The Mental Representation of Plans

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To My Parents

In loving memory of Whiskey and Hatsch
and
In remembrance of the victims of September 11th, 2001
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Zusammenfassung


In drei Experimenten wurde die mentale Repräsentation beider Komponenten von Vorsätzen (d.h. der günstigen Situation und der zielrealisierenden Handlung) mit Hilfe einer lexikalischen Entscheidungsaufgabe untersucht. In Experiment 1 zeigte sich, dass die Bildung eines selbstgenerierten Vorsatzes zu einer mentalen Repräsentation, wie auch zu einer erhöhten Aktivierung der günstigen Situation und der zielrealisierenden Handlung führt. Die Bildung zugewiesener Vorsätze in Experiment 2 ergab, dass die Planaktivierung (d.h. erhöhte Aktivierung beider Vorsatz-Komponenten) auf die funktionale Beziehung der wenn-dann-Komponenten und deren Aktivierungskonvention (im Gegensatz zu günstigen Situationen und zielrealisierenden Handlungen welche nicht Teil eines Vorsatzes sind) zurückzuführen sind. In Experiment 3 konnte der Effekt der Planaktivierung trotz kognitiver Belastung gezeigt werden, daher kann die Aktivierung beider Vorsatz-Komponenten auf einen automatischen Prozess zurückgeführt werden, welcher keine kognitiven Ressourcen benötigt.
Im Anschluss werden Implikationen der vorliegenden Arbeit für den Forschungsbereich von Vorsätzen an der Schnittstelle zwischen kognitiven und motivationalen Prozessen diskutiert.
Abstract

Plans in the form of implementation intentions have been shown to be an effective tool for overcoming self-regulatory problems in goal pursuit and for promoting goal attainment (Gollwitzer, 1993, 1996; Gollwitzer, Bayer, & McCulloch, 2005; Gollwitzer & Sheeran, in press). Implementation intentions are if-then plans that link good opportunities to act (i.e., specified situations) with behavioral responses that are effective in accomplishing one’s goals (i.e., goal-directed behaviors). The concept of implementation intentions is viewed as a particularly fruitful approach to self-regulation as it addresses the cognitive and motivational processes (previously studied in isolation) that facilitate the translation of intentions into action. However, so far, only the if-component (i.e., the specified situation) of implementation intentions has been investigated on a cognitive level of analysis, whereas the then-component (i.e., the goal-directed response) has been restricted to a behavioral level. The present dissertation addresses this shortcoming by investigating the basic cognitive properties of both components of implementation intentions.

Three experiments investigated the mental representation of the components of implementation intentions by using a lexical decision task. In Experiment 1, the formation of self-generated implementation intentions revealed that the specified situation and the goal-directed behavior become mentally represented and highly activated. In Experiment 2, formation of assigned implementation intentions showed that the effect of plan activation (i.e., heightened activation of both components of implementation intentions) is based on the superior status of the components (compared to situations and behaviors that are not part of an implementation intention) and the functional relation of the if- and then-component. Experiment 3 administered the lexical decision task under mental load and found that the plan activation effect does not require cognitive resources, thus pointing to the automatic nature of the effect.

Several implications for future implementation intention research in the interface between cognitive and motivational properties are discussed.
1. INTRODUCTION

We think how late it shall be, how the duties of the day will suffer; we say, I must get up, this is ignominious, etc. But still the warm bed feels too delicious, the cold outside too cruel, and the resolution faints away and postpones itself again and again just as it seemed on the verge of bursting the resistance and passing over into decisive act. Now how do we ever get up under such circumstances?

--Williams James (1890)

Most, if not all, human activity is goal directed. Yet how do we manage to act in accordance with our resolutions (i.e., intentions and goals)? And what factors determine whether goal pursuit fails or succeeds to have its desired effects? However mundane William James’s question raised over a century ago might appear, it foreshadowed a science of goal-directed behavior and self-regulation that has only begun to provide promising insights (Ajzen, 1991; Bargh & Gollwitzer, 1994; Locke & Latham, 1990; Pervin, 1989).

In the very beginning of psychology as a science, it was widely agreed upon that the psychological state preceding goal-directed behavior consisted of the anticipation of “to-be-expected” or “remembered” sensory consequences. For example, Wundt (1893) claimed that an act of will is preceded by a perception that is limited to the effect of the to-be-executed movement. Similarly, William James (1890/1981) stated: “An anticipatory image … is the only psychic state which introspection lets us discern as the forerunner of our voluntary acts” (p. 1112).

Intentions as precursors to and regulators of behavior entered into psychological theorizing after the turn of the century, when the Würzburg school of thought turned from the analysis of thought processes to the analysis of the will. The Würzburg scholars (e.g., Ach, 1935; Lewin, 1926) proceeded to experimentally examine the effects of intentions on behavior. However, due to the increasing popularity of Behaviorism (e.g., Bindra, 1959; Tolman, 1925), the work of the Würzburg School ultimately received less recognition. Moreover, with the advent of the cognitive revolution (1950s), and its emphasis on the computer metaphor of information
processing to explain human behavior, interest in volitional aspects of behavior declined even further.

Only recently have questions regarding the structure and the effect of intentions on behavior re-emerged and been tackled anew (for a summary, see Hoffmann & Stock, 2000). Within the field of social psychology, innovative research programs explore how the interaction of cognitive and motivational principles (previously studied in opposition) impact goal-driven action. The concept of implementation intentions (Gollwitzer, 1993, 1996) is one contemporary and particularly fruitful program addressing the cognitive and motivational processes that facilitate the translation of intentions into action. Implementation intentions are simple if-then plans that specify in a concrete manner how a goal intention is to be realized. These simple plans have been shown to be widely effective self-regulatory tools in the service of goal intentions (e.g., Gollwitzer & Brandstätter, 1997; Lengfelder & Gollwitzer, 2000; Sheeran & Orbell, 2000; overview by Sheeran, Webb, & Gollwitzer, 2005). The present work is rooted in this approach, attempting to map out the basic cognitive properties of implementation intentions by investigating the mental representation of the components of if-then plans. Shedding light on the cognitive processes that underlie the functioning of if-then plans will promote the understanding of how implementation intentions help people attain outcomes they desire.

Within this introduction, the reader will first be familiarized with the cognitive concept of mental representations. Next, as goals represent the reference point of any investigation on intentions, a brief summary on past and present theorizing on goals will precede their explication as mental construct and research object in the interface between cognition and motivation. Finally, theoretical and empirical fundamentals of implementation intentions as a tool for effective self-regulation in goal pursuit will be presented, followed by an introduction to the primary objective of the present research: to define implementation intentions as a mental construct.

1.1 MENTAL REPRESENTATIONS

Psychologists generally define mental representations, or knowledge structures, as an encoding of information in memory. An individual can create, retain, and access
representations. Once accessed, the individual can then use the representation in various ways. For example, your impression of your friend René is a mental representation that contains your feelings about him and your beliefs about what he is like. You might draw on your impression of your friend to describe, evaluate, or make behavioral decisions regarding him. A representation can be explicitly accessed in that a previously stored representation is intentionally retrieved from memory (e.g., you recall René’s favorite song when asked to describe his type of music), or implicitly in that a previously stored representation affects current perceptions or judgments without intention, and even without conscious awareness (e.g., a past heated argument with René makes you describe him as aggressive, even if the argument is not consciously remembered).

1.1.1 **Representation of Declarative and Procedural Knowledge**

Our current understanding of mental representations has been shaped by various disciplines, including philosophy, linguistics, psychology, and computer science. Each discipline tends to focus on a different aspect of knowledge and because our unified knowledge is so vast, a great variety of mental representations has been proposed (i.e., concepts, features, propositions, scripts, schemas, images, mental models, productions, conditions, actions, and symbols). However, the types of knowledge that are largely investigated by cognitive psychologists come in two formats: declarative and procedural (Anderson, 1983; Smith, 1994). Within a given theory, **declarative knowledge** refers to the content of a cognition: The nature and organization of information that an individual acquires, processes, stores in memory, and uses in judgment. For example, our knowledge of “a bird is an animal that flies” is an example of declarative knowledge. **Procedural knowledge** describes the processes that act on declarative knowledge: The sequences of interrelated operations that transform, store, retrieve, or make inferences based on declarative knowledge. For example, motor and cognitive skills – such as riding a bike or comprehension of language – typify procedural knowledge. To generate any overt behavior, both properties (i.e., declarative and procedural knowledge) must operate together (Smith, 1994).

Mentally, the two types of knowledge (i.e., declarative and procedural) are represented differently. In social psychology, the structure of declarative mental
representations is mostly portrayed in *associative networks*¹ (Smith, 1998; Smith & Queller, 2004). The core assumption of associative networks is that representations are constructed from discrete nodes connected by links. Nodes are pre-existing concepts or new concepts that can be formed by inferring meaning from a pattern of linkages to other nodes. For example, to interpret the sentence “The dog ran home” one could construct a new proposition (i.e., sentence) node with a *subject* link to a node representing ‘dog’, a *verb* link to a node for ‘ran’, and an *object* link to a node for ‘home’. The links between nodes are formed through contiguity; that is, when the concepts or nodes are activated simultaneously. In the same vein, already existing links are strengthened to the extent that the objects they link are activated simultaneously. A node can become activated if it is perceptually present or actively thought about. An activated node spreads activation to connected nodes via the intervening links, increasing activation of the connected nodes. This process is called “spreading activation” (Anderson, 1983). Within the currently activated subset of the associate network (i.e., working memory), memory retrieval amounts to raising a node’s activation level above some threshold, whereby the retrieval of closely related nodes takes less time than of distant nodes. The activation of a node decays with time, whereby estimates of the rate of decay vary widely (Anderson, 1983; Higgins, 1996; Ostrom, Skowronski, & Nowak, 1994).

