

Implementation intentions: A look back at fifteen years of progress

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Implementation intentions are if-then plans that spell out when, where, and how a set goal has to be put into action: «*If situation x is encountered, then I will perform behavior y!*», thereby linking a critical situation with a goal-directed behavior. Over the last fifteen years, implementation intentions, as compared to simple goal intentions («*I intend to reach z!*»), have demonstrated their effectiveness as self-regulation strategies in promoting desired behaviors or when unpleasant actions have to be carried out. By forming implementation intentions, the control of unwanted influences (e.g., temptations, bad habits, adverse self-states) on an ongoing goal pursuit can also be facilitated. Furthermore, implementation intentions have been shown to ease goal-directed actions in critical populations such as patients with a frontal brain lesion, schizophrenic patients, and opiate addicts in withdrawal, for whom the initiation problems of the goal-directed action are more accentuated.

Las intenciones de implementación: una mirada atrás a quince años de progreso. Las intenciones de implementación son planes «si-entonces» («if-then plans») que especifican cuándo, dónde y cómo se va a llevar a la acción una meta propuesta: «*Si me encuentro con la situación x, entonces llevaré a cabo la conducta y!*», ligando de esta manera una situación crítica con una conducta dirigida a la meta. Durante los últimos quince años, las intenciones de implementación han resultado ser estrategias eficaces de autorregulación, en comparación con las metas simples, para promover comportamientos deseados o cuando hay que realizar acciones no placenteras. Mediante la formación de intenciones de implementación también se pueden controlar las influencias indeseadas (por ejemplo, tentaciones, malos hábitos, estados personales adversos). Asimismo, han demostrado facilitar las acciones encaminadas hacia una meta en poblaciones críticas, como pacientes con lesiones cerebrales frontales, esquizofrénicos, y pacientes bajo el síndrome de abstinencia, para quienes los problemas de iniciación de acciones dirigidas hacia una meta son más acentuados.

Intentions represent a central concept in modern social psychology. As immediate predictors of behavior, intentions have been at the centre of research for many years, for instance in the theories of planned behaviour and reasoned action (e.g., Ajzen & Madden, 1986; Madden, Ellen, & Ajzen, 1992). However, although the attitude-behavior relation has received much attention, this was not the case regarding the concrete psychological mechanisms mediating the effects of intentions on behaviour (Bamberg, 2000; Gollwitzer, Bayer, & Mc Culloch, 2005). This is all the more striking as intentions have been shown to account for only 28% of the variance in future behavior (Sheeran, 2002). Whereas researchers observed this gap between goal intentions and actual behavior (summary by Sheeran, 2002), it is commonly narrowed by forming implementation intentions (summary by Gollwitzer & Sheeran, 2006).

Implementation intentions pertain to so-called self-regulation theories of goal striving, which attempt to explain the volitional processes that mediate the effects of goals on behavior (Gollwitzer &

Moskowitz, 1996). In this context, goal pursuit is frequently linked to implementation problems pertaining to either the initiation of a task, or its successful completion. Solving volitional problems of the first kind (i.e., initiating the task) involves the individual seizing good occasions in which to act despite being, for example, tired or absorbed in an ongoing activity, whereas the latter (i.e., successfully completing the task) requires protecting oneself against distractions, persisting when faced with difficulties and resuming disrupted goal pursuits (e.g., Gollwitzer, 1999; Gollwitzer & Moskowitz, 1996; Oettingen & Gollwitzer, 2001). Alleviating these problems of goal attainment stands at the centre of Gollwitzer's theorizing about implementation intentions (1993, 1996, 1999).

Since implementation intentions were discovered in 1990 in a study about the transition from weighing to willing (Gollwitzer, Heckhausen, & Ratajczak, 1990), implementation intentions have been at the centre of research in both Europe and the USA. Specifically, not only the underlying processes, but also their effectiveness in several domains, including health psychology, emotion psychology, clinical psychology, and social psychology have been studied for the last 15 years.

