Chapter 10
Breaking Habits Using Implementation Intentions

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A substantial part of our daily behaviour is habitual (Wood, Quinn, & Kashy, 2002), including behaviours that we would rather not perform. For example, think about the cookie you routinely eat with your 11 o'clock coffee, or the bag of crisps that you mindlessly reach for while watching TV. Habits develop as people repeatedly perform a specific behaviour (e.g. reaching for the crisps) in a stable situation (e.g. watching TV) to pursue their goals, until eventually, the behaviour follows *automatically* upon encountering this situation (Aarts & Dijksterhuis, 2000; Verplanken, 2006). Although habit formation allows individuals to perform their daily routines in a very efficient manner, they can become problematic when intentions change, such as when someone with the habit of eating crisps when watching TV wants to restrict his/her caloric intake. Even though this person may be highly motivated to eat fewer high calorie crisps, in case of strong habits, and thus a strong association between the situation (watching TV) and the behaviour (reaching for the crisps), motivational factors are unlikely to overrule the automatic tendency to reach for the crisps when watching television. If the habit is sufficiently strong, chances are thus high that one will find oneself sitting in front of the TV, emptying a bag of crisps regardless of one's good intentions to diet. Indeed, many of us will agree that successfully changing 'bad' habits, such as the one described above, is difficult and may at times even feel impossible to realize, despite strong intentions to do so. It is therefore not surprising that psychologists have tried to identify strategies that can support people in changing their habits once they are no longer adaptive or wanted. One of the strategies that has received particular attention in the literature, and that will be the topic of this chapter, is the formation of 'implementation intentions' (specific if–then action plans; Gollwitzer, 1993, 1999).

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B. Verplanken (ed.), *The Psychology of Habit*,
https://doi.org/10.1007/978-3-319-97529-0_10

In this chapter we start out by introducing implementation intentions as a self-regulation strategy designed to help people acting in line with their good intentions. We will then move to the use of this strategy in relation to breaking habits specifically. We will discuss several studies that have tested the effectiveness of implementation intentions as a tool for overcoming bad habits across various domains. In addition, we will attempt to provide more insight into the processes by which this self-regulation strategy operates to compete with unwanted habits. We will then continue by highlighting some of the challenges and requirements for an effective use of this strategy when applying it in the real world. Finally, we will discuss additional techniques that could be combined with implementation intentions to enhance their effectiveness when it comes to changing complex habitual behaviours. In this chapter, we discuss the potential of implementation intention on overcoming unwanted habits in general, but readers may notice that we devote particular attention to habits in the domain of eating. Unhealthy eating behaviour is largely predicted by habits (Tricomi, Balleine, & O'Doherty, 2009; van't Riet, Sijtsema, Dagevos, & De Bruijn, 2011; Verhoeven, Adriaanse, Evers, & de Ridder, 2012), but also a behaviour that people frequently seek to change, making it a prototypical dilemma between good intentions on the one hand and unwanted habits on the other hand, which is why unhealthy eating habits have received considerable attention in implementation intention research (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011; Vilà, Carrero, & Redondo, 2017).

Implementation Intentions

Implementation intentions are specific action plans that specify where, when and how one will act to achieve one's goal. They were designed as a volitional strategy to promote the translation of intentions into actions, and to overcome the so-called intention–behaviour gap (Webb & Sheeran, 2006). Implementation intentions support the enactment of one's goal intentions by linking a specific good opportunity to act (where, when) to a pre-selected goal-directed action (how) using an if–then format. So, whereas goal intentions describe a desired end-state ('I intend to achieve Z!'), implementation intentions support the enactment of goal intentions by specifying a good opportunity to act (when, where) and linking this to a desired goal-directed action (how) in an if–then plan ('If I am in situation X, then I will perform goal-directed behaviour Y!;' Gollwitzer, 1993, 1999). For example, an individual with the goal to exercise more frequently ('I intend to exercise more often') may formulate the implementation intention 'If I come home from work, then I will put on my running shoes and go for a run' (Oettingen & Gollwitzer, 2010). By specifying a specific opportunity in advance, this situation becomes more cognitively accessible and individuals are more likely to recognize this situation as a good opportunity to act. Moreover, as a result of formulating implementation intentions an association between the specific situation and the desired behaviour response is created. After sufficient mental rehearsal of this if–then link, the situation becomes

automatically linked to a specific behaviour with the result that one no longer has to decide in situ about which goal-directed behaviour to perform. Rather, when the specified situation ('coming home from work') is encountered, the behaviour ('putting one my running shoes') is now thought to be elicited automatically (Gollwitzer, 1999).