Procedural knowledge is represented in terms of production rules. Formally, a production rule has the general form of “IF this is the situation, THEN do that.” Within this IF-THEN expression, the IF clause specifies conditions that must be satisfied for the rule to fire, and the THEN clause includes actions executed by the rule. A set of rules designed to execute a specific skill is also referred to as a production system. Execution of the rules in a production system is dynamic, with a rule being triggered when its conditions are met. Productions are acquired and automatized through practice. According to Anderson’s theory of skill acquisition (Anderson, 1982, 1987), there are two processes underlying skill acquisition: proceduralization and composition, with the key factor of both processes being practice. *Proceduralization* refers to the

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¹ The recent literature within social psychology differentiates between following four models of mental representations: associative networks, schemas, exemplars, and distributed representations (Smith, 1998; Smith & Queller, 2004). For a detailed description of basic assumptions, illustrative models, and applications of the four different types of representations, see Smith (1998).
transformation of slow declarative knowledge into fast-access (i.e., automatic) procedural knowledge. In contrast to nonautomatic (i.e., controlled) cognitive processes, automatic processing is described as unintentional, effortless, autonomous, and outside of awareness and conscious control, as well as fast and efficient (Shiffrin & Dumais, 1981; Smith, 1994). Put differently, a process known to tax attentional resources (i.e., items must be maintained in limited-capacity working memory) is considered a controlled or nonautomatic process, whereas one that does not tax these resources is by default an automatic process.

Empirical research strategies for distinguishing automatic from nonautomatic processing generally rely on the central properties of automatic processing; that is, speed and efficiency. For instance, if a primarily nonautomatic process (e.g. driving a car with gear shift for the first time) is transformed into an automatic process as a result of practice, performance is assumed to become faster and less prone to errors. A way of testing processes for automaticity is by introducing external cognitive load to the process in question. For example, Gilbert (1989) argued that certain social inferences are more automatic than others, on the grounds that an external cognitive load interferes with some inferences but not others. That is, people generally make inferences about a person’s traits that correspond to observed behaviors, regardless of cognitive load (i.e., automatic social inference). Only when sufficient capacity is available will the perceiver go further to consider whether the inference should be corrected on the basis of situational pressures that might have produced the behavior (i.e., nonautomatic social inference). Therefore, if cognitive load is added to tax working memory (e.g., in the form of asking the perceiver to perform a second task such as memorizing meaningless syllables at the same time as inferring traits) no correction in regard to the situational pressure will occur. In other words, the process of social inference becomes less efficient.

A second process associated with skill acquisition by practice is composition. It involves combining two production rules into one, thus saving time as the rule is executed. For example, Hayes-Roth’s (1977) classic paper on the “evolution of cognitive structures” describes how the mental representations of associated components can become “unitized” as a functionally single element. Associative links can bind together different aspects of an object or concept into a single representation,
often together with related information such as the specific context in which the object was encountered. Upon activation, the associations subsumed under this single representation run off in an all-or-none fashion, in other words, the unified representation can be retrieved as a whole when activated by a part. For example, person representations can become highly integrated: People might form an impression of a person who returned a lost wallet, has blond hair, and is inferred to be honest. These and other characteristics are all integrated into a single impression (i.e., representation) of the person (Carlston, 1994). At a later time, the associative structure serves as a retrieval mechanism that can reactivate all elements given the presence of a subset as cues.

1.1.2 Assessment of Mental Representations

Prim ing has been utilized as a means for mapping mental representations (e.g., Aarts & Dijksterhuis, 2000a, 2000b, 2003; Chartrand & Bargh, 2002; Kruglanski et al., 2002), and occurs when perceiving or thinking about one concept makes it easier to process related concepts. For instance, semantic knowledge, which has been demonstrated to exist in associative networks of interrelated concepts (Collins & Loftus, 1975; Collins & Quillian, 1969), has been explored by means of semantic priming. Classic studies of semantic priming show that people can more quickly identify the target word “nurse” if it is presented immediately following a semantically related prime word like “doctor” than following an unrelated prime word like “tree” (Meyer & Schvaneveldt, 1971, 1976). Work by Neely (1977) and others demonstrate that this effect can occur even when the prime-target interval is too short for the perceiver to strategically generate an expectation about the type of word coming next. It can also occur when the prime is presented subliminally (i.e., too short to be consciously perceived), and therefore the prime can exert its effect without conscious awareness of the perceiver. Such evidence indicates that the effect is independent of any intentional use of the prime to facilitate task performance; therefore, it represents a form of implicit memory by definition.

Generally, semantic priming is assumed to be mediated by associative links via a spreading activation mechanism. As described earlier in this chapter, a concept that is activated in some way (e.g., by being perceptually present or the subject of conscious
thought) is assumed to spread activation over links to its connected concept nodes (e.g., Anderson, 1983). The result is the excitation at these nodes approaches the threshold needed for activation, making them easier to activate by additional external (i.e., perceptual) inputs. Thus the word “nurse” is more quickly identified if it is presented following “doctor” than following an unrelated word because activation spreads over associative links from “doctor” to “nurse”.

In sum, investigating mental representations enables the assessment of how knowledge is structured in the mind. Furthermore, this level of analysis allows important insights into the procedures and processes based on these knowledge structures. The present research aims at conferring this notion to the concept of implementation intentions. Results of various experiments indicate that if-then plans promote goal attainment. The investigation of implementation intentions’ underlying cognitive properties will provide answers as to how these plans function.

1.2 GOAL CONCEPTS

Historic theorizing on goals is characterized by relentless conceptual and empirical battles, but a scarcity of different ideas on the functioning of goals. Today there are no big theoretical controversies, and experiments that critically compare different theories are hardly observed; but there is a wealth of different theories and ideas on goals and goal-directed behavior (Oettingen & Gollwitzer, 2001).

1.2.1 Historical Background

According to the view of behaviorism, goal-directed behavior is easily recognized by a number of observable features. Tolman (1925) highlighted the following characteristics:

When a rat runs a maze, it is to be observed that his running and searching activities persist until food is reached. And it appears that his persistence is the result of the physiological condition of hunger. We do not know whether the rat, in so “persisting”, is “conscious”; we do not know whether he “feels a purpose”; but we do know that, given (1) the physiological condition of hunger and given (2) the objective conditions of the maze, the rat thus persists until the food is
reached. It is this purely objective fact of persistence until a certain specific type of goal object is reached that we define as goal seeking. (pp. 285-286)

Later behaviorists (e.g., Bindra, 1959) extended this definition. Besides persistence, the main definitional feature mentioned by Tolman, further aspects were introduced. The *appropriateness* of goal-directed behavior in the sense that the goal-directed organism adopts an effective course of action in response to variations of the stimuli related to the goal. Likewise, goal-directed organisms also show hyperactivity when exposed to the stimuli associated with a previously experienced goal. This restlessness is commonly referred to as searching for the goal. According to the behaviorists, a goal is nothing more than a powerful incentive, such as food, that is chosen by the investigator as a reference point for describing observed behavior. Therefore, the reference point for goal-directed behavior is not the intention or the self-set goal of an organism, rather the incentive for a certain goal-state (e.g., satisfying hunger) triggers a corresponding behavioral goal (e.g., search for food; Watson, 1925/1930; for a summary, see Heckhausen, 1991).

In contrast to the mechanistic view of behaviorism, American mentalists emphasized the analysis of goal-directed behavior in relation to people’s subjective goals. William James (1890), in his *Principles of Psychology*, included a chapter on the will in which he discussed the following questions: How is it possible that a behavior which a person intends to perform fails to be executed (James referred to the *obstructed will*), and how is it possible that an undesired behavior is performed even though we have set ourselves the goal to suppress it (James referred to the *explosive will*)? Similarly, McDougall (1908/1931) postulated that subjective goals guide a person’s behavior. According to his view, guidance is achieved through cognitive activity that pertains to the analysis of the present context and the envisioned event or goal state to be realized. Furthermore, progress toward and attainment of the goal is seen as positive, and thwarting and failure is seen as negative experience. Hence, within the mentalist tradition, an explicit connection between cognitions and the behavioral outcome is postulated, a connection entirely discounted within the behaviorist view.

In the history of German psychology, the Würzburg school of thought also analyzed behavior in relation to cognitions. The most prominent proponents of the emerging “will psychology” were Narziß Ach (1905, 1910; for a summary, see Ach,
1935) and Kurt Lewin (1926). Ach (1935) assumed that mentally linking an anticipated situation to a concrete intended behavior creates a “determination,” and this determination in turn would urge the person to execute the intended action when encountering the specified situational stimulus. The strength of the determination should depend on the concreteness of the specified situation and the intensity of the act of intending (i.e., willing).

Kurt Lewin (1926), who dismissed Ach’s ideas as a simple “linkage theory of intention,” proposed a need theory of goal striving. Intentions are portrayed as quasi-needs and just as needs can be satisfied by various types of behaviors (e.g., hunger can be satisfied by eating fruit, vegetables, or bread), intentions can be satisfied by many different behaviors. The amount of the tension associated with the quasi-need is assumed to directly relate to the intensity of a person’s goal striving and this tension is abated only when the goal is achieved. Intentions, like needs, are assumed to assign a valence (in German: Aufforderungscharakter) to objects and events, which in turn presses for actions to be undertaken that could potentially achieve the intention (see as well Oettingen & Gollwitzer, 2000).

Many of the ideas regarding goal-directed behaviors espoused by James, McDougall, Ach, Lewin, and the behaviorists, have been integrated in modern goal theories. For example, the behaviorist distinctions between needs (i.e., motives), incentives, and goal-directed behavior are now present in goal theories that consider needs (e.g., the need for approval) as forces that prescribe incentives (e.g., being popular or accomplished). Behavioral goals are viewed as being in the service of these incentives. However, in contrast to the behaviorist view, but in line with the view of James, McDougall, Ach, and Lewin, the reference point of all contemporary goal theories is the internal, subjective goal. Goal-directed behavior refers to goals held by the individual (e.g., a person’s goal to stop smoking serves as a reference point for his or her efforts to achieve this goal). Hence, research questions focus on how and in what form goals are set and how goal setting affects behavior.

1.2.2 Modern Goal Theories

In social psychology, research and theorizing on goals and their effects on behavior has become very popular, as documented by the extensive recent literature on
this theme (e.g., Gollwitzer & Bargh, 1996; Gollwitzer & Moskowitz, 1996; Halisch & Kuhl, 1987; Higgins & Sorrentino, 1990; Kuhl & Beckmann, 1985; Martin & Tesser, 1996; Pervin, 1989; reviews by e.g., Bargh, 1990; Chaiken, Lieberman, & Eagly, 1989; Karniol & Ross, 1996; Krarol, 1993; Kruglanski, 1990; McIntosh & Martin, 1992). The reasons for this resurgence are manifold, some being rooted in the theoretical developments in the psychology of motivation (see Gollwitzer, 1991; Heckhausen, 1991; Kuhl, 1983), others within the impact of the cognitive revolution on social psychology (see Fiske, 1993).