The differentiation between goal intentions and implementation intentions

Implementation intentions (Gollwitzer, 1993, 1996, 1999) are if-then plans that spell out when, where and how a set goal has to

be put into action: «*If situation x is encountered, then I will perform behavior y!*», thereby linking a critical situation with a goal-directed behavior. They are to be distinguished from goal intentions that specify a desired performance or outcome and have the format of: «*I intend to reach z!*» Whereas goal intentions designate desired end-states the individual feels committed to attain, implementation intentions refer to the realization of the goal intention and create a commitment to respond to a specified critical situation in a planned, goal-directed manner. Implementation intentions are hierarchically subordinate to goal intentions, that is, they are formed in the service of respective goal intentions.

Processes related to the anticipated situation

Implementation intentions create a mental link between the specified critical situation («if-part») and the intended goal-oriented behavior («then-part»). As a consequence, the mental representation of the critical situation becomes activated and is therefore highly accessible. This allows for easy detection, effective recall, and a readiness to attend to the critical situation even if one is cognitively busy otherwise.

The hypothesis of the heightened accessibility has been supported by Gollwitzer, Bayer, Steller, & Bargh (cited in Gollwitzer, Fujita, & Oettingen, 2004) in a series of studies. In one of these studies, words portraying the anticipated critical situation were presented in a dichotic-listening task and found to be highly disruptive to focused attention in participants who furnished their goal intention with an implementation intention, as compared to those who formed a mere goal intention. Further, superior recall for the critical situation received empirical support in a cued recall experiment, where implementation intention participants had to specify when, where and how to play prepared games from large pre-designed options. These specified options were better recalled than non-specified ones even when recall was not assessed immediately, but 48 hours later. Moreover, the perceptual readiness to attend the critical situation was assessed in an embedded figures test, where detection performance of hidden figures was enhanced for implementation intention participants.

Processes related to the specified behavior

Forming such «if-then» links also delegates the control of the specified goal-directed behavior to the critical situation. As a consequence, automatic action initiation occurs in the presence of the specified situation, that is, action initiation becomes immediate, efficient, and no longer needs conscious intent (e.g., Aarts & Dijksterhuis, 2000; Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Brandstätter, 1997; Webb & Sheeran, 2004). This automatic action control has also been termed *strategic automaticity* or *instant habits*, as these automatic processes are based on a single mental act of linking a critical situation with a desired goal-directed behavior (Gollwitzer & Schaal, 1998; Gollwitzer, 1999), and are not the result of frequent past behavior as habits are (Aarts & Dijksterhuis, 2000).

The immediacy of action initiation was tested in a study by Gollwitzer and Brandstätter (1997, Study 3). All participants were instructed to counter argue videotaped xenophobic comments, while those in the implementation intention condition committed themselves to do so at selected good opportunities. It could be

shown that these latter participants seized appropriate occasions to initiate the counterargument more immediately than those participants who only familiarized themselves with suitable opportunities.

Two studies (Brandstätter et al., 2001, Studies 3 and 4) supported the hypothesis of an efficient action initiation. Participants who previously formed an implementation intention sped up the initiation of relevant goal-directed behavior (i.e., pressing a button) at the critical stimulus (i.e., in Study 1 if the number 5 was presented and in Study 2 if the number 3 was presented) in a go/no-go task. Implementation intentions were effective even despite the fact that participants were not completely focused on the critical situation, as prevented by a dual task paradigm. Furthermore, the immediate action initiation was found not only when participants executed an easy primary task at the same time, but also when executing a difficult one.

Finally, Bayer, Moskowitz and Gollwitzer (2005) explored whether forming implementation intentions led to action initiation without conscious intent once the critical situation is encountered. These authors assessed in two studies whether a subliminally presented critical situation is sufficient to ease the activation of goal-relevant words (Study 1) and execute the intended goal-directed response (Study 2). In the first experiment, goal intention participants were asked to assert themselves towards a rude experimenter by telling her off for her behavior, while implementation intention participants made plans regarding how to do so. Next, faces of the rude experimenter (i.e., the critical situation) or neutral faces were presented subliminally and read latencies of rudeness-related words were assessed. Faster reading times of target words were revealed for implementation intention participants, as compared to mere goal intention participants. In Study 2, participants classified geometrical figures in a priming task and were asked to respond as quickly as possible to the figures. In addition, implementation intention participants planned to react particularly fast to a certain stimuli. As in the first study, faster classification responses were found for this latter group.