Support for these two underlying processes comes from work by Aarts and colleagues (Aarts, Dijksterhuis, & Midden, 1999) and work by Webb and Sheeran (2007). Aarts and colleagues provided evidence for the suggestion that by describing a specific situation in the if-part of the plan, this situation becomes highly salient with the result that the specified situation is detected quickly as a good opportunity to act. In their study, participants were assigned the goal to collect a coupon before the end of the study. They were informed where to collect this coupon (at the secretary's office in a small corridor, near a red fire-hose). They then either formed a relevant implementation intention (to collect the coupon) or an irrelevant action plan (to spend the coupon). Subsequently, the accessibility of the critical situation was tested. Using a computerized word-associations task (a lexical decision task), participants responded to words related to the critical situation (e.g. corridor, fire-hose). The results demonstrated that participants formulating a relevant plan (for collecting the coupon rather than spending it) were more successful in achieving their goal. This effect was found to be mediated by the accessibility of the specified situation: after relevant plan-formation, but not after forming an irrelevant plan, the situational cues became more cognitively accessible (i.e. participants responded to words that represented situational cues faster after forming a relevant implementation intention) and this increased accessibility in turn lead to a higher likelihood of successfully collecting the coupon.

Webb and Sheeran (2008) replicated this study, but also investigated the second proposed mechanism, which is the association that is created between the cue in the if-part of the plan, and the specified response in the then-part, that is thought to be responsible for automatically triggering this response upon encountering the specified situation. In a word-associations task similar to Aarts et al. (1999), they now not only assessed the accessibility of the situational cues, but also the strength of the association between the cues and the response (e.g. the 'corridor–collect' association). Results replicated the findings of Aarts et al. (1999), but also demonstrated that the effectiveness of implementation intentions is mediated by both (1) the accessibility of the specified situation as well as (2) the strength of the link between this situation and the desired response.

Implementation intentions can thus promote acting in line with one's goal intentions by making a pre-selected situation to act more accessible and by automatically triggering the planned response upon encountering this situation. In this sense, it could be said that implementation intentions, which have been referred to as 'instant habits' (e.g. Gollwitzer, 1999), mimic habits, as both are characterized by strong cue–response associations and their corresponding automaticity. The difference between habits and implementation intentions, however, is that the automatic behaviours that they produce stem from different processes. Whereas habitual cue–response associations have developed during a history of rewarded repetition, strong

cue-response links resulting from implementation intentions are established through the process of deliberative planning (Gollwitzer, 2014). As a result, forming implementation intentions helps people to get started with their goal pursuit, to stay on track as implementation intentions shield ongoing goal-pursuit from other influences, and it helps performance of the behaviour while preserving mental capacity as the behaviour is triggered in a relatively automatic manner (Gollwitzer, 2014). Overall, the evidence for the effectiveness of implementation intentions in promoting goal-directed actions is compelling, and found across domains (e.g. consumer, prosocial, academic, health, environmental domain) with a meta-analysis (Gollwitzer & Sheeran, 2006) suggesting an overall medium to large effect on increased rate of goal attainment ($d = 0.65$). In addition, several domain specific meta-analyses have also yielded promising results with positive effects found for healthy eating (Adriaanse, Vinkers, et al., 2011; Vilà et al., 2017), exercise behaviour (Bélanger-Gravel, Godin, & Amireault, 2013; Carraro & Gaudreau, 2013) and improving prospective memory performance (Chen et al., 2015).

In sum, implementation intentions are specific action plans, typically formulated using an if–then structure, which describe a specific situation and link this to a desirable response. In this way, the described situation is easily detected and, upon encountering this cue, the specified response is activated automatically, thereby facilitating goal achievement. The mechanisms described above are relevant for implementation intentions in general. However, using implementation intentions to change existing habits is a more complicated matter. In the next section, we will discuss research on implementation intentions when they are designed to target existing habits.

Using Implementation Intentions to Break Unwanted Habits

Habits, both healthy and unhealthy, once started out as deliberate goal-directed actions. Over time, habits develop when an action is performed repeatedly under stable conditions in order to obtain a certain goal. Ultimately, a mental association is established between the context and the action. As a result, the action is triggered automatically when the specific context is encountered (Verplanken & Aarts, 1999). This automaticity entails that habits are performed efficiently, outside of our awareness, regardless of our intentions, and with little controllability (Bargh, 1994), which make habits in our daily lives adaptive, but also notoriously hard to control. Because of their automaticity, merely informing people, and motivating them to change their behaviour, is insufficient when it comes to bad habits, as such conscious processes do not amend the underlying cue–response associations that automatically trigger the unwanted response. Rather, behaviour change strategies targeting habitual behaviours ought to target the underlying cue–response associations.