The psychology of motivation has progressed within recent years from a focus on describing what is specified as the goal by the individual (i.e., an emphasis on goal content) to explaining the processes involved in the willful control of goal-directed action (i.e., an emphasis on goal-related behavioral regulation). Accordingly, modern goal theories can be grouped into two major categories; that is, theories on goal setting and theories on goal striving (Bayer, Ferguson, & Gollwitzer, 2003; reviews by Gollwitzer & Moskowitz, 1996; Oettingen & Gollwitzer, 2001). Theories on goal setting address the question of what goals a person will choose (i.e., what kind of end states a person finds attractive and feasible, and commits himself or himself to attain), examining, for instance, the fundamental regulatory needs that bring different categories of goals to mind (Higgins, 1997). Theories on goal striving, on the other hand, focus on behavior directed toward existing goals and attempt to explain the volitional processes that mediate the effects of goals on behavior. This new interest in volition led to the adoption of the goal concept, as goals are at the starting point of the willful control of action.

The cognitive revolution in social psychology (Bandura, 1977; Mischel, 1973) suggested important cognitive variables such as concepts, schemas, and mental representations and in tandem introduced tools and methods that allowed the investigation of motivational states, such as needs, intentions, and goals on a cognitive level. Yet motivational and cognitive perspectives in social psychology have often been viewed as rival interpretations of the same findings (cf. Bem, 1967; Bem, 1972; Kunda, 1990; Miller & Ross, 1975). There has been a growing realization among researchers, however, that motivation and cognition need to be studied as interdependent and mutually supporting processes (Bargh & Gollwitzer, 1994; Deci, 1975; Higgins, 1987,
1997; Kruglanski, Freedman, & Zeevi, 1971; Kruglanski et al., 2002; Lepper, Greene, & Nisbett; Sorrentino & Higgins 1986). Rather than attempting to explain social psychological phenomena in either motivational or cognitive terms, this new synergistic approach stresses the inherent interplay and inextricable relationship between the two.

1.3 GOAL STRUCTURE AND OPERATION

1.3.1 The Mental Representation of Goals

Modern goal theories define a goal as a mental representation of a desired state that may pertain to a behavior (e.g., to engage in a puzzle task, to work hard) or an outcome (e.g., to own money, to be proud of oneself; summaries by Carver & Scheier, 1998; Gollwitzer & Moskowitz, 1996). Goals are conceived as knowledge structures (Aarts & Dijksterhuis, 2000b; Bargh, 1990; Kruglanski, 1996; Shah & Kruglanski, 2000, 2003; Shah, Kruglanski, & Friedman, 2003; Kruglanski, Shah, Fishbach, Friedman, & Sleeth-Keppler, 2002) that are partially governed by principles that apply to cognitive structures in general. Therefore, just as for other forms of knowledge structures (e.g., semantic concepts, stereotypes, perceptual categories; Higgins, 1996), knowledge activation principles are relevant to the operation of goals (Bargh, 1997; Bargh & Barndollar, 1996; Bargh & Gollwitzer, 1994; Chartrand & Bargh, 1996).

As with semantic networks, the technique of priming has been utilized as a way to investigate goal activation and operation (Aarts & Dijksterhuis, 2000a, 2000b, 2003; Chartrand & Bargh, 2002; Kruglanski et al., 2002). However, unlike in semantic networks, in a goal network priming does not spread to other words or concepts that share a simple semantic relation to the goal. Goals prime procedures which operate on the environment and are used to fulfill these goals (Bargh & Gollwitzer, 1994). For instance, Bargh and Gollwitzer demonstrated in several experiments that social-behavioral goals can be activated by priming. Participants primed via a language test in an ostensibly unrelated first experiment behaved in line with the primed goal in a second experiment in which they had the opportunity to pursue that goal. Thus, for example, participants who had been primed with an achievement goal attained higher scores on a word search puzzle than did control group participants.
1.3.2 Automaticity in Goal Pursuit

Most goal theories emphasize the role of conscious choice in the adoption of goals and the role of conscious guidance for the pursuit of set goals (e.g., Ajzen, 1991; Bandura, 1986; Deci & Ryan, 1985; Locke & Latham, 1990). However, this traditional view of goals as primarily conscious regulators of behavior has been challenged. Recent research suggests that goals can be activated and pursued automatically, that is without conscious intent and awareness (e.g., Bargh et al., 2001; Chartrand & Bargh, 1996).

Central to the idea of automatic goal pursuit is the assumption that goals are mentally represented in hierarchically ordered knowledge structures (Aarts & Dijksterhuis, 2000a; Bargh & Gollwitzer, 1994; Kruglanski et al., 2002). Regarding the organization, an individual’s motivations are represented in memory at the highest or most abstract level of an organized hierarchy (Bargh & Chartrand, 1999). The descending hierarchical organization from abstract to concrete subsumes the goals, plan, strategies, and eventually the behaviors utilized to fulfill that motivation (Carver & Scheier, 1998; Martin & Tesser, 1989, 1996; Shah & Kruglanski, 2002, 2003; Schank & Langer, 1994; Vallacher & Wegner, 2000; Wilensky, 1983). Assuming an individual’s motivations tend to be chronic (i.e., at a constant state of elevated activation), certain situations will become repeatedly linked with the goals the individual chronically pursues within them. As a consequence of repeated and consistent pairing, strong mental links develop between the cognitive representation of situations and the specific goal operations (e.g., if you want to be fit [chronic motivation], you might set a goal to take the stairs, instead of the escalator, when in a public building [situation]). Following the model of a Hebbian circuit (Hebb, 1949), a conscious operator is no longer needed once the circuit has become sufficiently strengthened (e.g., once you have taken the stairs instead of the escalator numerous times, you no longer have to consciously think about inhibiting the desire to get on the escalator and making the effortful choice of taking the stairs). As a result, when the person enters the critical situation, the goal is automatically activated, guiding behavior within the situation without conscious choice or intention. In a test of their automotive model, Bargh and colleagues (Bargh, 1997; Bargh, et al., 2001) showed that goals (and the associated actions) can be elicited directly (i.e., automatically) by the environment. They found that participants who were primed with achievement or affiliation goals behaved in accordance with the primed
goal (i.e., solving either many or a few word puzzles in the presence of a confederate who appeared to be not skilled in the task). In other words, the situation elicited the relevant behavior as dictated by the primed goal.

As mental representations, goals are governed by the same common principles that generally characterize cognitive structures. Goals differ from other mental constructs however, in possessing distinctly motivational contents that determine their manner of functioning. Whereas nonmotivational constructs (e.g., perceptual and semantic representations) can only remain at the same activation level or decrease in activation over time (Anderson, 1983), goals, once activated, or made accessible, increase in strength over time until they are acted upon (Atkinson & Birtch, 1970). Therefore, rather than goal priming showing signs of decay, as would be the case in perceptual or semantic priming (Higgins, Bargh, & Lombardi, 1985; Srull & Wyer, 1979), the unfulfilled goal creates an internal state of tension that needs to be reduced by making progress toward the goal (Carver & Scheier, 1998; Miller, Galanter, & Pribram, 1960; Goschke & Kuhl, 1993; Liberman, Förster, & Higgins, 2005). This “pressing for realization” of the goal was demonstrated in an experiment by Bargh, Gollwitzer, Lee-Chai, Barndollar, and Trötschel (2001).

First, participants took part in a word search task that either contained achievement-related primes (succeed, win) or neutral primes (shampoo, window). Then, participants were given either a behavioral task relevant to the achievement goal (find as many words as possible with the given Scrabble tiles) or a perceptual-judgment task (read a story about a student whose behavior was ambiguous regarding achievement and then rate how achievement-oriented the person is) immediately or after a five minute delay. Since perceptual priming decays over time, achievement priming had an assimilative effect on the rating of the target person as compared to the no prime condition when the judgment task was completed immediately, but this difference was attenuated in the delay condition. In contrast, since goal priming increases over time, those in the achievement prime condition found more words with the Scrabble tiles than those in the no prime condition, and this difference actually increased in the delay condition as compared to the immediate condition. Thus, this research revealed a dissociation on task performance between the different priming manipulations.
1.3.3 Goal Systems Theory: A Cognitive Approach to Motivation

Kruglanski and his colleagues (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2003) have proposed a theory of goal systems that incorporates goals’ distinct motivational content, as well as the cognitive principles that goal representations share with other cognitive properties. Within social psychology, the theory of goal systems can, therefore, be placed in the “motivation as cognition” paradigm. Kruglanski and colleagues (2002) assume that motivational phenomena are a joint function of cognitive principles (that goal systems share with other cognitive systems) as they are applied to uniquely motivational contents, that is, to goals and to means. Put differently, the cognitive properties of goal systems set the constraints within which the motivational properties express themselves.

Motivational Properties of Goal Systems

Goal systems’ motivational properties relate primarily to subjective utility, which determine goal commitment and mean choice (Kruglanski et al., 2002). Goal commitment is defined as the degree to which an individual is determined to pursue a goal and is assumed to vary as a function of subjective utility determined by considerations of the value assigned to the goal and its expectancy of attainment. Goal commitment may express itself in persistence of goal strivings and in emotional reactivity to successful or unsuccessful strivings. Subjective utility considerations are also expected to drive the choice of appropriate means. It is assumed that the means most likely to be chosen are those which promise the greatest expectancy of attainment of a given goal, therefore advancing goal pursuit.

Cognitive Properties of Goal Systems

Goal systems are defined as mental representations of motivational networks composed of interconnected goals and means (Kruglanski et al., 2002; see Figure 1), whereby any kind of mean that is assumed to afford effective goal pursuit is considered as mentally represented within a goal network (Shah & Kruglanski, 2003).
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Figure 1. A system of goals and means (cf. Kruglanski et al, 2002).

The interconnectedness can occur both vertically and laterally. The vertically related structure of goals and means is described in terms of equifinality (see Figure 2) and multifinality (see Figure 3).

