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Health goal priming as a situated intervention tool: how to benefit from nonconscious motivational routes to health behaviour

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ABSTRACT

Recent research has shown the limited effects of intentions on behaviour, so that novel methods to facilitate behaviour change are needed that do not rely on conscious intentions. Here, it is argued that nonintentional effects on health behaviour, such as the effects of habits, impulses, and nonconscious goals, occur through the activation of cognitive structures by specific situations. Interventions should therefore be situated to change these effects, either by changing the critical cognitive structures (training interventions), or by changing which cognitive structures get activated (cueing interventions). The current article presents this framework for situated interventions, as well as examples of interventions of each type. Then, it introduces goal priming as a cueing intervention tool to activate health goals and thus facilitate healthier behaviour, even in tempting situations that typically activate short-term hedonic goals. Following a review of empirical evidence, five principles for the effective application of health goal primes are proposed, namely (1) to target individuals who value the primed goals, (2) by activating their specific motivation, (3) through effective cues (4) that attract attention at the right time. Finally, (5) an effective goal-directed behaviour needs to be known and accessible to the primed individual. These principles are illustrated with examples of different health behaviours in order to facilitate their application for successful behaviour change.

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The past two decades have seen a substantial shift in our understanding of how health behaviour is regulated. For a long time, it was assumed that our health behaviour is determined by conscious intentions, for example the intention to perform certain behaviours for their health benefits and to refrain from other behaviours because of their negative health consequences (e.g., Fishbein & Ajzen, 2011; Janz & Becker, 1984; Rogers & Prentice-Dunn, 1997). More recently, however, it has become clear that much of our actions are regulated by nonconscious and nonintentional processes. More often than not, the result of these processes is that the healthy intentions that one has consciously formed are not translated into behaviour, typically because the situation presents a tempting alternative. As a result, interventions that rely on conscious intentions for health behaviour are limited in their effectiveness. While our understanding of the nonconscious processes guiding behaviour has strongly increased over the past decades, most of these insights have

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not been translated into effective intervention tools. The current paper therefore offers a theoretical framework for developing such tools based on recent insights in nonconscious behaviour regulation and situated cognition, and it discusses existing intervention tools within that framework. It then offers goal priming as a situated strategy to facilitate goal pursuit without the need for conscious awareness, and thus to effectively use nonconscious motivational routes towards healthier behaviour.

The role of conscious intentions in health behaviour

Conscious intentions have traditionally played a strong role in social psychology and in health interventions that rely on social psychological principles. Theories like the health belief model, protection motivation theory, the theory of planned behaviour, and the transtheoretical model, have all inspired great amounts of research as well as numerous health behaviour interventions. Indeed, deliberate processes such as intentions are certainly important in trying to understand whether someone will attempt to stop smoking, join Weight Watchers, or buy running shoes in order to exercise more. More recently, however, intentions have been shown to be mainly effective if the behaviour and the circumstances are not conducive to habit formation, if the behaviour is performed under low cognitive and emotional load, and for people with high working memory capacity who are not under the influence of alcohol (e.g., Hofmann, Friese, & Wiers, 2008; Ouellette & Wood, 1998). Clearly, these conditions are typically not fulfilled in many domains where health behaviour change is desirable, such as eating behaviour, alcohol consumption, or physical activity. As a result, researchers have increasingly called for a paradigm shift in the area of health behaviour change, including the request to 'retire' the theory of planned behaviour (Sniehotta, Priesseu, & Araújo-Soares, 2014) and to increase the focus on automatic processes (e.g., Hollands, Marteau, & Fletcher, 2016; Marteau, Hollands, & Fletcher, 2012; Sheeran, Gollwitzer, & Bargh, 2013).

A recent meta-analysis of experimental studies of the intention-behaviour link (Webb & Sheeran, 2006) has provided important insights into the strength and conditions under which intentions lead to behaviour. Across the 47 studies included, successful interventions had a medium to large effect on intentions but only small to medium effect on behaviour, suggesting that not all of participants' good intentions were actually executed. In addition, while changes in intention due to the interventions mediated the effect of interventions on behaviour, this mediation was only partial, suggesting that interventions also affected behaviour in ways that were independent of conscious intentions. This finding, too, points to significant nonintentional influences on behaviour. Finally, the meta-analysis identified several important conceptual moderators and showed that interventions designed to change behaviour through intentions were less successful if participants had relatively low levels of control over their behaviour, if the behaviour in question was susceptible to habit formation, and if it concerned risky behaviours performed in a social context. These findings suggest that while intentions have important effects on behaviour, their influence is limited by nonconscious processes that are particularly important in health behaviour, such as habits and impulses, which are hard to control and which are triggered by specific situations in one's daily life.

Interventions for health behaviour change may be most effective if they take these effects into account and successfully change the cognitive processes triggered by such situations, thus, if they are situated (see Papies, 2016). The current paper will present a framework for situated interventions and will apply the notion of situating to the intervention tool of goal priming. To this end, it will first present an analysis of the processes underlying the effects of situational cues on behaviour. Then, two types of situated interventions will be suggested to change these processes, specifically training interventions and cueing interventions. Goal priming will be introduced as an example of a cueing intervention, together with five principles on how to implement goal priming to most effectively activate a long-term health goal by situational cues. This way, it will be shown that by taking into account situated cognitive processes, goal priming can change

the cognitions and behaviours that a health-relevant situation triggers, and thus lead to healthy goal pursuit.