Seeing that habits and implementation intentions appear to instigate similar automatic cue–response associations that only differ in origin; that is whether they are

the result of repeated action (i.e. habits) or reflect conscious planning (i.e. implementation intentions), several studies have explored whether, in addition to promoting the execution of new, desired behaviours, implementation intentions may also be used to decrease existing unwanted habits. These studies are based on the assumption that people who are familiar with their 'situation-behaviour profile' (i.e. they know which cue elicits the unwanted habitual response; Gollwitzer & Sheeran, 2006) could formulate implementation intentions that are tailored to these critical cues. That is, implementation intentions could specify a new, desired behaviour to enact when encountering the critical cue that previously triggered the habitual, unwanted response (Adriaanse, De Ridder, & De Wit, 2009; Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; Holland, Aarts, & Langendam, 2006) in order to create a new association that directly competes with the existing habit (but note that other formats of counterhabitual implementation intentions are also possible, such as implementation intentions specifying to ignore the critical cue, see below). For example, if a person wants to eat more healthily and is aware that s/he always eats crisps when watching television, this knowledge could be used to link the critical cue ('watching television') to a new, desired response (e.g. 'eating an apple'), resulting in the following implementation intention: 'If I am watching television and I want to eat something, then I will reach for the fruit bowl and take an apple'.

Taking a 'horse race' perspective on action control, whether or not the unwanted habitual behaviour or the newly planned behaviour would be executed upon encountering the critical cue would depend on the relative strength of the newly formed cue-goal directed response (e.g. TV-apple) and the habitual cue–unwanted behaviour (e.g., TV-crisps) associations (Adriaanse, Gollwitzer, de Ridder, de Wit, & Kroese, 2011). Provided that the cue-action link that is formed by the implementation intention is stronger than the habitual if–then pattern, the action stipulated in the implementation intention should theoretically overrule the habitual response. Below we will describe several studies across various domains that have adopted this approach to formulating counter-habitual implementation intentions. Please note that this is not an exhaustive overview of all of the relevant studies, but rather an illustration of the various applications of implementation intentions in relation to changing unwanted habits.

Empirical Evidence for Implementation Intentions Targeting Unwanted Habits

One of the first studies that tested this approach to breaking habits by formulating counter habitual implementation intentions was conducted by Holland and colleagues in a study on recycling habits (Holland et al., 2006). The results of this study were promising as they found that the formation of implementation intentions resulted in diminishing the old habit of throwing plastic cups and wastepaper into the bin and in promoting the new behaviour of recycling these items. Similarly, in

the domain of eating, Adriaanse et al. (2009) tested whether implementation intentions that specify a cue that is habitually related to unhealthy snack intake, and then link this cue to an alternative healthy snack, could diminish the intake of unhealthy snacks. Results showed that, providing that participants specified the right critical cue, implementation intentions were indeed effective in reducing unhealthy snack intake by approximately 90 kilocalories a day and substituting this for healthy snacks.

Several studies also applied implementation intentions to the breaking of smoking habits. Armitage (2016), for example, investigated whether implementation intentions formulated with the aid of a 'volitional help sheet' (a sheet including a list of critical situations that may trigger the unwanted behaviour as well as a list with useful alternative responses; Armitage, 2008) could decrease habitual cigarette smoking. Results revealed that forming implementation intentions decreased habitual cigarette smoking, as measured by the Self-Report Behavioural Automaticity Index (SRBAI; Gardner, Abraham, Lally, & De Bruijn, 2012) as well as the average number of cigarettes smoked at follow-up 1 month later. Importantly, the effects of implementation intentions on behaviour change were found to be mediated by changes in habits, which makes this one of the most convincing studies demonstrating that implementation intentions can truly aid in breaking existing habits. Of note, however, is a study by Webb and colleagues (Webb, Sheeran, & Luszczynska, 2009) who found that although implementation intentions could be effective in reducing smoking behaviour, this was only true for people with weak or moderately strong smoking habits. These findings could be interpreted as evidence for the horse race perspective on action control as they suggested that, implementation intentions may be effective in diminishing unwanted habitual behaviours, but only to the extent that the new association formed by the implementation intention is stronger than the original habitual cue–response association. Obviously, this becomes more difficult, the stronger the habit that the implementation intention has to compete with.

Brewster, Elliott, and Kelly (2015) investigated the effectiveness of implementation intentions on a different behaviour that is generally considered to be habitual, which is that of speeding. They found that, amongst the 'inclined abstainers' (i.e. those participants who indicated to speed more often than they intended to), implementation intentions formulated with the use of a volitional help sheet were effective in reducing self-reported exceeding of the speed limit as compared to a control group that received general information about the risks of speeding. Providing further evidence for the notion that implementation intentions reduced speeding by weakening the habit, it was found that the formation of implementation intentions weakened the past-subsequent speeding behaviour link. Conversely, as a result of formulating implementation intentions the intention–subsequent speeding behaviour association was strengthened.

