. M. (2007). Beyond-brand effect of television (TV) food advertisements/commercials on caloric intake and food choice of 5-7-year-old children. *Appetite*, 49, 263-267.
- Halpern, S.D., Ubel, P. A., & Asch, D. A. (2007). Harnessing the power of default options to improve health care. *New England Journal of Medicine*, 357, 1340-1344.

- Hertel, A. W., Finch, E. A., Kelly, K. M., King, C., Lando, H., Linde, J. A., Jeffery, R. W., & Rothman, A. J. (2008). The impact of expectations and satisfaction on the initiation and maintenance of smoking cessation: an experimental test. *Health Psychology, 27*, S197-206.
- Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on health behavior: a theoretical framework and empirical review. *Health Psychology Review, 2*, 111-137.
- Hollands, G. J., Shemilt, I., Marteau, T. M., Jebb, S. A., Kelly, M. P., Nakamura, R., Suhrcke, M., & Ogilvie, D. (2013). Altering micro-environments to change population health behaviour: towards an evidence base for choice architecture interventions. *BMC Public Health, 13*, 1218.
- Horton, R. (2011). Offline: Nudge. *Lancet, 377*, 192.
- Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education Quarterly, 11*, 1-47.
- Johnson, E.J., & Goldstein, D. (2003). Do defaults save lives? *Science, 302*, 1338-1339.
- Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. *American Economic Review, 93*, 1449-1475.
- Kahneman, D. (2011). *Thinking, fast and slow*. New York: Farrar, Straus and Giroux.
- Kahneman, D., & Thaler, R. (2006). Utility Maximisation and Experienced Utility. *Journal of Economic Perspectives, 20*, 221-234.
- Kahneman, D., & Tversky, A. (1979). Prospect theory: an analysis of decision under risk. *Econometrica, 263-291*.
- Kahneman, D., & Tversky, A. (2000). *Choices, values and frames*. New York: Cambridge University Press and the Russell Sage Foundation.

- King, D., Vlaev, I., Everett-Thomas, R., Fitzpatrick, M., Darzi, A., & Birnbach, D. (2015). Priming hand hygiene compliance in clinical environments. *Health Psychology* (forthcoming).
- Kinmonth, A. L., Wareham, N. J., Hardeman, W., Sutton, S., Prevost, A. T., Fanshawe, T., Williams, K. M., Ekelund, U., Spiegelhalter, D., & Griffin, S. J. (2008). Efficacy of a theory-based behavioral intervention to increase physical activity in an at-risk group in primary care (ProActive UK): a randomised trial. *Lancet*, *371*, 41-48.
- Knott, D., Muers, S., & Aldridge, S. (2008). *Achieving Culture Change: A Policy Framework*. Prime Ministers Strategy Unit, p.68.
- Kress, J. P., Pohlman, A. S., O'Connor, M. F., & Hall, J. B. (2000). Daily interruption of sedative infusions in critically ill patients undergoing mechanical ventilation. *New England Journal of Medicine*, *342*, 1471-1477.
- Loewenstein, G., Asch, D. A., Friedman, J. Y., Melichar, L. A., & Volpp, K. G. (2012). Can behavioral economics make us healthier? *BMJ*, *344*, e3482.
- Loewenstein, G., Brennan, T., & Volpp, K. G. (2007). Asymmetric paternalism to improve health behaviors. *Journal of American Medical Association*, *298*, 2415-2417.
- Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., ... Murray, C. J. L. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, *380*, 2095-2128.
- Mackenbach, J. P., Stirbu, I., Roskam, A. J., Schaap, M. M., Menvielle, G., Leinsalu, M., & Kunst, A. E. (2008). Socioeconomic inequalities in health in 22 European countries. *New England Journal of Medicine*, *358*, 2468-2481.
- Madrian, B. C., & Shea, D. F. (2001). The power of suggestion: Inertia in 401(k) participation and savings behavior. *Quarterly Journal of Economics*, *116*, 1149-1187.