Figure 2. Equifinality configuration of goals and means (cf. Kruglanski et al, 2002).

Figure 3. Multifinality configuration of goals and means (cf. Kruglanski et al, 2002).
A goal system exhibits *equifinality* if a goal has several means of completion, while a system demonstrates *multifinality* when a mean applies to more than one goal. Lateral connections between the entities are also possible in that a given goal may be associatively linked to other goals and means (e.g., because of their common link to a given goal).

Further, associations (i.e., lateral and vertical) are assumed to differ in their degree of associative strength. Two main forms of association between entities are differentiated: excitatory and inhibitory. An *excitatory* association denotes a positive relation between units, so that activation of a given unit leads to a corresponding increment in the accessibility of an associated unit. Shah, Kruglanski, and Friedman (2003) assume that vertical relations within goal systems (i.e., between goals and means and vice versa) will be primarily excitatory. An *inhibitory* association denotes a negative relation between units so that activation of a given unit results in a corresponding decrement in activation of an associated unit. Lateral relations within goal systems, that is, between alternative competing goals, or alternative competing means, are assumed to be primarily inhibitory (Shah, Kruglanski, & Friedman, 2003). However, in contrast to alternative goals that are competing (e.g., finishing a due paper vs. going to bed at a healthy time), there may be occasions wherein the attainment of one goal facilitates an attainment of the other (e.g., getting a Ph.D. and becoming a successful scientist). According to goal systems theory then, this lateral relation should be excitatory. Shah and Kruglanski (2002) have recently tested the lateral relation between alternative goals and obtained evidence that the influence on goal pursuit exerted by accessible alternative goals can be inhibitory or excitatory, depending on how the alternative goals relate to a focal goal. Examining diverse aspects of goal pursuit (e.g., commitment and progress toward a focal goal), they consistently found that alternatives unrelated to the focal goal pull resources away from it, whereas alternatives facilitatively related to a focal goal draw resources toward it.

A further important characteristic of goal-systems is *means dissociation*, which pertains to the phenomenon that the strength of any given mean, therefore the likelihood of its use, is determined by how many other means are associated to the same goal.
Specifically, this research calls upon the “fan effect” \(^2\) (Anderson, 1974, 1983) to describe the nature of equifinality. The basic argument is if a goal has many means, then there is less chance that any one will be chosen. In turn, the strength of one mean is weakened by the presence of other available means linked to that goal or concept.

**The Interplay Between Goals and Means**

According to the theory of goal systems, goals are knowledge structures (Kruglanski, 1996) and, as such, should follow similar principles of acquisition, activation, change, and organization that have been articulated in reference to all knowledge structures regardless of content (e.g., Higgins, 1996). Like other knowledge structures, goals can vary in the number and strength of their connection to other knowledge structures. However, because goals represent a specific type of knowledge structure, that is, one that defines a future desired state, they should come to be associated particularly with those constructs that facilitate their attainment (i.e., means). According to Kruglanski and colleagues (Kruglanski et al., 2002; Shah & Kruglanski, 2003), the pursuit of goals through a specific mean creates a mentally represented association between them, based on their functional and dynamic relation to each other that differs from associations arising from semantic relations. Whereas a semantic relation between two mental constructs depends on the constructs’ shared meaning and may be relatively stable across times and individuals, the functional relation between goals and their respective means pertains to the constructs’ joint motivational function which may vary greatly (e.g., depending on individuals idiosyncratic self-regulation history).

Kruglanski and his colleagues have extensively detailed and investigated the dynamic interplay between goals and means (Kruglanski, 1996; Kruglanski et al., 2002; Shah & Kruglanski, 2000, 2002, 2003; Shah, Kruglanski, & Friedman, 2003). The associative thread linking goals and means has been explored by priming one element (i.e., a goal or a mean) and measuring the extent to which this activates the other element (i.e., the related mean or goal). This priming technique requires that participants are exposed to a prime stimulus prior to responding to a target word, and

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\(^2\) The classic “fan effect” (Anderson, 1974, 1983) pertains to the fact that the greater the number of specific facts linked to a general mental construct (i.e., the greater the general constructs’ “fan size”), the less likely any particular fact will be retrieved or recalled.
assumes responses will be quicker when the prime is cognitively associated with the target (see semantic priming in 1.1 Mental Representations herein). The priming procedure is administrated either supraliminal (participants consciously see the word) or subliminal (participants do not consciously realize that a prime has been present, as presentation time of the prime is too short). Construct activation is generally measured via a lexical decision task, in which participants are asked to identify whether the presented target words are words or non-words; response latencies serve as measure of target accessibility.

At the outset of empirically testing the assumed cognitive association between goals and their respective means within a goal system, Kruglanski and colleagues (review by Kruglanski et al., 2002; Shah & Kruglanski, 2000, 2003) investigated the goal-mean link according to their hierarchical organization, assuming a downward spread of activation from goals to lower order means. For example, in support of the integral structural configuration of the goal-mean link within a goal system, Shah and Kruglanski (2000) reported the following experiment. They had participants list three attributes that they wanted to possess (“Be Goals”, using Vallacher and Wegner’s [2000] terminology) and one attribute that they did not want to possess, and then had them list a specific way to achieve each attribute (deemed as means). Next, participants were given a lexical decision task to test the accessibility of the mean when primed with the goal. They found the reaction times to the means when primed with attribute or goal were faster than when the mean was primed with a non-goal control word. Crucially, this priming effect did not occur in cases where the given prime was the goal or attribute that they did not want to possess. Based on their results, Shah and Kruglanski reason as followed. First, these findings reflect the capability of goals to prime (i.e., activate) their attainment means and are therefore consistent with the notion that goals and means are cognitively associated with each other. Second, the accessibility of the mean given the proper goal is evidence of the functional relation and structure between them. Conversely, the lack of evidence for the priming of a mean with a goal that has no personal relevance speaks against the alternative explanation that the simple semantic

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3 Some modified versions of the lexical decision task have participants identify the target word as an attribute (e.g., Shah & Kruglanski, 2003).
association between goal and means may have produced the aforementioned accessibility.

In so far as goals occupy a higher place in the motivational hierarchy than means, the foregoing flow of activation may be described as “top down.” However, in a new line of research, Shah and Kruglanski (2003) recently tested the activation in the opposite direction: the “bottom up” priming of goals by their attainment means. They hypothesized that based on their functional relationship, goals would be automatically brought to mind by the means that serve them, and that such goal activation would in turn aid goal attainment. They investigated their hypothesis with a range of means including goal-directed activities, specific behavioral strategies, and opportunities perceived as likely to contribute to the attainment of a goal.

In one experiment (Shah & Kruglanski, 2003, Experiment 1), participants were given a lexical decision task to test the accessibility of normatively significant goals (e.g., educated or fit) when subliminally primed with a customary attainment mean in the form of a goal-directed behavior (e.g., study or run). Next, they were asked to assess the perceived effectiveness of the means. In line with their prediction, the results indicated that goals were more accessible when first primed with a corresponding means than when primed with a control word, as attested by lower response times on the lexical decision task. Further, the rated instrumentality of a means was positively related to the strength of the means-goal association for the corresponding goal, but not the control-means association measure. The results of this study clearly demonstrate that goals can be activated by their respective means and that such activation is moderated by the perceived effectiveness of the means, the latter ruling out that the relation is merely driven by a general semantic relation between means and goals.

Shah and Kruglanski (2003) replicated these findings referring to means as a goal-directed strategy aimed at improving task performance, or a situation regarded as an “opportunity” for advancing one’s objective. Using a specific task goal (i.e., finding anagram solutions), participants were primed with a strategy (Study 2) or situation (Study 3) previously described as facilitative to goal attainment while completing “practice” anagrams. To measure the degree to which the foregoing manipulation affected the accessibility of the task goal, participants were given a lexical decision task. Next, the assumption that priming of goals by means would have implications for
goal pursuit was tested by measuring task performance and persistence on the following actual anagram test. In both studies, as predicted, participants in the means priming condition demonstrated greater goal accessibility (i.e., lower average latencies to goal-related stimuli) than did their control-prime counterparts. In addition, participants persisted longer and performed better on the anagram task in the means priming condition than in the control condition. Hence in all conducted studies, the “means” in question, however represented, produced the same “bottom up” priming of a currently pursued goal, and in consequence (the increased accessibility of the goal) improved task persistence and performance.

In summary, the finding that in all of Shah and Kruglanski’s studies (2003) an analogue “bottom up” priming effect was found for different means, attests to the cognitively functional equivalence of widely disparate forms of instrumentality (i.e., goal-directed behaviors, strategies, and situations). Furthermore, their results that means, as cognitive structures, were capable of activating the goals they serve and appropriately shaped such significant aspects of self-regulation as task persistence and performance, strongly suggest that the treatment and investigation of means as cognitive entities (i.e., mental representations) allows further seminal insight into self-regulatory phenomenon.

1.4 IMPLEMENTATION INTENTIONS AND GOAL ACHIEVEMENT: SELF-REGULATION IN GOAL PURSUIT

Understanding what factors determine whether people succeed or fail in achieving desired goals is a fundamental concern in both basic and applied psychology. Most theories of motivation and self-regulation converge on the idea that goal setting is the key act of willing (i.e., volition) that promotes goal attainment (e.g., Ajzen, 1991; Atkinson, 1957; Bandura, 1991; Carver & Scheier, 1998; Gollwitzer, 1990; Locke & Latham, 1990). The basic assumption is that the strength of a person’s intention to reach a goal (i.e., the goal intention) determines respective accomplishments (Austin & Vancouver, 1996; Gollwitzer & Moskowitz, 1996; Oettingen & Gollwitzer, 2001; Sheeran, 2002). Although accumulated research supports this idea (e.g., Armitage & Conner, 2001; Sheeran, 2002; Sutton, 1998), there is also supporting evidence that not
all good intentions lead to Rome (Orbell & Sheeran, 1998; Sheeran, 2002). To address this issue, Gollwitzer (1993, 1996, 1999) proposed that successful goal achievement is facilitated by a second act of willing wherein the goal intention is furnished with an if-then plan specifying when, where, and how the person will instigate responses that promote goal realization. These plans are termed *implementation intentions*.