Other automatic tendencies that have been augmented using implementation intentions are stereotypes and emotional responses. Specifically implementation intentions have been found to aid in reducing automatic stereotypical thoughts (Stewart & Payne, 2008) as well as the actual behavioural expression of implicit stereotypes (Mendoza, Gollwitzer, & Amodio, 2010). In terms of automatic

emotional responses, implementation intentions have been found to be effective in reducing spider fear in spider phobics (Schweiger Gallo & Gollwitzer, 2007; Schweiger Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer, 2009) as well as in reducing prompted disgust reactions (Schweiger Gallo et al., 2009). Other examples of automatic effects that have been found amendable by the use of implementation intentions are switch costs in a task-switching paradigm as well as the automatic effects of spatial location in a Simon task (Cohen, Bayer, Jaudas, & Gollwitzer, 2008).

Underlying Mechanisms of Implementation Intentions Targeting Unwanted Habits

The studies outlined above demonstrate that implementation intentions can be effective in overruling various habitual behaviours. Although some evidence was also reported to demonstrate that effects on behaviour were mediated by changes in automaticity (in the context of smoking; Armitage, 2016) and that implementation intentions weakened the past-subsequent behaviour link (in the context of speeding; Brewster et al., 2015), still the studies discussed above do not provide much insight into the cognitive underpinning that make counter-habitual implementation intentions effective tools in overruling habits. That is, these studies do not provide insight into the effects on the cue-response associations that the implementation intentions were designed to target. Adriaanse and colleagues (2011) designed a study to fill this gap in the literature and to tap into these cognitive underpinning. Specifically, building on Kruglanski et al. (2002) goal systems theory, they hypothesized that the formation of a counter-habitual implementation intention strengthens the association between the critical cue and the alternative response, and simultaneously inhibits the association between the critical cue and the habitual response, and that the combination of these effects cancel out the advantage of the habitual over the alternative means in winning the race.

To test their hypotheses, Adriaanse, Gollwitzer, et al. (2011) conducted a computerized word association task (a lexical decision task) in which participants were asked to respond as quickly and accurately as possible to letter strings appearing on the screen according to whether they represented an existing word or a non-word. Before taking the lexical decision task, all participants had formulated the goal-intention to eat fewer unhealthy snacks. Half of the participants then augmented this goal-intention by an implementation intention linking a personal critical cue to a personally selected alternative snack. The lexical decision task that followed included words that represented participants' habitual unhealthy snacks as well as their personally selected healthy alternative snack. To test their hypotheses, reaction times for recognizing the habitual snack and the alternative snack as words, after first being exposed (primed) with their personally provided critical cue, were compared between participants in the goal intention and goal intention + implementation

intention conditions. So, in this paradigm, the reaction times to the habitual snack after first being exposed to the critical cue reflects the strength of the habit, whereas the reaction time to the alternative snack after being exposed to the critical cue reflects the new, planned association.

Results of three studies were in line with the authors' expectations. Counter-habitual implementation intentions that specified the replacement of a habitual response by an alternative response in a critical situation indeed increased the strength of the mental link between the cue and the alternative response, and reduced the strength of the mental link between the same cue and the habitual response. The implementation intentions, however, did not immediately replace the old habit by a new habit, as in the most critical test of their hypotheses (Study 3), the alternative and habitual response were equally strongly related to the critical situation. From their findings, the authors concluded that implementation intentions are effective in overcoming unwanted habits, as they allow individuals to return to the type of action control—guided by our conscious intentions—that existed before any habit was created in the first place. In other words, after formulating the counter-habitual implementation intention the old habitual and the new alternative response are now again truly competitive in winning the horse race for activation when encountering the critical cue. These findings suggest that although having good intentions may not be sufficient when behaviour change involves breaking existing habits, it is a necessary first step towards success, at least when using implementation intentions. This suggestion also aligns with the general literature on implementation intentions which has demonstrated numerous times that implementation intentions are effective only when they are supported by strong goal-intentions (Sheeran, Webb, & Gollwitzer, 2005).

Other Types of Counter-Habitual Implementation Intentions

It is important to point out that the studies discussed above studied one specific type of counter-habitual implementation intention, whereas several variants of implementation intentions have been proposed to aid in the breaking of habits (Gollwitzer, Bayer, & McCulloch, 2005). That is, in addition to implementation intentions that specify the substitution of a habitual response with an alternative response, such as the ones described above ('If I am in critical situation X, then I will perform alternative behaviour Y!'), implementation intentions could also be formulated to specify the negation of the habitual response ('If I am in critical situation X, then I will not perform habitual behaviour Z!') or to ignore the critical cue associated with the habitual response ('If I am in critical situation X, then I will ignore X!'). Unfortunately, implementation intentions using a negating format have proven to be ineffective in breaking habits (Adriaanse, Van Oosten, De Ridder, De Wit, & Evers, 2011; Otis & Pelletier, 2008; but for positive findings see Sullivan & Rothman, 2008), because they ironically strengthen rather than diminish the association between the cue and the unwanted response, in particular in case of strong habits

(Adriaanse, Van Oosten, et al., 2011). Yet, implementation intentions that specify an ignore-response do appear to be a good alternative. These 'ignore' implementation intentions have for example been found to help people to effectively deal with interfering inner states (i.e. cravings for junk food and disruptive thoughts, feelings, and physiological states; Achtziger, Gollwitzer, & Sheeran, 2008), to reduce implicit stereotyping (Mendoza et al., 2010), and to aid in down-regulating emotions, such as disgust and fear responses (Schweiger, Gallo et al., 2009).