Effectiveness of implementation intentions

For more than a decade, research has consistently shown that by means of forming implementation intentions, volitional problems related to the initiation of a task, as well as bringing an initiated goal pursuit to a successful end can be facilitated. This is the case regarding the attainment of both wanted and unwanted behaviors, but also for the control of unwanted influences (e.g., temptations), as well as for the promotion of goal attainment in critical populations that have difficulties with action control such as ADHD children or schizophrenics (overview by Gollwitzer et al., 2004, 2005).

Initiating goal striving

Implementation intentions have been shown to be effective self-regulatory tools which support the initiation and attainment of desired behaviors pertaining to different domains such as academic performance, pro-environmental behavior or the health domain. For instance, forming implementation intentions has been found to facilitate carrying out all kinds of behaviors that are somewhat difficult to control, for example writing a research report during Christmas break (Gollwitzer & Brandstätter, 1997).

Two further experiments by Oettingen, Hönig, and Gollwitzer (2000) showed that furnishing a goal intention with an implementation intention facilitates meeting academic goals such as writing a curriculum vitae or performing arithmetic tasks on time. Further, Brandstätter and her colleagues (2003) could also recently corroborate the relevance of this self-regulatory strategy in another domain of academic performance, since participants who formed an implementation intention were more successful in initiating vocational retraining after two years.

In addition, participants who wanted to use public transportation instead of their habitual, routine transportation mode also benefited significantly from forming implementation intentions in a field experiment (Bamberg, 2000). Indeed, only 37% of the participants who formed a goal intention, as compared to 63% of the implementation intention participants, changed their travel mode routine and used a public bus. Further, Sheeran and Silverman (2003) found that participants were more than twice as likely to attend workplace health and safety training courses after forming an implementation intention. Moreover, greater improvements in frequency and total time spent exercising per week were found for participants who furnished their goal intentions with implementation intentions (Prestwich, Lawton, & Conner, 2003).

Another study analyzing the initiation of goal striving was conducted by Sheeran and Orbell (1999). Here, the authors investigated whether forming implementation intentions could promote taking daily doses of vitamin C pills and found that participants in the implementation intention condition missed significantly fewer pills (26%) than goal intention participants (61%) after 3 weeks. Forming implementation intentions has been

also shown to be effective when it comes to performing unpleasant goal pursuits such as cervical smear tests. Sheeran and Orbell (2000) showed for example that a remarkable 92% of the participants in the implementation intention condition went for screening, as compared to the 69% of goal intention participants. Orbell and Sheeran (2000) found in addition that functional activity was resumed sooner after 3 months in a sample of replacement surgery patients who had formed implementation intentions than those patients who had not.

The likelihood of performing a breast examination during the following month after contacting participants was also enhanced by forming implementation intentions (Orbell, Hodgkins, & Sheeran, 1997). In order to test these latter effects on behavior over a longer time period, Prestwich and colleagues (2005) asked participants to form implementation intentions to promote breast self-examination and found that this strategy significantly increased the likelihood of breast self-examination at one month, and marginally at six months. More importantly, in a second study the planning of collaborative breast self-examination involving a partner showed a 100% success rate. Further, in a study by Steadman and Quine (2004) the performance of testicular self-examination was increased significantly for implementation intention participants, since 65% of the participants who formed an implementation intention reported performing testicular self-examination, as compared to the 40% of the control condition.

Another study in the health domain (Armitage, 2004) evaluated the effects of implementation intentions on reducing dietary fat intake. In fact, of the 264 participants, only those in the implementation intention condition reduced their fat intake, saturated fat intake and the proportion of energy derived from fat.