1.4.1 The Goal Intention – Behavior Gap

Goal intentions are self-instructions to attain certain outcomes or perform particular behaviors and typically take the format of “I intend to reach Z!” They are derived from beliefs about the feasibility and desirability of actions and end states (e.g., Ajzen, 1991; Atkinson, 1957; Bandura, 1991, 1997; Brehm & Self, 1989; Carver & Scheier, 1998; Gollwitzer, 1990; Heckhausen, 1991; Locke & Latham, 1990; Vroom, 1964) and represent the culmination of the decision making process (Gollwitzer, 1990). Goal intentions signal the end of deliberating about what actions to perform or outcomes to reach; they imply a commitment to act that may vary in strength (Ajzen, 1991; Gollwitzer, 1990; Sheeran, 2002; Webb & Sheeran, 2005).

In traditional theories of goal pursuit, goal intentions are construed as the most immediate and important predictor of attainment. For instance, preeminent accounts of goal-directed behavior such as control theory (Carver & Scheier, 1982, 1998), social cognitive theory (Bandura, 1986, 1997), and goal setting theory (Locke & Latham, 1990), models of attitude-behavior relations such as the theories of reasoned action (Fishbein, 1980; Fishbein & Ajzen, 1975) and planned behavior (Ajzen, 1991), and the model of interpersonal behavior (Triandis, 1980) each have intentions playing a central role in their theorizing about action. Accordingly, research has been concerned for several decades with the factors that determine strong intentions and little attention was paid to mechanisms mediating the effects of intentions on behavior. However, evidence has accumulated indicating a substantial “gap” between people’s goal intentions and their subsequent attainment (review by Gollwitzer & Sheeran, in press; Sheeran, 2002; Webb & Sheeran, 2004). The single act of willing involved in forming a goal intention does not appear to be sufficient to ensure goal achievement.
1.4.2 The Self-Regulation of Goal Striving and Goal Attainment

Recent research on goals has demonstrated that variables other than strength of goal intention affect the intensity of goal pursuit and the rate of goal attainment (reviews by Gollwitzer & Moskowitz, 1996; Oettingen & Gollwitzer, 2001). Theories on goal setting construe features related to the content and structure of set goals as critical in determining the likelihood of goal achievement (e.g., Banura, 1991; Deci & Ryan, 1991; Dweck, 1999; Higgins, 2000; Locke & Latham, 1990). For instance, people who set learning goals rather than performance goals are better at dealing with failure experiences and, consequently, show more persistent and successful goal pursuit (Dweck, 1999). Higgins (2000) demonstrated that people who pursue their goals using means that have a natural “fit” to the content of the goal have a better chance of goal attainment. For example, people with promotion goals (that focus on gain and achievement) are more likely to realize those goals using eagerness means whereas prevention goals (that focus on safety and security) are more likely to be realized by vigilance means.

Theories on goal striving, on the other hand, assume that setting a goal (of whatever kind) is only a first step en route to goal realization and that successful goal pursuit also depends on self-regulatory skills in initiating goal-directed behaviors and bringing them to a successful end. A key impetus for self-regulation research on goals is the model of action phases (Gollwitzer, 1990; Heckhausen, 1991; Heckhausen & Gollwitzer, 1987) that construes goal attainment in terms of solving a number of consecutive tasks. Goal setting is viewed as merely the first of these tasks—with planning how to achieve the goal, getting started, and successfully completing goal pursuit as equally important subsequent tasks.

The model of action phases seeks to provide a comprehensive temporal account of goal pursuit. Four different consecutive action phases are postulated by the model. The first, predecisional, phase starts from the assumption that people have many more wishes and desires than they can possibly realize. Here people’s task is to deliberate about the desirability and feasibility of their various wishes in order to choose which ones will be turned into binding goals. The model is in line with classic motivational notions (e.g., Atkinson, 1957; Fishbein & Ajzen, 1975; Lewin, 1926) that people commit to those goals in which attainment is perceived as both highly desirable and
feasible. However, the model of action phases also states that goal attainment is not yet secured by the act of goal setting (i.e., by having formed strong goal intentions). Rather, goal accomplishment requires an additional step in which the individual effectively regulates the actual striving for the goal (i.e., engages in effective implementation).

Once a person has committed to a goal she makes the transition to the second, *preaditional*, phase. Here, the goal-relevant task is to initiate goal-directed behaviors successfully. This may be straightforward when the respective actions have become routinized through frequent and consistent performance in stable situational contexts. However, matters are likely to be more complex when people are unfamiliar with, or vague about, the respective goal-directed actions and contexts of performance. In these circumstances, people are likely to benefit from fashioning plans that spell out when, where, and how to implement goal-directed behaviors.

The initiation of actual performance of the respective goal-directed behaviors marks the transition to the third, *actional*, phase. The task to be accomplished during this phase pertains to responding flexibly and adaptively to contextual threats to goal progress so that goal pursuit is not derailed prematurely. In other words, the key actional task is to bring the respective actions to a successful conclusion by shielding it from distractions and temptations that could potentially disrupt goal pursuit.

In the final action phase, the *postactional* phase, the task is to evaluate goal achievement both in terms of degree of attainment (“Did I do as well as I had hoped?”) and quality of attainment outcomes (“Was it worth doing?”). This process involves comparing what has been achieved to one’s original wishes and desires. If the result does not correspond to the initially sought-after outcome, goal pursuit may be restarted reducing standards of performance. Yet when further pursuit is inappropriate, this comparison may lead to goal disengagement. Thus, goal completion is likely to provide valuable information that serves as feedback for the evaluations of the feasibility and desirability of future courses of action. In this sense, people return to where they started - the position of deliberating about their various wishes and desires.

The model of action phases explicates the differences between the motivational issue of goal choice and the volitional (i.e., willful) issue of goal implementation (a
conceptual distinction proposed by the German will psychologists⁴, and stimulates hypotheses on the conditions and processes of the willful implementation of chosen goals. Planning (phase II) and taking action (phase III) both refer to the execution of goals, and therefore are volitional processes. Accordingly, the preactional and the actional phase are referred to as volitional phases. On the other hand, deliberating between wishes, selecting the appropriate goal (phase I) and evaluating goal achievement (phase IV) are considered as classic motivational phenomenon, and thus, are referred to as motivational phases (Brandstätter & Gollwitzer, 1994).

1.4.3 Self-regulatory Problems in Goal Pursuit

The foregoing discussion suggests that merely forming a goal intention does not guarantee goal achievement as people must accomplish further tasks en route to goal completion. So what are these challenges that arise during goal pursuit and how can people tackle them successfully by using self-regulatory strategies? The model of action phases implies that self-regulatory problems can accrue in different guises during the course of goal pursuit. For instance, after having set a goal, people often procrastinate on acting on their intentions and thus, fail to initiate goal-directed behavior. Moreover, in everyday life people commonly strive for multiple, often competing goals, many of which are not simple short-term but long-term projects that require repeated efforts (e.g., getting one’s new apartment furnished). Thus, goal pursuits may come to an early halt because competing projects have temporarily gained priority and the individual fails to successfully resume the original project (Gollwitzer, 1996; Heckhausen, 1991).

Getting started with or resuming an interrupted goal is rather simple when the necessary steps are well-practiced or routine and the relevant situational context releases critical behavior in a more or less automatic fashion (e.g., passing one’s mailbox triggers getting the mail). Often, however, this fails to be the case when the goal-directed behavior is not part of an everyday routine (e.g., returning a damaged package to the sender). Consequently, an individual has to make an effort to seize suitable opportunities to act on his or her goals. People often fail to take notice of fruitful opportunities for initiating goal-directed behavior when attention is directed elsewhere (e.g., one is absorbed by competing goal pursuits, wrapped up in ruminations,

⁴ For an elaboration on this see Gollwitzer and Moskowitz (1996).
or gripped by an intense emotional experience). Even if people are actively searching for a favorable opportunity in a given situational context, they may nevertheless fail to seize it simply because the opportunity presented itself only for a short moment and they did not respond quickly enough.

Disengaging from goal pursuit that becomes unproductive is another source of self-regulatory problems in goal pursuit (review by Wrosch, Scheier, Carver, & Schulz, 2003), especially if the situation in question activates self-defensive concerns. In sum, problems of goal attainment are manifold and action control by goal intentions alone is often insufficient for successful goal pursuit. Therefore, it seems crucial that people acquire efficient tools or strategies to deal effectively with self-regulatory problems while pursuing their goals.

1.4.4 Implementation Intentions: A Strategy for Effective Self-Regulation of Goal Pursuit

A recent development in intention-behavior relations is Gollwitzer’s (1993, 1996, 1999) concept of implementation intentions, a concept stimulated by the action phase model. Implementation intentions are if-then plans aimed at helping overcome self-regulatory problems in goal pursuit and promoting the execution of goal-directed behaviors. This form of planning is assumed to increase the likelihood that strong goal intentions are realized successfully, and is therefore expected to bridge the goal intention-behavior gap.

Implementation intentions are if-then plans that link good opportunities to act with behavioral responses that are effective in accomplishing one’s goals. Implementation intentions are to be distinguished from goal intentions. Whereas goal intentions specify what one wants to achieve (i.e., “I intend to reach Z!”), implementation intentions specify both the behavior that one will perform in the service of goal achievement and the situational context in which one will enact it (i.e., “If situation X occurs, then I will initiate goal-directed behavior Y!”). Thus, a goal intention refers to what one intends to achieve, whereas an implementation intention specifies when, where, and how one intends to achieve it. While goal intentions commit a person to achieving a certain end state, implementation intentions refer to the realization of the
goal intention and forming them creates a commitment to respond to a specified critical situation in a planned goal-directed way.

To form an implementation intention, the person must first identify a response that will promote goal attainment and, second, anticipate a suitable occasion to initiate that response. For instance, a possible implementation intention in the service of the goal intention to accomplish a Ph.D. would link an appropriate behavior (e.g., writing the dissertation) to a suitable situational context (e.g., sitting in front of the computer). As a consequence, a strong link is created between the critical situation of sitting at the computer and the goal-directed response of writing the dissertation.