Mechanisms of nonconscious influences on health behaviour

The pattern of findings suggesting that situational cues play a crucial role in health behaviour is consistent with research on automatic self-regulation in psychology more generally (e.g., Bargh & Morrell, 2008; Barsalou, 2009; Dijksterhuis, Smith, van Baaren, & Wigboldus, 2005; Papies & Aarts, 2016). Most relevant to health behaviour, cues from the environment have been shown to affect behaviour by activating habits (for a review, see Wood & Neal, 2007), or by triggering impulses or goals (for reviews, see Hofmann et al., 2008; Papies & Aarts, 2016; Papies & Barsalou, 2015; Stroebe, van Koningsbruggen, Papies, & Aarts, 2013). Importantly, this suggests that such cues do not affect behaviour directly, but rather by activating cognitive structures that have been formed by previous experiences in similar situations, and which in turn affect behaviour (Papies & Barsalou, 2015; see also Strack & Deutsch, 2004). I will now discuss these structures in more detail, before addressing implications for developing interventions to change the effects of situational cues.

Habits have been described as associations between specific situational cues and actions, which individuals form by repeatedly performing a goal-directed behaviour in the same context (Aarts & Dijksterhuis, 2000; Gardner, 2015; Ouellette & Wood, 1998). *Impulses* are typically conceived as immediate approach responses towards rewarding stimuli (Hofmann et al., 2008). *Goals* have been defined as behaviours or end states that are associated with reward, and which are supported by knowledge structures that include situational information and goal-directed means (Custers & Aarts, 2010; Papies & Aarts, 2016).

In line with Barsalou (2009, 2016) and Papies and Barsalou (2015), the cognitive structures underlying habits, impulses, and goals, can be described as *situated conceptualisations* of health behaviours that have been stored in memory during previous experiences. As people perform health-relevant behaviours, such as eating, drinking, or exercising, they store comprehensive representations of these experiences and their context in memory. Such representations may include, for example, information about one's own actions, about one's cognitive, affective, and interoceptive states, about the goals one is pursuing in the situation, and contextual information about space, people, and objects present (Barsalou, 2009). When eating chips on the sofa, for example, while watching a movie with friends on a weekend night, one may store a representation of eating chips that includes sensory information about taste and texture of the food, as well as information about the room, one's friends, and feelings of reward. Similarly, during grocery shopping, one may store a representation of a shopping experience that includes moving through the store while pushing one's cart, grabbing items from a shelf, patting one's pockets for the grocery list, and the goal of buying tasty foods for one's family. As one performs a behaviour repeatedly with similar goals and in the same context, the stored representation will become more and more entrenched in memory.

Once such a situated conceptualisation has been stored, activating any of its element on later occasions can re-activate its other elements, with those elements then more likely to be enacted. In other words, an action previously performed in a certain context can be triggered automatically by a contextual cue, leading to nonconscious effects on behaviour (for more detailed accounts, see Barsalou, 2009; Papies & Barsalou, 2015). Research on habits, for example, has shown that priming social drinkers with cues of socialising can trigger thoughts about drinking, as well as alcohol choices (Sheeran et al., 2005). Similarly, work on desire and goals has shown that reading about or seeing chips triggers thoughts about their taste and texture, of eating and enjoying them, and of watching movies with one's friends (Papies, 2013). Such a cue can also inhibit the competing goal of dieting (Fishbach, Friedman, & Kruglanski, 2003; Papies, Stroebe, & Aarts, 2008a; Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008), and it increases salivation and the desire to eat (Keesman, Papies, Vermeent, Aarts, & Hafner, 2015), which can lead, for example, to impulsive

eating behaviour (see also Hofmann et al., 2008). As this brief analysis has shown, cognitive structures, which are here referred to as situated conceptualisations, mediate the effects of situational cues on health behaviour, and this can explain the effects of habits, impulses, and goals.

The idea of situated conceptualisations affecting behaviour may be a useful framework for developing situated interventions to improve the nonconscious regulation of health behaviour. This framework is displayed in Figure 1. Specifically, interventions can either attempt to *modify the existing situated conceptualisations*, or cognitive structures, that underlie people's nonconscious health behaviour, so that these new, healthier situated conceptualisations get activated in health-relevant situations and guide behaviour. As most of these types of interventions involve a form of training, I will refer to these interventions as *training interventions*. Alternatively, interventions can attempt to *modify features of critical situations* such that they change which of a person's existing situated conceptualisations get activated by situational cues, leading to healthier behaviour as a result. As most of these types of interventions involve changing salient cues, I will refer to these interventions as *cueing interventions*. In sum, these two situated intervention strategies differ by whether they use training to change cognitive structures, or use cueing to change which situational cues affect behaviour (see also Papies, 2016; Papies & Barsalou, 2015).

Interventions to affect nonconscious regulation of health behaviour

Training interventions

Research over the past years has made tremendous progress in developing intervention tools to change the cognitive structures underlying health behaviour. Traditionally, researchers have focused on rather explicit ways of changing cognitive structures, for example by health education or fear appeals. However, such strategies have been shown to affect attitudes and intentions rather than behaviour, suggesting that they do not change the nonconscious regulatory processes which rely for example on habits, impulses, and nonconscious goals and that typically have a strong effect on health behaviour. Within the framework outlined here, I suggest that these intervention strategies may not change individuals' situated conceptualisations of behaviour that are activated by situational cues, and therefore do not affect nonconscious behaviour regulation.