Simple Plans in a Complex World

In sum, several studies reported compelling evidence for the effectiveness of implementation intentions for changing unwanted habit. Yet it should be noted that the effects on diminishing unwanted habits may be weaker than overall effects on promoting novel behaviours. For example, the meta-analysis of Adriaanse, Vinkers, et al. (2011) revealed that effects on increasing fruit and vegetable intake where notably stronger than on decreasing unhealthy food intake. Two more recent meta-analyses on this topic have yielded somewhat opposing results with a meta-analysis on fat intake by Vilà et al. (2017) yielding an overall moderate effect on reducing fat intake and another meta-analysis reporting small effects post-intervention and negligible effects at follow-up on food intake and no effect on weight change (Turton, Bruidegom, Cardi, Hirsch, & Treasure, 2016). Based on these latter findings, some experts on habit and habit change (e.g. Carden & Wood, 2018) have concluded that implementation intentions are not a particularly promising tool when trying to break habits, and that rather, we should focus on altering the environments that trigger the unwanted habits. Although this may certainly be a very effective approach to changing habits (e.g. Verplanken & Wood, 2006; Wood, Tam, & Witt, 2005), this is also a quite drastic approach which may not always be realistic, and at times even impossible. For example, we cannot always move or change jobs whenever we want to kick a bad habit, and several of the cues triggering our unwanted habits may simply be impossible to avoid (e.g. internal cues such as emotions or other inner states). So, we would argue that even if future studies would consistently suggest that implementation intentions yield only a small effect on altering habits, the fact that they can be considered a very minimally invasive intervention makes them an appealing strategy to apply, potentially alongside other interventions such as mental contrasting (Adriaanse et al., 2010; Stadler, Oettingen, & Gollwitzer, 2009), inhibitory control training or attentional bias modification (Turton et al., 2016).

Indeed, implementation intentions involve the formation of a single if–then plan, which means that they are convenient to use, applicable to a large range of behaviours, relatively cheap to implement, and impose little burden on participants (Hagger & Luszczynska, 2014) and therefore seem ideal to be used in large scale behaviour change interventions. Nonetheless, the usefulness and effectiveness of implementation intentions is limited under certain circumstances, especially when they are applied to change existing habits in real-life settings. Below we will

highlight several of these circumstances and challenges, which may very well also explain the mixed evidence alluded to above. In addition to highlighting these challenges, we will attempt to make suggestions for potential solutions to deal with these challenges in order to formulate effective implementation intentions, even when behaviour change involves more complex behaviours or circumstances.

Requirements for Implementation Intentions in General

Formulating Precise If–Then Plans

The specificity of implementation intentions is thought to be crucial for its effectiveness, as targeting cues that are described more precisely, will be detected more easily. Also, describing more clear (rather than vague) cues and responses will leave little room for deliberation, which facilitates the elicitation of the desired action (De Vet, Oenema, & Brug, 2011; Gollwitzer, 1999). Although some researchers have found effects using more general plans specifying when, where and how to act, while others have been using strict instructions to formulate specific 'if…, then…' plans, two studies that have put the effectiveness of specific versus global plans to the test, however, demonstrate that the specific if–then format is more effective than global plans (Chapman, Armitage, & Norman, 2009; Oettingen, Hönig, & Gollwitzer, 2000). Therefore, using specific if–then plans seems advisable.

To promote the formulation of specific plans, researchers have compared the effect of implementation intentions that are *generated by professionals* (e.g. the experimenter or a therapist) with plans formulated by participants themselves. Implementation intentions are typically more effective when its formation is guided by a professional (Armitage, 2009; Ziegelmann, Lippke, & Schwarzer, 2006). Yet, having professionals generate tailored implementation intentions seriously threatens the applicability of this strategy. When aiming for large-scale behaviour change interventions, it is preferred to combine implementation intentions with other strategies that promote correct formulation, such as using a *volitional help sheet* (Armitage, 2008).