Selecting suitable opportunities to enact goal-directed responses entails that people anticipate situations where it would be fitting to execute goal-directed responses. The critical situation specified in one’s plan can involve an internal cue (e.g., a strong feeling) or an external cue (e.g., a particular place, object, person, or point in time). The cues can either be related to viable opportunities to act (i.e., it is easy to perform actions that are instrumental for reaching the goal) or to anticipated obstacles to goal pursuit. Thus, cue selection can focus on initiating and stabilizing the goal pursuit at hand, or on shielding it from particular anticipated obstacles.

Forming an implementation intention also involves the selection of an effective goal-directed behavior. In line with the theory of goal systems (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2002) it is assumed that for any given goal, various routes to goal attainment are available. Accordingly, the specification of the then-component can take many different forms. For example, there may be several behaviors (e.g., writing the dissertation and talking to the professors one would like to be on the audit committee) that are helpful on the way to goal achievement (e.g., accomplish a Ph.D.). In addition, not only can an implementation intention specify one of the many behaviors that lead to goal attainment, it can also specify which behavior could potentially hinder goal attainment and therefore should be suppressed (e.g., suppression of checking e-mails while sitting in front of the computer). Furthermore, the specification of the goal-directed responses can either focus on the initiation or the maintenance of goal pursuit. Finally, the then-component of an implementation intention may specify ignoring those stimuli that have the potential to instigate unwanted attention or behavioral responses that could derail goal pursuit.
1.4.5 Implementation Intentions: A Cognitive Approach to Motivation

Whereas the model of action phases was designed to explicate the differences between the motivational issue of goal choice and the volitional issue of goal implementation, the concept of implementation intentions was introduced to explain the beneficial effects of planning on goal striving in regard to the cognitive processes that these specific plans trigger (Gollwitzer 1993, 1996). These specific plans create a mental link between an anticipated situation and a certain goal-directed behavior is established in the form of an if-then plan. In this respect, implementation intentions resemble Anderson’s concept of production rules (1983, 1992) that can be conceptualized as an “IF…THEN…” relation linking a certain stimulus condition in the environment to appropriate actions. What makes implementation intentions unique, however, are their motivational properties related to considerations of expectancy and value, such as commitment to the plan (Gollwitzer, 1996) and choice of the components (i.e., the critical future situation and the goal-directed behavior). Besides the motivational and cognitive properties inherent to implementation intentions, if-then plans are further connected to motivational and cognitive properties of the underlying goal intention. The effects of implementation intentions have been shown to be contingent upon high commitment to the respective goal intention (as motivational property; Orbell, Hodgkins, Sheeran, 1997) and the activation of the goal under which the plan was formed (as cognitive property; Sheeran, Webb, & Gollwitzer, 2005). Hence, in line with Kruglanski’s theory of goal systems (Kruglanski et al., 2002; Shah, Kruglanski, & Friedmann, 2003), Gollwitzer’s concept of implementation intention incorporates cognitive and motivational properties that are assumed to interactively impact goal attainment and can therefore be studied under the rubric of the “motivation as cognition” paradigm.

Regarding the organization, implementation intentions are subordinate to goal intentions (as they serve the purpose of promoting the attainment of the goal specified in the goal intention), occupying a lower place in the motivational hierarchy than their respective goal intention. Following Kruglanski and colleagues’ (Kruglanski et al., 2002; Shah, Kruglanski, & Friedmann, 2003) conception of a goal network of interconnected goals and means, forming implementation intentions creates another link within this structure. Specifically, the link connects two strategically specified “means”,...
that is, the suitable situation (S) and the effective goal-directed behavior (B). Accordingly, the hierarchical structure between the goal intention (G) and the implementation intention, as well as their constructive links, could be portrayed as depicted in Figure 4.

![Figure 4. Schematic representation of an implementation intention with its respective goal intention.](image)

### 1.4.6 Implementation Intentions: Effects

Numerous studies attest to the benefits of implementation intentions in promoting goal achievement, especially if the behavior in question is demanding or unpleasant. For example, Sheeran and Orbell (2000) asked one half of a sample of women to form an implementation intention that specified when, where, and how they would make an appointment for cervical cancer screening. Medical records showed that these women were much more likely to be screened than were women who did not form implementation intentions (rates were 92% and 69%, respectively). Findings of several studies by Schaal and Gollwitzer (2000) demonstrated that subjects who had formed an implementation intention in addition to a goal intention were able to solve more arithmetic problems despite being distracted by simultaneously shown film clips of advertisement, compared to subjects which had only formed a goal intention.

Implementation intentions have also been shown to promote goal attainment in populations impaired in conscious action control, such as frontal lobe patients, schizophrenic patients, and opiate addicts under withdrawal. For example, Brandstätter, Lengfelder, and Gollwitzer (2001, Study 1) found that opiate addicts under withdrawal
who had formed an implementation intention with respect to when, where, and how to write a curriculum vitae were more successful in implementing their goal intention (i.e., writing the curriculum vitae) than opiate addicts under withdrawal who had not formed an implementation intention.

In a meta-analysis, Gollwitzer and Sheeran (in press) analyzed the effectiveness of implementation intentions for self-regulatory problems having to do with initiating goal pursuit, shielding ongoing goal pursuit from unwanted influences, disengaging from failing goals, and conserving capacity for future goal striving. Findings from 94 independent studies of the impact of implementation intentions on goal achievement showed that implementation intentions had a positive effect of medium-to-large magnitude size ($d = .65$). This finding was robust across variations in study design, outcomes measurement, and domains of goal attainment. Thus, there is sufficient evidence that the concept of implementation intentions is a very effective and valuable self-regulatory strategy to help people reach their goals. But why do implementation intentions benefit goal achievement and how do these effects come about?

### 1.4.7 Component Processes of Implementation Intentions

To understand why plans in the form of implementation intentions help people obtain outcomes that they desire, Gollwitzer (1993, 1996) argues as follows. Since implementation intentions consist of two distinct elements (i.e., the specified situational context and the intended behavior), implementation intentions are expected to facilitate goal attainment on the basis of psychological processes that relate both to the anticipated situation (specified in the if-component of the plan) and the goal-directed response (specified in the then-component of the plan).

#### The Specified Situation

Gollwitzer (1993, 1996, 1999) argues that because forming implementation intentions implies the selection of a critical future situation (i.e., a viable opportunity), the mental representation of this situation should become highly activated hence, more accessible (in line with findings that decisions make decision-consistent information more easily accessible; e.g., Dellarosa & Bourne, 1984). Forming an implementation intention involves the selection of a situation that is ripe for action, thereby rendering the critical situation salient. This idea implies that people process information about the
critical situation in a highly proficient manner (Gollwitzer, 1993; Gollwitzer, Bayer, Steller, & Bargh, 2004; Webb & Sheeran, in press). That is, compared to those who merely form a respective goal intention, people who form implementation intentions should exhibit increased accessibility of the critical cue, and thus should be better able to detect the cue and discriminate the cue from other similar stimuli. Moreover, they should pay spontaneous attention to the cue and better recall the cue. In sum, forming an implementation intention should induce heightened sensitivity to the critical situation at each stage of information processing such that people are better able to detect, attend to, and remember specified cues when these cues are encountered later.

This accessibility hypothesis for the specified situation (i.e., the mental representation of the situation specified in the if-part of the implementation intention becomes highly activated) was tested in studies measuring how well participants holding implementation intentions attended to, detected, and recalled the critical situation as compared to participants who had only formed goal intentions. For example, Steller (1992) analyzed the perceptual readiness for situational cues specified in implementation intentions by employing the so-called embedded figures test (Gottschaldt, 1926; Witkin, 1950). This test consists of complex geometrical figures (b-figures) that contain a smaller partial figure (a-figure). The a-figure is hidden within the b-figures according to Gestalt principles and is thus difficult to detect\(^5\). Subjects were asked to form implementation intentions that specified how to turn the a-figure into a new traffic sign. Subjects wrote down how they intended to draw their traffic sign (i.e., they had to make a choice of color, etc.). The control subjects were merely asked to form the goal intention to draw a traffic sign, without forming an implementation intention on how to do it. Before subjects were allowed to paint a paper model of their traffic sign, they were asked to work on a visual search task consisting of b-figures that either contained the a-figure (i.e., the traffic sign) or not. Enhanced detection of the hidden a-figures was observed when participants had specified the a-figure in the if-part of an implementation intention (i.e., had made plans on how to create a traffic sign from the a-figure), in comparison to participants that had only formed a goal intention. This

\(^5\)Gottschaldt (1926) reported that even excessive familiarization (over 300 trials) with the a-figure did not alleviate the difficulty of detecting it within the b-figures.
pattern of data suggests that forming an implementation intention facilitates the
detection of the specified opportunity.

Also supporting the hypothesis that implementation intentions lead to high
accessibility of the critical situation are the results of a study using a dichotic-listening
task (Mertin, 1994). In this task, words were presented to both ears simultaneously and
subjects were instructed to repeat (i.e., shadow) the words presented to one ear (i.e., the
attended channel) and ignore the words presented to the other ear (i.e., the nonattended
channel). Performing the shadowing task becomes difficult when the words presented to
the nonattended ear attract attention. Words in the nonattended (i.e., to be ignored)
channel describing the anticipated critical situation turned out to be highly disruptive to
focused attention in implementation intention participants as compared to goal intention
participants (i.e., the shadowing performance of the attended material decreased). This
finding implies that opportunities to act, as specified in implementation intentions, will
not easily escape people’s attention, even when people focus on other things (e.g., to a
stimulating conversation).

In addition, the heightened accessibility hypothesis was tested via a cued recall
procedure (Seehausen, Bayer, & Gollwitzer, 1994). Research participants had to form
implementation intentions specifying when, where, and how they wanted to play
prepared games from numerous pre-designed options. Immediately, or 48 hours later,
participants were given a surprise task to recall all of the options provided, cued by
where, when, and how. Options specified in implementation intentions were recalled
more effectively than nonspecified options, no matter whether recall was tested
immediately or at a later point. Apparently, the heightened activation of the specified
opportunities persists over time and makes these critical situations more easily
accessible for people who have formed implementation intentions. In sum, these results
imply that the facilitating effects of implementation intentions on the initiation of goal-
directed behaviors greatly depend on effectively detecting, readily attending to, and
successfully remembering the critical situational cues.