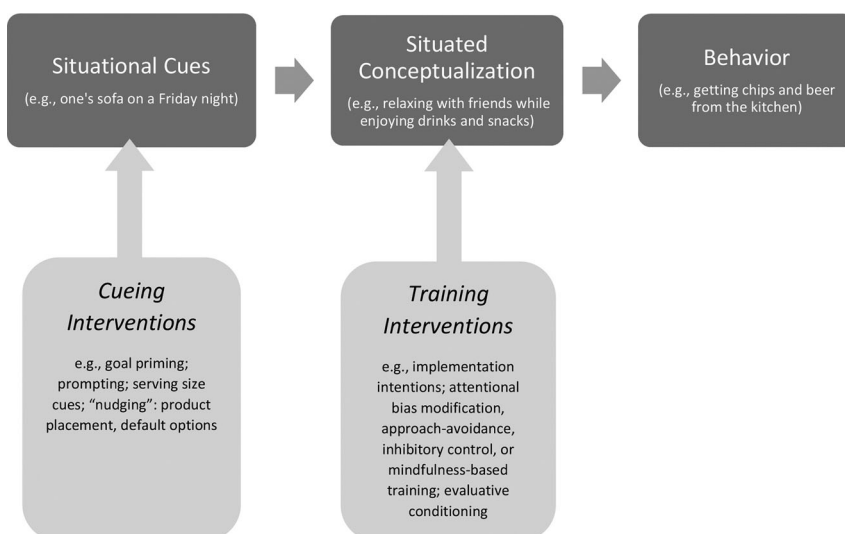


Figure 1. A framework for situated interventions that change the effects of situational cues on health behaviour: changing features of critical situations through *cueing interventions*, or changing situated conceptualisations through *training interventions*.

A similarly explicit approach with more promising results is planning, for example by so-called implementation intentions (Gollwitzer & Brandstätter, 1997). Here, individuals make specific plans for how to behave in response to a specific cue in a health-relevant situation in order to pursue a certain health goal. This strategy has shown to affect automatic responses to the specified cues as well as automatic evaluations (Hofmann, Deutsch, Lancaster, & Banaji, 2010) and behaviour (Gollwitzer & Sheeran, 2006), by committing a vivid image of one's planned behaviour in the specified situation to memory (Papies, Aarts, & de Vries, 2009). Consistent with the framework suggested here, this suggests that specific, situated planning can change the situated cognitive structures that underlie nonconscious behaviour regulation, insofar as it associates a new, healthy behaviour with the specified cue and as a result changes the representation that is likely to be activated by the context. Importantly, it is possible that existing cue-behaviour associations remain intact and are merely temporarily inhibited, rather than extinguished, when implementation intentions for new behaviours are formed (see Adriaanse, Gollwitzer, De Ridder, de Wit, & Kroese, 2011; Holland, Aarts, & Langendam, 2006; Lally & Gardner, 2013). Whether this affects long-term behaviour change remains to be determined.

More recently, another type of intervention approaches has been developed to change automatic responses to tempting cues, mostly by computerised training. Procedures such as attentional bias modification (e.g., Schoenmakers et al., 2010), approach-avoidance retraining (e.g., Wiers, Rinck, Kordts, Houben, & Strack, 2010), and inhibitory control training (e.g., Veling, Aarts, & Papies, 2011) are all designed to provide easily accessible and effortless ways to reduce the automatic approach impulses that are triggered by tempting stimuli and that have been learned through previous, rewarding interactions. A number of research programmes have now shown that such training procedures can reduce the likelihood that tempting stimuli trigger attentional bias and behavioural approach responses, and thus have beneficial effects for health behaviour (e.g., Veling, van Koningsbruggen, Aarts, & Stroebe, 2014; Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011; Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013). Other approaches, for example, based on mindfulness or on evaluative conditioning, have targeted affective or reward responses to tempting stimuli in order to change behavioural responses. Although less research has been done in this domain, these procedures have shown similar effects for reducing approach bias to tempting stimuli, as well as desire, actual choices, and consumption behaviour (e.g., Hollands, Prestwich, & Marteau, 2011; Jenkins & Tapper, 2014; Lacaille et al., 2014; Papies, Barsalou, & Custers, 2012; Papies, Pronk, Keesman, & Barsalou, 2015).

While such training interventions targeting cognitive structures have shown important benefits for health behaviour, they all require one-on-one interactions, for example, for planning, learning mindfulness-based techniques, or completing a re-training procedure. As a result, these intervention tools are not easily scalable and are limited in their applicability to larger populations. Therefore, we will now turn to cueing interventions which attempt to change which cognitive structures get activated by specific situations and might be more suitable for larger scale applications.

Cueing interventions

An alternative approach to affecting the nonconscious regulation of health behaviour is to change features of the environment in order to influence which situated conceptualisations, or cognitive structures, get activated by situational cues. Our current living environments tend to expose us to cues that activate short-term *hedonic goals*, such as indulging in tempting food or drink that provide immediate pleasure. This is often at the cost of long-term *investment goals*, such as watching one's weight or controlling one's alcohol intake for the sake of one's health later in life. Indeed, the exposure to a tempting stimulus is likely to trigger simulations of consuming and enjoying it (Keesman et al., 2015; Papies, 2013; Simmons, Martin, & Barsalou, 2005), making thoughts of a competing long-term health goal increasingly unlikely (Papies et al., 2008a; Stroebe et al., 2013). In order to improve the nonconscious regulation of health behaviour, situational cues thus need to activate situated conceptualisations of long-term investment goals, rather

than of short-term hedonic goals only. Recent work has suggested that this can be achieved by goal priming (Papies, 2016).