- Marteau, T. M., Hollands, G. J., & Fletcher, P. C. (2012). Changing human behavior to prevent disease: the importance of targeting automatic processes. *Science*, *337*, 1492-1495.
- Marteau, T. M., Ogilvie, D., Roland, M., Suhrcke, M., & Kelly, M. P. (2011). Judging nudging: can nudging improve population health? *BMJ*, *342*, d228.
- McClure, S. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2004). Separate neural systems value immediate and delayed monetary rewards. *Science*, *306*, 503-507.
- Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., et al. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, *46*, 81-95.
- Michie, S., van Stralen, M. M., & West, R. (2011). The behavior change wheel: A new method for characterising and designing behavior change interventions. *Implementation Science*, *6*, 42.
- Mokdad, A.H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States. *Journal of the American Medical Association*, *291*, 1238-1245.
- Mantzari, E., Vogt, F., Shemilt, I., Wei, Y., Higgins, J. P. T., & Marteau, T. M. (2015). Personal financial incentives for changing habitual health-related behaviors: A systematic review and meta-analysis. *Preventive Medicine*, *75*, 75-85.
- Moseley, A., & Stoker, G. (2015). Putting public policy defaults to the test: The case of organ donor registration. *International Public Management Journal*, *18*, 246-264.
- Murphy, S., Moore, G., Williams, A., & Moore, L. (2012). An exploratory cluster randomised trial of a university halls of residence based social norms intervention in Wales, UK. *BMC Public Health*, *12*, 186.
- Orbell, S., & Verplanken, B. (2010). The automatic component of habit in health behavior:

- habit as cue-contingent automaticity. *Health Psychology, 29*, 374–383.
- Ouellette, J., Hessling, R., Gibbons, F., Reis-Bergan, M., & Gerrard, M. (2005). Using images to increase exercise behavior: Prototypes vs. possible selves. *Personality and Social Psychology Bulletin, 31*, 610-620.
- Parfit, D. (1984). *Reasons and persons*. Oxford: Oxford University Press.
- Parsons, A.C., Shraim, M., Inglis, J., Aveyard, P., & Hajek, P. (2009). Interventions for preventing weight gain after smoking cessation. *Cochrane Database of Systematic Reviews*, CD006219.
- Paul-Ebhohimhen, V., & Avenell, A. (2008). Systematic review of the use of financial incentives in treatments for obesity and overweight. *Obesity Review, 9*, 355-367.
- Perkins, H. W., & Craig, D. W. (2006). A successful social norms campaign to reduce alcohol misuse among college student-athletes. *Journal of Studies on Alcohol, 67*, 880-889.
- Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47*, 1101-1114.
- Purshouse, R.C., Meier, P. S., Brennan, A., Taylor, K. B., & Rafia, R. (2010). Estimated effect of alcohol pricing policies on health and health economic outcomes in England: an epidemiological model. *Lancet, 375*, 1355-1364.
- Rangel, A., Camerer, C., & Montague, M. (2008). A framework for studying the neurobiology of value-based decision-making. *Nature Reviews Neuroscience, 9*, 545-556.
- Rogers, R. W. (1983). Cognitive and physiological processes in fear appraisal and attitude change: A revised theory of protection motivation. In J. Cacioppo & R. Petty (Eds.), *Social Psychophysiology*. New York: Guilford Press.
- Rogers, T., & Frey, E. (2015). Changing behavior beyond the here and now. In *Blackwell Handbook of Judgment and Decision Making*.

- Rolls, E. T. (2014). *Emotion and decision-making explained*. Oxford University Press.
- Schaap, M. M., Kunst, A. E., Leinsalu, M., Regidor, E., Ekholm, O., Dzurova, D., Helmert, U., Klumbiene, J., Santana, P., & Mackenbach, J. P. (2008). Effect of nationwide tobacco control policies on smoking cessation in high and low educated groups in 18 European countries. *Tobacco Control, 17*, 248-255.
- Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In I. R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 217-242). Washington, DC: Hemisphere.
- Schweitzer, M., Hershey, J., & Asch, D. (1996). Individual choice in spending accounts: Can we rely on employees to choose well? *Medical Care, 34*, 583-593.
- Seymour, B., T. Singer, & R. Dolan (2007). The neurobiology of punishment. *Nature Reviews Neuroscience, 8*, 300-311.
- Shafir, E. (2012). *The behavioral foundations of public policy*. Princeton University Press.
- Sheeran, P. (2002). *Intention-behavior relations: A conceptual and empirical review*. London: Wiley.
- Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health Psychology, 32*, 460-473.
- Shumaker, S., Schron, E., Ockene, J., & McBee, W. (2008). *The handbook of health behavior change*, 2nd ed. New York: Springer.
- Sieverding, M., Decker, S. & Zimmermann, F. (2010). Information About Low Participation in Cancer Screening Demotivates Other People. *Psychological Science, 21*, 941-943.
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*, 220-247.
- Sunstein, C., & Thaler, R. (2003). Libertarian paternalism is not an oxymoron. *University of Chicago Law Review, 70*, 1159-1202.