The Specified Goal-Directed Behavior

Implementation intentions have also been shown to benefit action initiation
that forming an implementation intention (i.e., linking a critical situation to an intended
behavior in the form of an if-then plan) is a conscious act that effectively delegates control of behavior from the self to specified situational cues that directly elicit action (also described as “strategic abdication of action control”). Forming an if-then plan means that the person commits herself in advance to acting as soon as certain contextual constraints are satisfied. Once the specified situation is encountered, action initiation should proceed swiftly and effortlessly, without requiring the person’s conscious intent. Thus, the execution of a behavior specified in an implementation intention is assumed to exhibit diagnostic features of automaticity as identified by Bargh (1992, 1994).

Automaticity commonly characterizes highly over-learned activities (e.g., driving a car, typing) including the operation of habits (Aarts & Dijksterhuis, 2000a, 2000b; Sheeran et al., in press; Wood, Quinn, & Kashy, 2002). Action control by implementation intentions seems to exhibit three features of automatic processes: immediacy, efficiency, and lack of awareness. Immediacy has been tested by means of response latencies and by the temporal proximity of actual performance to the time of performance specified in the implementation intentions. In both cases, people who formed if-then plans exhibited swifter responses compared to participants who formed respective goal intentions (e.g., Gollwitzer & Brandstätter, 1997, Experiment 3; Oettingen, Höning, & Gollwitzer, 2000, Experiment 3; Webb & Sheeran, in press). The efficiency of implementation intentions is supported by studies that varied cognitive load either through selection of the sample (e.g., schizophrenic patients, heroin addicts under withdrawal), or by experimental manipulations using dual task paradigms (e.g., Brandstätter, Lengfelder, & Gollwitzer, 2001; Lengfelder & Gollwitzer, 2000). Finally, there is evidence that the effective operation of implementation intentions does not require that people be consciously aware of either the anticipated critical situation or the respective goal intention (e.g., Bayer, Moskowitz, & Gollwitzer, 2004; Sheeran, Webb, & Gollwitzer, 2005). These results imply that by forming an implementation intention people can enhance the rate of goal completion obtained by conscious and effortful guidance of behavior (action control by goal intentions) by strategically switching to automated self-regulation of goal pursuit (overview by Gollwitzer & Sheeran, in press).
1.5 IMPLEMENTATION INTENTIONS AS MENTAL CONSTRUCT

Many of the core concepts of social psychology (e.g., attitudes, self-concept, stereotypes, and goals) are mental representations (Smith, 1998; Smith & Queller, 2003). Thus, most theories in social psychology, because they deal with these concepts, implicitly or explicitly make assumptions about how mental representations are constructed, stored in memory, and used to make judgments or plan actions. Nevertheless, in many theories these concepts’ underlying mental representations along with their respective assumptions, remain implicit and unelaborated (Smith & Queller, 2003). The present research aims at addressing this shortcoming in regard to the concept of implementation intentions.

As detailed in the previous section, results of various experiments have demonstrated the beneficial effects of implementation intentions on goal attainment, and recent research has found strong support for postulated component processes (i.e., heightened sensitivity to the specified situation and automatic initiation of the goal-directed behavior) to explain implementation intentions’ effectiveness. However, in order to fully explicate the concept of implementation intentions, the underlying mental representations remain to be explored.

On a macro level, the formation of an if-then plan (i.e., an implementation intention) is described as mentally linking an anticipated situation (i.e., the if-part) to a certain goal-directed behavior (i.e., the then-part; Gollwitzer, 1993, 1996). Notwithstanding the specific contents of the if- and then-part of an implementation intention, the assumption of “mentally linking” the if-part to the then-part infers the act of linking one mental representation to another representation in the form of “IF…, THEN…”’. In other words, the forming of an implementation intention is implicitly assumed to involve two basic mental components, one referring to the if-part, the other to the then-part.

However, on a micro level of analysis, only one component of the implementation intention, that is the if-component (i.e., the specified situation), has been referred to and investigated on a cognitive level. So far, the question of how the then-component (i.e., the goal-directed behavior) is mentally represented has received no theoretical analysis and empirical attention. Rather, hitherto research on the then-
component of an implementation intention has been limited to a behavioral level, investigating the goal-directed behavior when being triggered by the specified situation.

In line with the recent resurgence in research on goals and their respective means (e.g., Aarts & Dijksterhuis, 2000b; Shah & Kruglanski, 2003), implementation intentions are conceptually portrayed as knowledge structure (i.e., as an if-component linked to a then-component). Yet, if-then plans represent a unique category of knowledge as they possess distinctly motivational contents that determine their manner of functioning. Therefore, the outstanding out-line of implementation intentions’ basic cognitive properties (i.e., its components’ mental representation) will help shed further light on the interplay of implementation intentions’ cognitive and motivational properties, and promote the understanding of how these plans help people obtain outcomes they desire.

1.5.1 Mental Representation of the Specified Situation

As explicated in the previous section, results of various experiments have supported the assumption of heightened sensitivity to the if-component of implementation intentions in regard to superior attention, enhanced recall, and better detection of the specified situation. Furthermore, these results have been interpreted as evidence for the mental representation of the critical future situation to be highly activated (Gollwitzer, 1993, 1996).

In all of these studies, different cognitive functions (i.e., memory, attention, and perception) were measured in a direct way (e.g., memory was measured by recall performance) and the results of these explicit measurements were interpreted as evidence for a heightened accessibility of the critical situation. However, indirect measures (e.g., performance latencies in a lexical decision task) have become the norm in social psychology to measure construct activation (e.g., Kruglanski et al., 2002; Marsh, Hicks, & Bink, 1998; Marsh & Landau, 1995; Shah & Kruglanski, 2000), as implicit measures are less susceptible to alternative explanations for obtained results. Thus, the question that arises is whether the obtained effect (e.g., superior recall) is really a consequence of the investigated phenomenon (i.e., highly activated mental representation of the situation because of having formed an implementation intention), or whether it rather reflects the selective use of voluntary (i.e., controlled) strategies
(e.g., superior recall due to intensive rehearsal or imagining of the specified situation). Therefore, in order to provide more straightforward evidence for the specified situation to be highly activated due to having formed an implementation intention, an indirect measure should be the measure of choice.

1.5.2 Mental Representation of the Goal-Directed Behavior: The Black Box

Gollwitzer (1993, 1996) posits that the mental representation of the specified situation within an implementation intention is highly accessible due to the fact that forming an implementation intention implies the selection of a suitable future situation. However, the forming of an implementation intention also implies the selection of an effective goal-directed behavior (Gollwitzer, 1993, 1996, 1999). In fact, the procedure of forming an implementation intention is described as first selecting an effective goal-directed behavior, which is then linked to the selected critical situation (review by Gollwitzer, Bayer, & McCulloch, 2005). However, the mental representation of the then-component of an implementation intention (i.e., the specified goal-directed behavior) and its accessibility so far represents a “black box” within implementation intention research, remaining to be theoretically addressed and empirically tested.

Thus far, as mentioned earlier, discussions of the specified behavior have been limited to its automatic nature. Research on the then-component has largely provided a “mechanistic” account of the rise of the goal-directed responses. That is, the specified behavior within an implementation intention has been merely conceptualized as automatic response to the stimulus cue, without consideration of potential intervening mental processes.

However, based on recent theorizing and results on implementation intentions, the following assumptions seem tenable in regard to the mental representation of the goal-directed behavior within an implementation intention: First, as implementation intentions represent a knowledge structure, both components, that is the specified situation and the goal-directed behavior should be mentally represented when the implementation intention is formed (i.e., once the specified situation becomes linked to the goal-directed behavior). Second, as past research has shown that the behavior automatically runs off on encounter of the situation, the mental representation of the goal-directed behavior within an implementation intention should become highly
accessible. The question that arises in regard to the activation of the mental representation of the specified behavior is if it becomes activated upon linking the specified situation and the goal-directed behavior in the form of an if-then plan or only when the specified situation is encountered? However, as forming an implementation intention also involves the selection of the intended behavior (besides the selection of an anticipated situation), the mental representation of the goal-directed behavior should be activated when the implementation intention is formed (i.e., once the specified situation becomes linked to the goal-directed behavior).

Support for the idea that automatic goal-directed behavior is mentally represented and highly activated (when paired with an environmental stimulus) was obtained by Aarts and Dijksterhuis (2000b). They tested habits as knowledge structures. Regarding their functional characteristics, implementation intentions and habits are very similar (e.g., Guthrie, 1959). Both lead to an immediate and efficient (i.e., automatic) execution of specific behaviors on appearance of specified situational contexts. However, implementation intentions and habits differ in terms of how automaticity originates. With implementation intentions, a single mental act (i.e., mentally linking an anticipated situation to a certain goal-directed behavior) is necessary to lay the ground for an automatic process to occur (Gollwitzer, 1993, 1999). In contrast, habits become automatic only through frequent and consistent pairing of the environmental stimulus with the relevant behavior (e.g., Anderson, 1992; Bargh, 1997; Logan, 1988; Newell & Rosenbloom, 1981; Shiffrin & Dumais, 1981; Shiffrin & Schneider, 1997; Speelman & Mayberly, 1998).

Aarts and Dijksterhuis (2000b) expanded the idea of habits as automatic behavior to habits as a form of goal-directed automatic behavior (cf. goal-dependent automaticity; Bargh, 1992, 1994), suggesting that the activation of habitual automatic behavior is dependent on goals. In line with Bargh and colleagues’ automotive model (Bargh, 1997; Bargh, Gollwitzer, Chai, & Barndollar, 1999), Aarts and Dijksterhuis assume that the environment is capable of activating goal-directed behavior automatically. However, they argue that in the case of habits, only when the behavior is associated with the activated goal, can the environment activate the habitual (i.e., goal-directed) behavior automatically. Therefore, they posit that habits are mentally represented as links between goals and actions (that are instrumental in attaining this
goal), which develop via the frequency of pairings between the goal-directed action and the situation it has been repeatedly been performed in.