Health goal priming

Priming refers to the activation of a mental representation by external cues, thus affecting information processing and possibly behaviour (Bargh & Chartrand, 2000). Goal priming refers to the case where the concept activated by the external cue is a goal, and the prime affects behaviour in an attempt to pursue the primed goal (Custers & Aarts, 2005, 2010). A goal is defined as a state or behaviour that has reward value and therefore motivates a person to pursue it, leading for example to instrumental behaviours, to the inhibition of competing behaviours, and to persistent efforts to complete a goal after interruptions (Custers & Aarts, 2005; Hart & Albarracín, 2009; Shah, Friedman, & Kruglanski, 2002). Importantly, once a goal has been activated by external cues, it can be pursued without awareness of the cue, the goal, and the processes affecting behaviour, and without conscious intentions to perform the behaviour. In sum, goal priming can translate an existing motivation into behaviour through nonconscious processes of self-regulation (for detailed reviews of the mechanisms of nonconscious goal pursuit, see Custers & Aarts, 2010; Papies & Aarts, 2016).

Goal priming effects have been shown in a variety of domains. Early research has shown that activating the goal of impression formation leads to better memory organisation and recall of information about another person, compared to a mere memorisation goal. This effect occurred without participants being aware of the primes or their effects on their behaviour, and thus without participants forming conscious intentions to memorise information in a specific way (Chartrand & Bargh, 1996). More recently, priming the concept of drinking outside of conscious awareness has been found to increase motivation to drink and to increase soda consumption, but only when participants are fluid-deprived and thus have a goal to drink (Velkamp, Aarts, & Custers, 2008). Similarly, priming 'achievement' has been shown to increase motivation and effort at difficult tasks, but only among achievement-motivated individuals, and again without participants being aware of the briefly presented primes influencing their behaviour (Hart & Albarracín, 2009). Priming with religious concepts has been shown to increase prosocial behaviour, but only if the primes refer to rewarding aspects of religion (e.g., 'heaven') and not if they refer to more neutral aspects (e.g., 'hymn'; Harrell, 2012). In addition, a recent meta-analysis in this domain confirmed this religious priming effect, but only among those participants who strongly value the primed concept, that is, who are religious (Shariff, Willard, Andersen, & Norenzayan, 2016).

A meta-analysis synthesising the priming literature across domains confirmed that the exposure to goal-related words can indeed trigger motivated behaviour (Weingarten et al., 2016). Specifically, this meta-analysis showed that priming effects were stronger and more persistent over time if the primed concepts were indeed strongly valued by the individuals. In addition, the effect was shown to be robust, with little evidence for publication bias. A number of the included studies were conducted in the domains of health and consumption behaviour, and these showed slightly larger effect sizes than other priming studies. Together, these findings suggest that presenting health-related cues might positively influence health behaviour, among individuals who value the primed concepts.

A number of studies have specifically assessed the effects of health primes on cognition and behaviour relevant to health. I will discuss these next. Without aiming to provide an exhaustive review of the literature, I will first focus on laboratory studies, as these are informative for demonstrating the phenomenon and some of the underlying mechanisms. Then, field experiments utilising health goal primes will be discussed, as these are informative for using primes as real-life intervention tools. In both types of studies, the work so far has almost exclusively been done in the domain of eating behaviour, but other domains will be addressed where appropriate.

In the laboratory

Controlled laboratory experiments have demonstrated that the exposure to health-related cues can affect cognitive processes relevant to health behaviour. Fishbach and colleagues, for example, have

shown that exposing diet-concerned individuals to diet-relevant cues activates thoughts about weight and dieting, and accordingly increases choices of healthy foods (Fishbach et al., 2003). In addition, priming participants with goals that they strive for, including health goals, inhibits thoughts about temptations that would interfere with their pursuit (Fishbach et al., 2003; see also Shah et al., 2002). Later work demonstrated that subtly exposing chronic dieters to diet-related words can decrease their attention to words denoting tempting, diet-incongruent foods (Papies, Stroebe, & Aarts, 2008b). A recent eye-tracking study showed that health primes increased the time participants spent looking at healthy foods, and this in turn predicted their healthy choices (van der Laan, Papies, Hooge, & Smeets, 2016). Thus, health goal primes may work by activating participants' health motivation and directing attention to healthy stimuli in their environment, at the expense of desire for unhealthy temptations (see Papies & Aarts, 2016, for a more detailed discussion; see also Stroebe et al., 2013).