Figure 1
Implementation intention effects for different self-regulatory problems and goal domains

Initiating goal striving	
<i>Academic</i>	<ul style="list-style-type: none"> - Initiating vocational retraining (Brandstätter et al., 2003) - Writing a research report during Christmas break (Gollwitzer & Brandstätter, 1997) - Writing a curriculum vitae (Oettingen, Hönig, & Gollwitzer, 2000) - Performing arithmetic tasks on time (Oettingen, Hönig, & Gollwitzer, 2000)
<i>Environmental</i>	<ul style="list-style-type: none"> - Using public transportation (Bamberg, 2000)
<i>Health</i>	<ul style="list-style-type: none"> - Reducing dietary fat intake (Armitage, 2004) - Performing a breast examination (Orbell, Hodgkins, & Sheeran, 1997) - Resuming functional activity after surgery (Orbell & Sheeran, 2000) - Promote breast self-examination (Prestwich et al., 2005) - Improving the frequency and total time spent exercising per week (Prestwich, Lawton, & Conner, 2003) - Taking daily doses of vitamin C pills (Sheeran & Orbell, 1999) - Performing cervical smear tests (Sheeran & Orbell, 2000) - Attending workplace health and safety training courses (Sheeran & Silverman, 2003) - Performing testicular self-examination (Steadman & Quine, 2004) - Eating healthily (Verplanken & Faes, 1999)
Shielding goal striving from unwanted influences	
	<ul style="list-style-type: none"> - Controlling stereotypic and prejudicial reactions (Achtziger, 2003) - Protecting ongoing behaviors from distractions (Gollwitzer & Schaal, 1998) - Suppressing unwanted emotional responses (Schweiger Gallo et al., 2006)
Conserving self-regulatory capability	
	<ul style="list-style-type: none"> - No ego-depletion (Webb & Sheeran, 2003) - No rebound effect (Gollwitzer, Trötschel, & Sumner, 2002; cited in Gollwitzer et al., 2004, 2005)

Not least, a study by Verplanken and Faes (1999) showed that those participants who wanted to eat healthily also profited from this self-regulatory strategy.

Shielding goal striving from unwanted influences

Implementation intentions also facilitate the control of unwanted influences (e.g., temptations, bad habits, adverse self-states; Gollwitzer & Schaal, 1998; Gollwitzer & Bayer, 2000; Gollwitzer et al., 2005) on an ongoing goal pursuit. The control of undesired responding has been tested, for example, regarding both the control of stereotypic and prejudicial reactions (see also Álvarez Castillo, 2005), the protection of ongoing behaviors from distractions, and the suppression of unwanted emotional responses. In the former, forming implementation intentions inhibited the automatic activation of stereotypical beliefs. In two studies, Achtziger (2003) analyzed whether stereotype activation and stereotype use under different types of cognitive load could be intentionally controlled due to the strategic benefits of forming an implementation intention (e.g., strategic automaticity, swift and effective action initiation). In a first study, implementation intention participants were able to control the use of the stereotype even under high cognitive load. In fact, participants were presented stereotype-consistent and stereotype-inconsistent data of the target person while either one of two components of working memory, the phonological loop or the central executive, were impaired. It was found that only those participants who formed an implementation intention which specified processing the stereotype-inconsistent information could recall this information and thus were able to control the use of the stereotype. In Study 2, a sequential priming paradigm was used, where pictures of soccer fans served as primes and relevant negative versus positive person attributes as targets (e.g., comradely, stupid). Reaction times to the positive attributes of soccer fans showed that these were activated, while negative characteristics were deactivated only for implementation intention participants («And if I see a soccer fan, then I won't evaluate him negatively!»).