Ensuring High Motivation

Implementation intentions are described as being subordinate to goal intentions (Gollwitzer, 1993, 1999), meaning that a strong goal intention needs to be in place before implementation intentions can be effective. Research indeed demonstrates that implementation intentions' effectiveness depends on the strength of one's goal intention: the stronger one's goal intention is, the more effective action plans are (Sheeran et al., 2005). In addition, it has been found that implementation intentions are effective only when the instructions to make plans are provided in an autonomy supportive manner (Koestner et al., 2006) meaning that people should be intrinsically rather than extrinsically motivated to enact their plans in order for the plans to be effective. One strategy that may be particularly useful to boast overall goal

commitment while simultaneously enhancing the personal relevance of the plan would be to augment the formation of implementation intentions with the use of mental contrasting (MCII), a strategy which we will discuss below.

Requirements for Implementation Intentions When Changing Habits

Finding the Critical Cue

Implementation intentions that aim to substitute an old habitual response for a planned alternative response are effective only to the extent that they specify the actual trigger of the unwanted behaviour. That is, for the implementation intention to be effective in substituting the unwanted behaviour, the planned response needs to directly compete with the unwanted automatic response, which means that the planned response needs to be linked to the critical cue that triggers the unwanted habitual response. An implementation intention specifying a cue that does not represent the actual trigger of the unwanted behaviour may be effective in adding a new wanted response to participants' behavioural repertoire, but they will not result in replacing an old behaviour (Adriaanse et al., 2009). Thus, unlike implementation intentions designed to promote new behaviours (e.g. to perform a breast self-exam, to increase vitamin C intake), for counter-habitual implementation intentions specifying *any* good opportunity to act is not sufficient, as for effectively breaking habits *the* critical cue triggering the unwanted behaviour needs to be specified. Unfortunately, this requirement makes the formation of effective counter-habitual implementation intentions considerably more difficult, as people generally have poor introspection into the reasons for their own behaviour (Nisbett & Wilson, 1977). In case of habits, introspection into the reasons for one's behaviour should be particularly problematic seeing that habitual behaviours are characterized by automaticity and unawareness (Verhoeven, Adriaanse, De Vet, Fennis, & De Ridder, 2014).

Identifying cues that trigger one's habits may thus be prone to error, and even more so when behaviour change involves a complex behaviour that may be triggered by a variety of subtle cues. Example of such complex behaviours are most health-risk behaviours, (e.g. unhealthy snacking, smoking, drinking) where critical cues may often be related to subjective internal states (e.g. boredom) rather than to more objective situational cues reflecting a specific time or place (Adriaanse et al., 2009). Indeed, in the domain of eating, it has been found that people may hold false beliefs about the causes of their eating, and may rely on (personally) popular, but inaccurate, beliefs that their unhealthy eating is triggered by negative emotions (Adriaanse, De Ridder, & Evers, 2011; Evers, De Ridder, & Adriaanse, 2009).

One strategy that might help the identification of critical cues is *cue-monitoring*, which has been used in relation to formulating counter-habitual implementation intentions in the domain of eating (Verhoeven et al., 2014). In cue-monitoring, people reflect on their critical situations in situ, using a diary. In the context of eating behaviour, this means that participants do not only reflect on their snack consumption,

but also on the situation triggering the consumption, by monitoring their location, activity company, and feelings when they engage in unhealthy snacking. Moreover, participants are asked which aspect of the situation reflects their most important trigger for unhealthy snacking (such as feeling bored). As in cue-monitoring people reflect on their behaviour in situ, dependence on retrospective memory is limited. This strategy has been found to be effective in itself, but may also be used to inform the identification of critical cues for if–then plans (Verhoeven et al., 2014).

Another technique that may foster insight into critical cues is '*mental contrasting'* (Oettingen, 2012). Mental contrasting is a self-regulation strategy in which people first imagine the desirable future and subsequently think about the reality that prevents them from fulfilling their goals. By explicitly contrasting their future wishes with the present reality, people obtain a clearer picture of the obstacles that stand in their way and that they need to take action in order to achieve their desired future. This leads to heightened levels of (expectancy-dependent) commitment towards achieving one's selected goals. Interestingly, Adriaanse et al. (2010) report evidence suggesting that mental contrasting may also aid the identification of the cues driving the unwanted habits that people desire to overcome, and that combining implementation intentions with mental contrasting (MCII) enhanced implementation intention efficacy. This provides further evidence for the notion that the efficacy of implementation intention interventions in diminishing unwanted habits is dependent on whether people can accurately specify critical cues for their habitual behaviour. Moreover, these findings highlight the potential of supplementing the use of implementation intentions with strategies that foster identification of critical cues. Indeed, several studies have reported beneficial effects of MCII on various behaviours ranging from exercising (Sailer et al., 2015; Stadler et al., 2009) and eating (e.g. Loy, Wieber, Gollwitzer, & Oettingen, 2016; Stadler et al., 2009) to improving time management (Oettingen, Kappes, Guttenberg, & Gollwitzer, 2015).