Further experiments have extended these findings to actual behaviour. Seeing or consuming healthy foods has been shown to reduce intake of unhealthy foods, mostly among dieters (Buckland, Finlayson, & Hetherington, 2013a, 2013b; Buckland, Finlayson, Edge, & Hetherington, 2014). Similarly, health primes such as dieting advertisements, compared to control or indulgent food advertisements, can prevent overeating on unhealthy foods, again especially among dieters, and especially in the afternoon (Anschutz, Van Strien, & Engels, 2011; Boland, Connell, & Vallen, 2013; Versluis & Papies, 2016). Other weight-related cues, such as the presence of scales or very slim sculptures, have been found to prevent participants from modelling the overeating on unhealthy foods displayed by a confederate, and to reduce unhealthy consumption more generally (Brunner, 2010; Brunner & Siegrist, 2012). Finally, a study in the domain of physical activity has shown that the exposure to words related to physical activity can boost the choice of using the stairs over the elevator at the next opportunity (Wryobeck & Chen, 2003). Together, these laboratory experiments, mostly in the domain of eating behaviour, suggest that exposure to health-related cues can activate health goals and trigger health-oriented behaviour.

In the field

Research on health priming in field settings is rather scarce compared to laboratory settings, but the findings are consistent with the principles demonstrated by laboratory experiments. One of the first studies in this area was conducted by Papies and Hamstra (2010) and took place in a butcher's store. In the priming condition, a poster announcing a low-calorie recipe was mounted on the inside of the glass door to the store, and included words like 'slim figure', 'extra slim', and 'weight'. In the control condition, this poster was absent. While customers were being served, they could sample free meat snacks from a tray on the counter. The number of snacks consumed was recorded unobtrusively. Afterwards, participants completed a brief questionnaire that among others, assessed their dieting motivation (Herman & Polivy, 1980). Results showed that chronic dieters who had been primed with the goal of healthy eating and dieting by means of the poster consumed fewer snacks than dieters in the control condition, whereas non-dieters were not affected by the prime. This finding was later replicated conceptually in a restaurant, where the primes were integrated into the menu. Again, dieters made more healthy menu choices (e.g., ordering a salad instead of a burger) in the priming condition, whereas non-dieters were not affected (Papies & Veling, 2013). In a recent study with a similar set-up, a poster priming health or slimness next to a vending machine increased the sales of healthy items (Stöckli, Stämpfli, Messner, & Brunner, 2016). Here, no individual behaviour was observed, so that it is unclear whether the healthy choices were primarily made by diet-concerned individuals or whether they were independent of participants' health and dieting motivation.

A field experiment in a grocery store, finally, has demonstrated that health primes can also affect grocery shopping and therefore, likely impact eating behaviour at home and across more than one instance. Here, overweight and normal-weight participants received a recipe flyer upon entering the grocery store. As an experimental manipulation, this flyer was either supplemented with health- and dieting-related words or not. After doing their groceries as usual, participants completed a brief

questionnaire, while a photograph of their grocery receipt was taken. Analyses of participants' purchases showed that while overweight customers bought more unhealthy snacks in the control condition than normal-weight participants, these purchases were strongly reduced by the health prime. Normal-weight participants were not affected by the prime (Papies, Potjes, Keesman, Schwinghammer, & van Koningsbruggen, 2014).

This field experiment further tested the roles of attention and awareness during health goal priming. Importantly, results showed that consciously thinking about the prime during shopping did not moderate its effectiveness (Papies et al., 2014). Specifically, participants were more likely to think about the recipe flyer while they were shopping when it contained health and diet primes, and especially when they were overweight. But whether they thought about it or not, did not affect the effectiveness of the prime. In other words, even those overweight participants who had not looked at the flyer again or thought about it, bought fewer unhealthy snacks when they had received a health prime flyer while entering the store.

At the same time, the prime only worked if participants reported that they had looked at the recipe flyer when they first received it. Clearly, some degree of initial attention was necessary for goal priming effects to occur. In addition, the impact of the prime was not moderated by the duration of the shopping episode. This is in line with theorising on the role of motivational value in cognition, which suggests that in contrast to concepts without reward value, goal representations can be maintained active over longer periods of time, probably in order to detect and act on suitable opportunities for goal pursuit as they arise (Weingarten et al., 2016). Thus, health goal primes may benefit from such motivational effects and affect behaviour even across extended periods. Future research should establish the temporal constraints of goal primes in field settings more directly. Importantly, however, the work so far suggests that health goal primes can help individuals to translate their motivation for health goals into actual behaviour, without relying on conscious awareness and even in busy daily-life settings.

Other cueing interventions

A number of other interventions affecting health behaviour can be identified as cueing interventions in that they change situational cues in order to affect which situated conceptualisations are activated and thus change behaviour. A comprehensive discussion of these interventions is beyond the scope of the current paper. I will focus on interventions that change the salience of behavioural options, as these are well-documented, powerful cueing interventions affecting the nonconscious regulation of health behaviour (see Hollands et al., 2013).

In the domain of eating behaviour, portion sizes have typically been found to be strong cues for determining the consumption amount, so that individuals eat more from larger than from smaller portions, even if they are not hungry or the food is not particularly attractive (for a meta-analysis, see Hollands et al., 2015). Research on how to prevent such effects has shown that presenting foods in smaller units, or presenting alternative serving size cues, can reduce intake from large portions, presumably by making the appropriateness of smaller servings more salient (Geier, Rozin, & Doros, 2006; Kerameas, Vartanian, Peter, & Polivy, 2015; Spanos, Kenda, & Vartanian, 2015; Versluis, Papies, & Marchiori, 2015). In addition, cueing of how much one has already consumed can curb overeating (Wansink & Payne, 2007). Less research is available for salience interventions in other domains of health behaviour. One consistent finding in the domain of physical activity, however, is that increasing the salience of stair use by prompts can increase stair use over the use of the elevator (Lee et al., 2012; Soler et al., 2010). In addition, work on alcohol taxation has shown that increasing the salience of tax paid on alcoholic drinks reduces consumption (e.g., Chetty, Looney, & Kroft, 2007; Hanson & Sullivan, 2015).