Regarding the protection of ongoing behaviors from distractions, the implementation intentions centered on taking focus away from the critical situation could be shown to be an effective self-regulatory tool in protecting participants from distractions. Gollwitzer and Schaal (1998) followed a study by Patterson and Mischel (1976), where preschool children were told that they could play with attractive, desirable toys depending on their completion of a boring, repetitive task consisting of placing pegs into a pegboard. At the same time children worked on the task, attractive toys were shown in the so-called «Mr. Clown Box». In Gollwitzer and Schaal's study, participants were asked to perform a series of self-paced arithmetic problems presented on a computer screen, while distracting clips of award winning commercials were presented. Findings revealed that the mere goal intention «I will not let myself get distracted!» was less effective in protecting participants from these distractions than the distraction-inhibiting implementation intention «And if a distraction arises, then I will ignore it!». Thus, distraction-inhibiting implementation intentions helped participants improving their level of performance on the task at hand, thus helping to ward off the distractions.

In a recent series of experiments, Schweiger Gallo et al. (2006) analyzed the effectiveness of forming implementation intentions on the suppression of undesired emotional responses. In a first study, participants were exposed to a series of pictures used to

elicit disgust. Only participants with implementation intentions were able to reduce arousal as compared to a control group. As anticipated, participants who operated under a mere goal (intention) did not manage to do so. Further, the effectiveness of implementation intentions as well as the ineffectiveness of mere goal intentions was replicated in a second study with the control of spider fear. Moreover, participants who exhibited fear of spiders upon using implementation intentions even managed to suppress their fear to the low level observed with a sample of participants who were pre-selected on the basis of having no fear of spiders at all. Consequently, the volitional control of disgust and strong fear is possible when forming an implementation intention, but not merely by a goal intention.

Conserving self-regulatory capability

Research on the costs of action control by implementation intentions in terms of undermining the success of subsequent goal pursuits has revealed that the effectiveness of forming implementation intentions does not produce ego-depletion and causes no rebound effect (Gollwitzer et al., 2004). Most interestingly, Webb and Sheeran (2003) observed that the facilitation of goal attainment by implementation intentions is achieved without ego-depletion (Baumeister, Bratslavsky, Muraven, & Tice, 1998), indicating that goal pursuits guided by implementation intentions leave a person's self-regulatory capacities intact. Research participants who used implementation intentions to achieve a difficult task goal (i.e., high performance on the Stroop task) showed no deficits in the successful regulation of a subsequent demanding cognitive task (i.e., tracing puzzles). These results support previous ones by Gollwitzer and Bayer (2000), who found that the differences in performing anagrams after watching a humorous movie in control participants (told to yield to their emotions) and self-regulation participants (told to control their emotions) disappeared after having formed implementation intentions.

Not least, Gollwitzer, Trötschel, and Sumner (2002, cited in Gollwitzer et al., 2004, 2005) showed in two further studies that implementation intentions used for the control of stereotyping others did not incur rebound effects. Participants first had to form a nonstereotypical impression of a homeless person before evaluating homeless people in general (Study 1) or perform a lexical decision task that assessed the accessibility of homeless stereotypes (Study 2). Compared to participants who furnished their goal intention with an implementation intention, judgments of mere goal intention participants were more stereotypical in the first study. In addition, these latter participants identified stereotypes faster in the second study, thus revealing a higher accessibility of homeless stereotypes.

Implementation intention effects on critical populations

Furthermore, implementation intentions promote goal attainment in populations that have difficulties with action control in general, such as patients with frontal brain lesions (Lengfelder & Gollwitzer, 2001) and opiate addicts in withdrawal (Brandstätter et al., 2001). To illustrate, in a study by Brandstätter and colleagues (2001, Study 2) schizophrenic patients and control participants were instructed to perform a go/no-go task and received either an implementation intention («If number 3 appears,

I will respond particularly fast!») or the goal to increase their response speed to the number 3 by familiarizing with the instruction (i.e., writing out the number repeatedly on a sheet of paper). Results showed that schizophrenic patients who formed implementation intentions sped up their responding to the critical, but not to the noncritical stimuli.

Another clinical population who also profits from implementation intentions is ADHD children (Gawrilow & Gollwitzer, 2005). In a first study, Gawrilow and Gollwitzer found that children with ADHD who furnished a suppression goal with an implementation intention were more successful in completing their goal of suppressing an unwanted response in a go/no-go task than participants with a mere goal intention. Furthermore, the ADHD-children who formed an implementation intention showed the same response inhibition performance as children without any psychological disorders. The benefits of forming implementation intentions in ADHD-children were replicated in a second study, where a combination of implementation intentions and psycho stimulant medication was found to produce the best suppression performance in these children.