- Thaler, R., & Benartzi, S. (2004). Save more tomorrow: Using behavioral economics to increase employee savings. *Journal of Political Economy*, *112*, 164-187.
- Thaler, R., & Sunstein, C. (2008). *Nudge: Improving decisions about health, wealth and happiness*. New Haven: Yale University Press.
- Tunis, S. R., Hayward, R. S., Wilson, M. C., Rubin, H. R., Bass E. B., Johnston, M., et al. (1994). Internists' attitudes about clinical practice guidelines. *Annals of Internal Medicine*, *120*, 956-963.
- Tybur, J. M., & Griskevicius, V. (2013). Evolutionary psychology: A fresh perspective for understanding and changing problematic behavior. *Public Administration Review*, *73*, 12-22.
- Verplanken, B., Friberg, O., Wang, C. E., Trafimow, D., & Woolf, K. (2007). Mental habits: Metacognitive reflection on negative self-thinking. *Journal of Personality and Social Psychology*, *92*, 526-541.
- Vlaev, I., & Dolan, P. (2015). Action change theory: A reinforcement learning perspective on behavior change. *Review of General Psychology*, *19*, 69-95.
- Volpp, K. G., Asch, D. A., Galvin, R., & Loewenstein, G. (2011). Redesigning employee health incentives: lessons from behavioral economics. *New England Journal of Medicine*, *365*, 388-390.
- Volpp, K. G., John, L. K., Troxel, A. B., Norton, L., Fassbender, J., & Loewenstein, G. (2008). Financial incentive-based approaches for weight loss: a randomized trial. *Journal of American Medical Association*, *300*, 2631-2637.
- Wansink, B., & Cheney, M. M. (2005). Super Bowls: serving bowl size and food consumption. *Journal of American Medical Association*, *293*, 1727-1728.

- Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*, 249-268.
- Weinstein, N. D., & Sandman, P. M. (1992). A model of the precaution adoption process: Evidence from home radon testing. *Health Psychology*, *10*, 25-33.
- West, R., Townsend, J. , Joossens, L., Arnott, D., & Lewis, S. (2008). Why combating tobacco smuggling is a priority. *BMJ*, *337*, a1933.
- WHO (2009). *Global health risks: mortality and burden of disease attributable to selected major risks*. Geneva: World Health Organisation.
- Williams, B., Bezner, J., Chesbro, S., & Leavitt, R. (2006). The effect of a walking program on perceived benefits and barriers to exercise in postmenopausal African American women. *Journal of Geriatric Physical Therapy*, *29*, 43-49.
- Wood, W., & Neal, D. T. (2007). A new look at habits and the habit-goal interface. *Psychological Review*, *114*, 843-863.
- Wryobeck, J., & Chen, Y. (2003). Using priming techniques to facilitate health behaviors. *Clinical Psychologist*, *7*, 105-108.



Table 1

*The MINDSPACE Framework for Behavior Change. The specific brain systems and psychological processes that they generate can explain the mindspace elements and the examples discussed in the article (note that other nudges and examples may be better explained by different combinations of these underlying causes).*

MINDSPACE techniques	Behavior	Brain System	Psychological Process
Messenger	We are heavily influenced by who communicates information to us	Impulsive	Attraction, Trusting
Incentives	Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses	Impulsive	Greed, Fear
Norms	We are strongly influenced by what others do	Impulsive Habit	Belonging Motor
Defaults	We ‘go with the flow’ of pre-set options	Impulsive	Fear, Comfort
Saliency	Our attention is drawn to what is novel and seems relevant to us	Habit	Mental
Priming	Our acts are often influenced by sub-conscious cues	Habit	Motor
Affect	Our emotional associations can powerfully shape our actions	Impulsive	Disgust, Fear, Attraction
Commitments	We seek to be consistent with our public promises, and reciprocate acts	Impulsive Habit	Status Motor

Theory to Practice  
Hal G. Rainey, Editor

Ego

We act in ways that make us feel better  
about ourselves

Impulsive

Status,  
Self-Worth

---

*Figure 1.* Self-regulatory processes involved in behavioral change. The three core brain systems for behavioral control can generate psychological processes (thoughts, drives, emotions, and mental and motor habits) and can independently influence behavior.