Product placement is another powerful cueing intervention, often discussed in the context of 'nudging' healthy choices (see Marteau, Ogilvie, Roland, Suhrcke, & Kelly, 2011). Placing more vegetables on a buffet increases vegetable intake (Bucher, Siegrist, & van der Horst, 2014; Bucher, van der Horst, & Siegrist, 2011). Placing dishes near the top or bottom of a menu or placing snacks in

the middle of a selection increases their choice (Dayan & Bar-Hillel, 2011; Keller, Markert, & Bucher, 2015), and making it difficult to serve oneself an item from a buffet decreases its choice, even when the food is attractive (Rozin et al., 2011). All of these interventions may work by activating different cognitive structures than in the control condition, such as thoughts about the benefits of eating vegetables, or of using the stairs, and thus influence health behaviour. In contrast to goal priming interventions, however, their effects may be restricted to the immediate time and place where they are presented, except if they activate a long-term goal that supports goal pursuit even across a delay (Weingarten et al., 2016). Future research may address ways in which product placement can be used to systematically activate health goals and thus instigate motivated behaviour in their pursuit.

Applying health goal primes

Based on the findings on health goal priming and on our insights into the underlying mechanism of nonconscious self-regulation, five principles will now be proposed for the effective application of health goal primes as an intervention tool (see also Papies, 2016). These principles and examples of their application are also summarised in Table 1. Situating a goal priming intervention this way should make it most effective for changing the cognitive responses triggered by health-relevant situations, and thus leading to healthier goal pursuit.

Target individuals who value the primed goals

Research on the mechanisms underlying nonconscious self-regulation has shown that goal primes work by activating states or behaviours that are associated with positive affect and which therefore mobilise cognitive and behavioural resources in support of goal pursuit (for a review, see Papies & Aarts, 2016). In other words, only when a person values a concept that is activated by a prime, such as healthy eating, will this lead to the motivational benefits that support goal pursuit, such as activating goal-relevant cognitions, directing attention towards goal-supporting stimuli, and avoiding stimuli that interfere with the goal. In line with this proposition, most studies on health goal priming find that effects of primes are moderated by participants' goal motivation. Priming effects are

Table 1. Five principles for the effective application of health goal primes, and examples of how to apply these principles in interventions to improve nonconscious regulation of health behavior.

Principle	Examples of applications in previous research	Implications for interventions
1. Target individuals who value the primed goals	Primes targeted at individuals motivated towards dieting (e.g., Papies & Hamstra, 2010) or achievement (Hart & Albarracín, 2009)	Identify motivated target group, for example, individuals motivated to curb alcohol consumption, increase physical activity, increase fluid intake.
2. Tap into the right reasons	Primes referring to slim figure (Papies et al., 2014) or to being fit (Wryobeck & Chen, 2003)	Identify what specific, possibly long-term motivation underlies goals of target group, for example, productivity, physical strength, physical appearance, longevity.
3. Use effective cues	Primes referring to positive outcomes to be achieved (rather than negative outcomes to be avoided or neutral concepts; Harrell, 2012; Papies et al., 2014)	Identify positive cues strongly associated with goal among target group, for example, positive displays of physical strength, healthy skin, healthy older age.
4. Attract attention at the right time	Primes integrated into restaurant menus (Papies & Veling, 2013) or at presented at beginning of grocery shopping episode (Papies et al., 2014)	Identify at which point critical goal-relevant decision is made in targeted setting, for example, when entering workplace cafeteria, when deciding on whether to bike or drive to work, in the soft drink aisle of the grocery store.
5. Ensure that health goal pursuit is possible	Targeted individuals aware of which behaviours are in line with health goal, such as ordering salad (Papies & Veling, 2013) and avoiding high-calorie snack purchases (Papies et al., 2014).	Ensure knowledge and availability of healthy options, such as fruit, water, stairs, and bike paths.

particularly pronounced among participants for whom the goal primes are relevant, for example because they are concerned about their weight or are motivated to live healthily (see Weingarten et al., 2016, for a meta-analysis supporting the moderating role of goal value). Thus, for a health goal prime to be effective, one should first identify a target group who values the goal and is motivated to change their health behaviour. For an intervention to reduce alcohol consumption, for example, it should be clear who is interested in curbing drinking: is it college freshmen, young professionals, pensioners, or yet another group? If an individual is not motivated, such as a freshman who is more interested in developing a new social life than in protecting long-term health, priming the goal of reducing drinking is not going to be effective, as it will not activate the motivational support system needed for effective goal pursuit.

Tap into the right reasons

In order to activate individuals' resources necessary for goal pursuit, it is essential to know the specific motivation underlying a particular goal (see also Kok et al., 2015). When an individual performs a goal-directed behaviour with a certain long-term outcome in mind, this will become part of the situated representation of the behaviour (Barsalou, 2009; Papies & Barsalou, 2015). As a result, activating it in a later situation can trigger goal-directed cognition and behaviour. Perhaps intuitively following these principles, studies involving diet primes have typically referred to the critical long-term motivation of a slim figure, rather than, for example, the cardiovascular benefits of a healthy weight. Similarly applying this principle to an alcohol intervention, if young professionals are motivated to drink less in order to maintain their productivity at work, reminding them of this specific motivation is going to be more effective than reminding them of, for example, the carcinogenic effects of alcohol and of the health benefits of avoiding these. In many cases, applying this principle may mean that research into the specific motivation supporting a target group's goal striving may be necessary, before effective goal primes can be designed.