Costs of action control by implementation intentions

Recent research on the costs of action control by implementation intentions has also revealed that forming implementation intentions is not accompanied by rigidity. This issue was addressed by Jaudas and Gollwitzer (2004) in two studies. In the first study, participants performed a choice reaction paradigm consisting of two blocks of 100 trials each. Participants in the goal intention committed to the goal: «I will try to get as many points as possible!», whereas implementation intention participants furnished their goal intention with the implementation intention «And if the flower icon appears, then I will quickly grab the 50 points!» In a first block of trials, the cue specified in the implementation intention was the best available cue to act toward the goal. Nonetheless, in a second block an unexpected new cue (i.e., a better alternative) was presented together with the original cue. Results revealed that implementation intention participants were able to select this new symbol rapidly and efficiently, showing that forming implementation intentions facilitate task goal attainment without costs in terms of rigidity when a novel and better alternative was presented. Thus action control by implementation intentions seems not only to be highly efficient, but also does not lack controllability as it serves flexibly the respective super-ordinate goal.

In a second study, Jaudas and Gollwitzer investigated the effects of providing implementation intention participants with feedback that their if-then plans do not promote goal attainment, but rather hamper goal progress. Here, participants were asked to play a computer game in which they had to navigate a virtual figure through ten different, successively presented mazes. They were told that a little green arrow would appear at some junctions pointing to the shortest possible way in order to facilitate task performance (although in only 3 out of the 10 mazes the green arrow pointed to the shortest way). It was found that participants who formed the mere goal intention «I will try to find the shortest way through the mazes as fast as possible!» and who received no feedback concerning whether they found the shortest way or not,

showed a significantly better performance than implementation intention participants. Despite this fact, when the low instrumentality of forming the if-then plan «And if the green arrow shows up, then I'll quickly press the respective button!» was mentioned to implementation intention participants, they performed equally well as goal intention participants. Hence, implementation intention participants seem to disengage from their if-then plan when evidence is accumulated that the plan hinders rather than furthers task goal attainment.

New directions and conclusion

Despite the enormous amount of studies supporting the effectiveness of implementation intentions as compared to goal intentions, much work remains to be done in order to further assess the benefits of this self-regulatory strategy, as well as their underlying mechanisms (see also Gollwitzer & Sheeran, 2006). First of all, although the benefits of forming implementation intentions have been analyzed in a variety of domains (e.g., academic, health), others are still lacking in research (e.g., consumer behavior, and organizational settings). This is also true concerning the use of more representative groups than undergraduate students.

Further, insights have actually been gained into the underlying mechanisms of implementation due to neurophysiological research. Here, for example, the analysis of the electrocortical correlates of emotion regulation by ignore-implementation intentions has recently revealed that those participants who furnished their goal intention with an ignore-implementation intention showed a significantly smaller P1 in response to pictures of spiders (Schweiger Gallo et al., 2006). These data indeed suggest that implementation intentions produce their effects through cortical control that sets in very early in the information processing system, and do not appear to down-regulate an already experienced negative emotion, but rather block the emergence of negative emotions at their onset. Electrocortical correlates could thus continue to be assessed, as they offer the possibility of determining at what point in the time course different types of implementation intentions (e.g., suppression implementation intentions vs. inhibition implementation intentions) exert their effects after the critical stimuli are encountered.

In summary, the present review has shown how forming implementation intentions has been revealed over the last 15 years to be an effective self-regulatory tool in domains including health psychology (e.g., intake of pills, healthy eating), clinical psychology (e.g., ADHD children, schizophrenic patients), and social psychology (ego depletion, rebound effect, etc.). Notwithstanding, future research is needed to comprehend to a greater extent the functioning of implementation intentions. Consequently, not only basic research, but also applied research and clinical interventions should profit from this line of investigation.

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