Lastly, several studies have demonstrated that providing examples in the form of a *volitional help sheet* may be helpful (Armitage, 2008) and there is some tentative evidence that inducing a '*hot' state* (e.g. hunger) before asking participants to think about critical cues (De Ridder, Ouwehand, Stok, & Aarts, 2011) may be useful as well. This latter approach builds on the notion that people are generally in a 'cold' state when making plans and that people in a cold state tend to underestimate the influence of hot states (e.g. hunger, emotions) on their behaviour (Loewenstein, 1996). This could be problematic seeing that these hot states are plausible candidates to be critical cues for various unwanted habits, such as unwanted eating habits.

Strengthening the Link Between 'If' and 'Then'

The degree to which implementation intentions are effective when competing with existing habits is for a large part determined by the association that is created between the specified situation and response (Webb & Sheeran, 2007). Therefore, a strong if–then link is essential. Ways to strengthen the link between the cue and the

response are, for example, to repeat the plan multiple times by writing, repeating in one's head or saying the plan out loud (Hagger et al., 2016). Another solution that is found effective is to apply mental imagery (Knäuper et al., 2011; Knäuper, Roseman, Johnson, & Krantz, 2009). *Mental imagery* is rehearsing the performance of the specific action in the targeted situation in mind. As mental imagery drives on rich multisensory processes, it is thought to be highly similar to the real experience. Therefore, mentally imagining the performance of the planned action in the specified context is supposed to mimic processes of rehearsal in the actual situation, thereby enhancing the accessibility of the targeted situation and strengthening the association that is developed between this situation and the desirable response (Knäuper et al., 2009, 2011). Hence, adding mental imagery is a relatively simple way to improve cue-accessibility and the strength of the if–then link, which in turn enhance plan effectiveness.

The Inflexibility of a Single If–Then Plan

Although implementation intentions' effectiveness is conditional on a strong and specific cue–response association, it may not always be practical to make a single, highly specific if–then plan when behaviour change involves targeting complex behaviours like, for example, eating. To start with, most unhealthy behavioural patterns are a result of multiple undesirable actions. For example, when it comes to eating, most people do not have a single bad habit, but eat unhealthily in response to a variety of cues (e.g. when feeling sad, when feeling bored, when watching TV, etc.; Cleobury & Tapper, 2014; Verhoeven, Adriaanse, de Vet, Fennis, & de Ridder, 2015). Formulating a single plan might address one of these cues, but one could wonder whether this is sufficient to change behaviour in a meaningful (e.g. clinically relevant) way. A seemingly logical approach in such cases, may be to formulate multiple plans each targeting a different critical cue for unhealthy snacking behaviour. Although this approach may sound intuitively appealing, it has been found that this may in fact be quite problematic as formulating multiple plans appears to jeopardize the effectiveness of implementation intentions (e.g. Verhoeven, Adriaanse, De Ridder, Vet, & Fennis, 2013).

Another problem related to formulating one specific plan when targeting habitual behaviours that people perform repeatedly during the day, involves the inflexibility of specifying one alternative behaviour. For example, when a person with the habit of eating crisps when watching TV formulates a plan to take an apple instead, this means that the effectiveness of the plan is dependent on the availability of this specific food item. In addition, although the repeated execution of the same behaviour may be conducive to the formation of a new habit, adopting the same alternative behaviour over and over again may not always be considered desirable. Indeed, people formulating implementation intentions to target daily habits may be tempted to specify multiple alternative responses rather than a single solution in the then-part of the plan. For example, when trying to account for the unavailability of apples, a solution would be to make a plan B ('If I am feeling bored and want to take

a snack, then I will eat an apple, or else, I will eat a banana!'). However, similar to specifying multiple plans, formulating such a plan B, thereby linking a critical situation to multiple solutions has been found to reduce the effectiveness of implementation intentions (Vinkers, Adriaanse, Kroese, & de Ridder, 2015). A better approach to avoid problems related to specifying a fixed alternative, could in some situations, be to use implementation intentions that specify an ignore-response (e.g. 'If I am in critical situation X, then I will ignore X!'). These 'ignore' implementation intentions have for example been found applicable to internal cues, such as cravings or disruptive thoughts or feelings as well (Achtziger et al., 2008).

Another solution to the problems explained above would be to apply implementation intentions as a *metacognitive strategy* by explaining the strategy to participants to enable the independent use of if–then plans (Verhoeven, 2015). Preliminary research demonstrated that it might be possible to teach people how to formulate their own plan, which could be adapted over time to accommodate changing needs, without the interference of a professional or intervention tool. In this way implementation intentions are truly used as a self-regulatory strategy, without depending on a professional. More research is however needed to test the effectiveness of metacognitive strategies.