Use effective cues

The specific motivation supporting goal-directed behaviour can best be activated by cues that (a) are positive and that (b) directly represent that motivation. Previous goal priming studies have effectively used images or sculptures of thin physiques, positive words denoting effects of healthy eating ('slim figure') or physical activity ('fit'), or advertisements featuring attractive scenes of healthy consumption or exercise behaviour. Negatively valenced cues, even if they semantically represent the relevant concept (e.g., sweaty shoes after a workout), will less effectively activate goals (see Harrell, 2012) and situated conceptualisations of rewarding healthy behaviour. Similarly, negative, avoidance-motivation cues that represent the opposite of the long-term motivation (e.g., images of a nauseating hangover on a Friday morning at one's workplace) are less likely to activate the reward-related motivational structures needed to support effective goal pursuit.

Attract attention at the right time

In order to affect behaviour in field settings, goal primes need to compete with myriad other cues that attract attention at any given time. First of all, they need to be processed with attention in order to activate a goal to begin with (Dijksterhuis & Aarts, 2010; Papies et al., 2014). Therefore, primes in field settings most likely need to be more salient than the unobtrusive or even subliminal primes often used in laboratory studies. Then, even though active goal representations have been shown to affect behaviour over extended periods in controlled laboratory settings (Weingarten et al., 2016), cognitive and motivational demands in field settings are likely much higher. Thus, a safe bet would be to present a prime close to the time that it needs to affect behaviour through activating relevant cognitive structures. In a restaurant setting, for example, goal primes have been

shown to be effective when they were integrated into the menu and could thus activate the conceptualisation of the benefits of eating a healthier meal right at the time when participants were making a menu choice (Papies & Veling, 2013). In a similar fashion, goal priming interventions in other domains and settings need to identify the moment when participants make health-related decisions. It is conceivable, for example, that a young professional who is motivated to curb alcohol consumption needs to be reminded of this not when first entering the pub, but when deciding on a drink later in the evening. This could be while sitting at the table, when walking to the bar, or even in the restroom.

Again, research may be necessary to establish the precise time when the critical decision is made, before designing an effective, situated intervention. Once this has been identified, the prime needs to be presented in such a way that it captures attention and thus is processed by the target group (Papies et al., 2014), to indeed change the situated conceptualisations triggered in the situation. Both of these conditions are particularly critical in busy settings where a lot of competing demands on attentional resources are present, or when attentional resources are limited due to other factors like alcohol consumption.

Ensure that health goal pursuit is possible

Finally, it is essential that a motivated individual who has been primed to pursue a health goal actually has access to means of pursuing it. This may seem obvious, but cannot always be taken for granted. Two conditions need to be met to satisfy this criterion: the individual needs to know which behaviours, in the given situation, would serve the health goal, and those behaviours need to be accessible. In health goal priming studies so far, participants were assumed to be aware that salads are healthier restaurant options (Papies & Veling, 2013), that dieting is best pursued by eating less M&M's (Versluis & Papies, 2016) and that healthier shopping means buying less high-calorie snacks (Papies et al., 2014). In other settings, however, the healthy behaviour may not always be obvious, and individuals with less nutrition knowledge, often associated with a lower level of education, may not be able to identify them well (e.g., Parmenter, Waller, & Wardle, 2000; Wardle, Parmenter, & Waller, 2000). In addition, healthy options may simply not be available. Corner shops, kiosks at public transport stations, and vending machines, for example, are notorious for providing only unhealthy food choices. In those cases, priming a health goal is less likely to be effective, since the only healthy alternative would be to refrain from purchasing any food at all. Similarly, priming alcohol reduction is more likely to be effective if non-alcoholic alternatives are available and are reasonably attractive.

Summary

In sum, an effective application of health goal primes should identify a motivated target group, and should activate their specific reasons to pursue the goal with effective cues that attract attention close to the decision point. In addition, the primed individual needs to know which goal-directed behaviours can be performed in order to pursue the health goal, and needs to have access to such a behaviour. This way, a situational cue will most likely activate the situated conceptualisation of a healthy goal-directed behaviour, leading to healthier behaviour as a result. These principles have been illustrated at the examples of healthy eating behaviour and reducing alcohol consumption. Their implications, however, also extend to other health behaviours such as biking to work, increasing fluid intake, getting enough sleep, and participating in screening programmes.

These principles for the application of health goal primes show that goal primes cannot act by themselves. Rather, their application needs to be supported by motivation, by knowledge about health behaviours, and by external circumstances that make goal pursuit possible. In other words, a goal prime will only affect a motivated individual who knows how to pursue a health goal and has the opportunity to do so. Thus, just like other cueing interventions, goal primes rely on the

foundations laid by health education and by smart policies that put in place the structural conditions for healthy goal pursuit (see also Hawkes et al., 2015; Marteau et al., 2011; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008).