Staying Motivated with Minor Changes

Implementation intentions typically focus on relatively small changes in one's lifestyle. For example, when it comes to eating behaviour, studies using implementation intentions have resulted in a reduction of approximately 90–125 kcal (Adriaanse et al., 2009, 2010; Sullivan & Rothman, 2008). This reduction, that is equal to about two handful of crisps, is a meaningful change for people's health on a population level (Hill, Wyatt, Reed, & Peters, 2003). In addition, such small, significant adaptations likely promote sustainable behaviour change on the long run. Yet, for individual participants, this might be hard to recognize, as this does not result in drastic weight reduction, or even in noticeable differences when looking in the mirror, and the effects of implementation intentions might therefore not be perceived as rewarding. It might discourage people if they do not experience results directly from implementation intention interventions, especially when alternative strategies might be offered that do promise quick and vast results (e.g. fad diets). How to keep people motivated in implementation intention interventions is one issue that has not been addressed much in the current literature. This is surprising considering that implementation intentions' effectiveness relies not only on the strength of the underlying goal intention but also on the commitment to the plan itself (Gollwitzer & Oettingen, 2016), which may diminish if it is not perceived as rewarding or helpful. One solution would be to embed implementation intentions with strategies that are developed to keep motivation high, such as *motivational interviewing* (Rubak, Sandbaek, Lauritzen, & Christensen, 2005; Treasure, 2004). Other additions such as *booster sessions* (Chapman & Armitage, 2010), *text messaging* (Prestwich, Perugini, & Hurling, 2009), *or planning together with significant others* (e.g. 'dyadic planning';

Burkert, Knoll, Luszczynska, & Gralla, 2012), might also be helpful to keep motivation levels high.

Concluding Thoughts

In conclusion, while implementation intentions are highly promising tools for behaviour change in applied contexts, these simple plans might not be so straightforward to use when trying to compete with existing habits in a complex world. In their daily lives, people might encounter specific boundary conditions that limited the applicability of implementation intentions. For example, people typically have multiple habits related to an overarching goal, while based on the literature, people are advised to make a single plan only. Also, as implementation intentions' effectiveness involves making one strict and specific plan according to a specific format, implementation intentions are inherently inflexible. This inflexibility clearly contrasts the ever-changing environment we are living in. Future research should therefore investigate ways to promote the flexible adjustments of people's personal plan to accommodate changes in their needs. Finally, as implementation intentions result in relatively small changes in one's lifestyle, it is important to acknowledge that motivation might reduce over time in implementation intentions interventions, and ways of keeping up participants' motivation level are important to consider.

Habit Research in Action

This box provides guidelines to do implementation intention research, based on the existing literature and our own experience, to support researchers who aim to study implementation intentions.

Control condition

Using high-quality control conditions is important to prevent the overestimation of implementation intentions' effectiveness (Adriaanse, Vinkers, et al., 2011). Ideally, participants in the control condition receive an active control exercise that mimics the implementation intention condition as much as possible, except for the implementation intention-specific instructions. This means that if participants in the planning conditions are asked to obtain a certain goal (e.g. 'try to eat fewer unhealthy snacks this week'), this should be communicated to the control participants too. Likewise, control conditions can be matched to receive a similar amount feedback, and spend a similar amount of time and effort on the exercise. Examples of control exercises are making a list of healthy options to eat more healthily (Adriaanse et al., 2009) or receiving tailored information (De Vries, Kremers, Smeets, Brug, & Eijmael, 2008), rather than merely receiving additional information or questionnaires.

Identifying the critical cue
When aiming to change habits, identification of the critical cue is essential, yet people generally have poor introspection into the triggers of their habits. Consider using additional strategies to promote identification of critical cues such as cue-monitoring (Verhoeven et al., 2014) or 'mental contrasting' (Oettingen, 2012) (see main text).

Instructions for plan-formation
It is not easy for participants to independently formulate correct implementation intentions. If possible, an experimenter could guide plan formation (Armitage, 2009; Ziegelmann et al., 2006). This is, however, not always possible or relevant (due to time/financial constraints or when testing for online interventions). To support formation of high quality plans, we use elaborate, step-by-step instructions, involving the following steps:

1. Ask participants to write down their single most important trigger for the targeted behaviour. If plan formation was preceded by a monitoring-period (e.g. cue-monitoring), encourage participants to think about the learnings from this phase.
2. Instruct participants to rewrite their personal trigger in one sentence starting with 'If…'.
3. Ask participants to write down one desirable, alternative response that could be performed instead. Examples could be provided. Participants should be instructed to always include an alternative (rather than making negating plans, e.g. planning to do nothing or to ignore the desire to perform the habitual action).
4. Prompt participants to rewrite their alternative in one sentence, starting with 'Then…'.
5. Ask participants to link the if-part and then-part to make the plan complete, by writing it down as one 'If…, then…' sentence.
6. To strengthen the if–then link, ask participants to repeat their plan by saying it out loud, writing it down once more, or vividly imagine enacting the plan (see Knäuper et al., 2009).

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