Discussion

Goal priming is a relatively novel intervention tool to improve the nonconscious regulation of health behaviour. Typically, our temptation-rich living environments activate enjoyment rather than health goals, and thus easily lead to unhealthy behaviours, even outside conscious awareness. As a result, the effect of conscious health intentions on behaviour is weaker than previously assumed, and intentions have only limited effectiveness for changing health behaviour. To improve the nonconscious regulation of health behaviour, especially in tempting situations, it is suggested here (see also Papies, 2016) that one can either use training interventions to change people's situated conceptualisations, or use cueing interventions to change which situated conceptualisations are activated by situational cues. Health goal priming is a type of cueing intervention that activates a health goal in a tempting situation and thus facilitates behaviour in line with the health goal.

Based on the framework and the findings presented here, a number of important issues for further research emerge. First of all, an important question is whether being exposed to health goal primes repeatedly leads to habituation, such that the primes no longer attract attention and therefore cease to affect behaviour. Possibly, this could be prevented by presenting primes in such a way that they keep attracting attention, for example by varying their timing, location, or visual features. In addition, being primed repeatedly and performing the primed behaviour consistently in the same context might lead to healthy habit formation (Lally & Gardner, 2013), and thus to beneficial long-term effects of repeated goal priming. Future research should examine whether habit formation can indeed result from goal primes, and whether this could precede potential habituation effects.

Turning healthy actions into a habit is a desirable target for behaviour change interventions. Given their well-entrenched and situated cognitive structures, habits allow us to perform a variety of behaviours in our daily lives in an efficient manner, without requiring conscious intentions and awareness. However, noting this feature of habits also warrants a brief discussion of some differences between the effects of cueing a habitual response, and cueing a goal. Typically, a goal is associated with a number of means that can be used to reach it (Kruglanski et al., 2002). As a result, when an external cue activates a goal, this can in turn activate any of its means for goal pursuit, depending on the context, and thus lead to a variety of behavioural outcomes. In contrast, an external cue that is associated with a habitual response is likely to trigger that specific response, so that a specific habitual behaviour will be pursued. Indeed, habits have typically been defined and studied as responses that are cued by a certain context (e.g., snacking when watching TV; Aarts & Dijksterhuis, 2000; Gardner, 2015; Wood & Neal, 2007), whereas goals can be representations of relatively concrete or abstract states that can be pursued flexibly in a variety of contexts (e.g., fitting one's clothes; being healthy). Research on nonconscious goal pursuit has identified a variety of cognitive processes that make this flexible goal pursuit possible, for example maintaining the goal representation active in working memory over extended periods of time to facilitate goal pursuit when the opportunity arises, and increasing the salience and positive valence of means for goal pursuit that one perceives in the environment (see Papies & Aarts, 2016, for a review). Thus, while habits and nonconscious goal pursuit share features of automaticity, there are important differences in the effects of cueing them on behaviour, especially in dynamic contexts. In the context of the current framework of situated interventions, it is important to note that if repeated goal priming leads to healthy habits, this would mean that a cueing intervention has in fact changed existing cognitive structures.

Clearly, further research also needs to be done to examine the scalability of health goal priming for larger interventions. In contrast to most training interventions, goal priming is integrated into the specific setting where the targeted health behaviour takes place. Therefore, goal priming is not dependent on extended training interactions, saving time and resources. At the same time, as

proposed in the goal priming principles outlined above, goal priming effects may remain limited to motivated target groups, which reduces their large-scale effectiveness (see also Forwood, Ahern, Hollands, Ng, & Marteau, 2015). Future studies should test this particular principle of goal priming as an intervention tool more systematically, and should also test the other principles for goal priming interventions outlined here.

Recently, dual-process models, specifying impulsive vs. reflective mechanisms underlying behaviour, have increasingly been applied to health behaviour (e.g., Gardner, 2015; Hofmann et al., 2008; Wiers et al., 2013). The current analysis of the role of situated conceptualisations in guiding behaviour outside of conscious awareness resembles the impulsive processes proposed by such models in important ways. Both frameworks predict, for example, that external cues can trigger impulsive responses through associative processes based on previous experiences (Hofmann et al., 2008; Strack & Deutsch, 2004). In addition, both analyses predict that nonconscious or impulsive processes are more likely to affect behaviour when habits are strong or when the capacity to consciously regulate behaviour is limited by internal or external circumstances (Hofmann et al., 2008; Webb & Sheeran, 2006). An important and unique feature of the current framework, however, is that goal-directed behaviour, including the pursuit of long-term health goals, can result automatically from situated conceptualisations in similar ways as the pursuit of short-term hedonic rewards. Indeed, the fact that goal pursuit can be triggered and executed without effort and conscious awareness is what makes health goal priming as an intervention tool possible and promising. Future research might seek to establish whether there are structural differences in the situated representations of short-term hedonic versus long-term investment goals that render different mechanisms in their pursuit likely (as dual-process models would predict), or whether structural similarities dominate (as the current framework would predict; see also Papies & Barsalou, 2015).

Conclusion

Research in social and health psychology over the past decades has identified the limits of conscious intentions for behaviour change. As a next step, psychological research on situated cognition and on nonconscious motivational routes to behaviour should inform the development of intervention tools in health psychology, in order to tackle some of the behavioural challenges posed by our temptation-rich living environments. Health goal priming is one such tool that naturally emerges from research in nonconscious self-regulation, and that – if applied in line with underlying principles derived from research findings – may benefit researchers and practitioners attempting to improve health behaviour regulation.

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