In one experiment (Arts & Dijksterhuis, 2000b, Experiment 1), participants categorized as habitual or non-habitual in the use of a bicycle as their mode of travel to the university were primed with a travel goal (e.g., having to attend lectures). Next, they were asked to respond to the word “bicycle” (goal-directed action-word) as fast as possible after being presented with a location prime (e.g., university) that corresponded to the earlier-activated travel goal. In line with Arts and Dijksterhuis’ predictions, only when the travel goal was initially primed did an advantage in response latencies to “bicycle” emerge in the habit condition as compared to the non-habit condition. No such advantage was found when the travel goal was not primed. In other words, the behavior was highly activated only when it had been previously performed in the situation (i.e., when it was habitual) and the habitual behavior was evidenced only when the goal was activated. Besides demonstrating the goal-dependent nature of habits, this study indicates the following in regard to goal-directed automatic behavior in habits: (a) The finding that goals were capable of priming the behaviors used to fulfill them supports the idea that goal-directed automatic behavior (in the form of a habit) is mentally represented (if not goal-activation could not have exerted an influence on the behavior), and (b) goal-directed automatic behavior can become highly activated when previously paired with an environmental stimulus (i.e., when a habit has been formed). In addition, this finding also supports the idea that “liberating” automatic goal-directed behavior from purely mechanistic explanations is necessary to expand and fully understand its function as an element of a certain knowledge structure.

Hence, although the hitherto way of investigating implementation intentions’ component processes (i.e., the if-part on a cognitive level, the then-part in terms of automaticity) has been shown to be enormously successful in generating a whole wealth of significant empirical findings and in understanding the component processes why implementation intentions enhance goal achievement, it comprises following limitations. First, the previous mode of implementation intention research takes over a rather behavioristic scheme of action as stimulus-triggered re-action, which restricts the goal-oriented behavior to be mechanically linked to the anticipated situation. Second, it prevents a complete mapping out of the cognitive properties of implementation
intentions (i.e., the accessibility of the mental representation of both components), which in turn constrains additional insights into the functioning of implementation intentions and their role as self-regulatory tool in goal attainment. Therefore, the present work aims at taking an initial step towards opening up research on implementation intentions to a new level of investigation by addressing the basic cognitive properties (i.e., the activation of the mental representation) of implementation intentions’ components.

1.6 THE PRESENT RESEARCH

Research has demonstrated that the cognitive treatment of motivational entities, namely goals and their means, affords conceptual and methodological advantages enabling new insights into problems of goal-directed automaticity, self-regulation, and goal attainment. In the present work, the author expands upon this idea by laying out the cognitive properties of implementation intentions’ basic components (i.e., the anticipated situation and the goal-directed behavior). Specifically, the present research will offer further explication of the mental representation of the anticipated situation, and will shed light on the neglected theoretical and empirical investigation of the mental representation of the goal-directed behavior of an implementation intention. The mapping out of an implementation intention as a mental representation and the investigation of its basic cognitive features (i.e., the accessibility of each mental representation) will offer further potential insights into the current understanding of the functioning of implementation intentions and their role in enhancing goal attainment. The following assumptions are made regarding the anticipated situation and the goal-directed behavior as elements of an implementation intention: (1) Both components are mentally represented as knowledge structures; (2) both components become highly activated, therefore highly accessible, upon formation of the implementation intention; and (3) the heightened accessibility of both elements is a result of (a) their superior status due to having been linked in an ‘if-then’ format and (b) the functional relation between the components, but not the result of a semantic relation or consciously applied strategy.
The present investigation consisted of three separate experiments, all using lexical decision to assess the mental representation of the specified situation and the goal-directed behavior of implementation intentions that were formed in the service of superordinate goal intentions. Experiment 1 was designed (a) to obtain a finer grained measure of activation (i.e., accessibility) of the mental representation of the specified situation, and (b) as initial exploration of the accessibility of the mental representation of the goal-directed behavior, respectively after having formed an implementation intention. Based on Gollwitzer’s (1993, 1996) argument that the selection of an implementation intention’s component leads to its heightened activation, Experiment 1 used self-generated implementation intentions. The purpose of Experiment 2 was to test the robustness of findings in Experiment 1 by introducing assigned (in contrast to self-generated) implementation intentions. Using assigned plans allowed to test the hypotheses that the heightened accessibility of the components of implementation intentions is (a) due to the superior status of the anticipated situation and the goal-directed behavior (and not to their mere generation), and (b) depends on the functional, but not semantic, relation between the if-part and the then-part within an implementation intention (i.e., as assigned implementation intentions allowed to control for semantic relatedness). Lastly, Experiment 3 examined the cognitive properties of implementation intentions’ components in regard to automatic versus strategically controlled processes by administering the lexical decision task under mental load.
2. EXPERIMENTS\textsuperscript{1}

2.1 EXPERIMENT 1: FORMING IF-THEN PLANS: ACTIVATION OF BOTH COMPONENTS?

2.1.1 Overview

The purpose of Experiment 1 was to test the hypothesis pertaining to the key assumption that forming an implementation intention (i.e., linking an anticipated situation and a goal-directed behavior in an if-then format) in the service of a goal intention results in both components of the plan being mentally represented and highly accessible. Specifically, Experiment 1 served (a) to replicate previous findings of heightened activation of the mental representation of the specified situation within an implementation intention, and (b) to explore the mental representation of the specified behavior within an implementation intention. Previous findings of activation of the specified situation are based on direct measures such as attention, recall, and detection rates. Therefore, in order to obtain more straightforward evidence of activation, an indirect measure of activation (i.e., lexical decision) was used to assess accessibility of implementation intentions’ components in the present research.

It was determined that the best method to preliminarily investigate the mental representation of both components of implementation intentions was to compare the accessibility of the anticipated situation and the goal-directed behavior between participants who had been asked to form implementation intentions (experimental condition) and participants who had been equally exposed to the situation-word and behavior-word but had not formed an implementation intention (yoked control condition). Furthermore, since most people pursue multiple goals at the same time, the mental representation of implementation intentions was explored in a complex goal structure (i.e., two unrelated goals furnished with two if-then plans each). Another feature of the method was to have participants in the experimental condition self-generate the implementation intentions, in line with Gollwitzer’s (1993, 1996) argument for selection being a factor in the heightened activation of an implementation intention’s particular component (see section 1.5 Implementation Intentions as Mental

\textsuperscript{1} See Appendix for materials (instructions and questionnaires) of all studies.
Construct herein). After generation of implementation intentions (experimental condition), or exposure to the respective component-words (yoked condition), a lexical decision task\(^2\) (hereinafter LDT) was assessed to tap the accessibility of the mental representation of the specified situation and the goal-directed behavior of which the previously formed implementation intentions were composed. Response latencies on the target words (i.e., situation-word and behavior-word) served as a measure of their activation. By applying the standard assumption that latency and activation are inversely related (e.g., Anderson, 1983; Ratcliff & McKoon, 1978), it was predicted that if the formation of implementation intentions leads to heightened accessibility of the specified situation and the goal-directed behavior, response latencies should be shorter for the situation-words and the behavior-words in the experimental condition compared to the yoked control condition.

2.1.2 Method

Participants

A total of 66 University of Konstanz students (39 women and 23 men\(^3\)) from different disciplines participated in return for course credit or 5 € (approximately $6). Two participants failed to follow instructions properly. As a result, both participants’ data, as well as the data of their yoked controls, were excluded from analyses. Hence, the data of 62 students were included in final analyses. Participants were randomly assigned to the experimental or yoked control conditions\(^4\).

Design

This experiment followed a 2 (condition: implementation intention vs. yoked control) x 3 (word type: situation-word vs. behavior-word vs. non-word) factorial design. The first factor varied between participants, and the second factor varied within participants. The dependent variable consisted of response latencies as measured by a lexical decision task.

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\(^2\) We did not use a priming procedure, as the purpose of the present work was to measure the mere activation (i.e., accessibility) of components of a knowledge structure (i.e., the if- and then-component of implementation intentions) and not its inherent links.

\(^3\) Gender of participants did not yield any significant effects on the dependent variables in the present studies and will not be discussed further.

\(^4\) By nature of the yoked control condition, the first participant had to be in the experimental condition.
**Materials and Procedure**

Upon arrival at the laboratory, participants were taken to individual cubicles where they were asked to sit at a computer. They were informed that the experiment consisted of different parts and that they would be given experimental instructions either on the computer screen or in paper and pencil form. Participants were provided with three consecutive tasks.

*Generation task.* The first task was completed on desktop computers and differed for the two conditions. Participants in the experimental condition were asked to generate self-relevant goal intentions and correspondent implementation intentions, whereas participants in the yoked control condition were exposed to the relevant words that the respective experimental participant (they were yoked to) had generated, this by asking them to work on word lists.

The computer program informed participants in the experimental condition that the first part of the experiment referred to personal goals. Participants were told that they would be asked to generate personally important and current goals in two different domains by first writing down their goal as entire sentence, and by summarizing their goal in one word in a second step. In order to control for situational framing effects (e.g., Kruglanski et al., 2002) participants were provided with two domains in which they were asked to generate one goal each: “health” and “personal relationships”. These two domains were chosen as they have been found to be of significance to many college students (cf. Wicker, Lambert, Richardson, & Kahler, 1984). The computer program instructed participants to first write down their goal in one of the two given domains by completing the sentence “I want to…” (e.g., “I want to improve my relationship.” as interpersonal goal), and to then write down their goal sentence in one word (e.g., “relationship”).

After generation of the first goal, participants were then asked to list four behaviors (as one-word item) they thought of beneficial for achieving their goal. Then, they were asked to generate relevant situations (as one-word item) in which they wanted to carry out the behaviors they had listed before. Therefore, they were presented with each listed behavior (e.g., “forgive”) and were instructed to list a viable

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5 Goal systems are highly flexible and context-dependent in that their shape and form may vary in accordance with situational framing effects (Kruglanski et al., 2002).
opportunity next to it (e.g., “conversation”). The same procedure was repeated for the goal in the second domain (the presented order of domains was randomized across participants), resulting in two goals with four behavior-situation pairs per goal for each participant.

Next, participants were asked to form implementation intentions (i.e., if-then plans), whereas the generated situations constituted the “if-part” and the generated behaviors constituted the “then-part” of each implementation intention. Therefore, participants were presented with each generated behavior-situation pair and given instructions to formulate an “IF..., THEN...” implementation intention by filling in the blanks with the situation in the “if-part” and the behavior in the “then-part” of the structure respectively, and by creating a meaningful sentence with it (e.g., “IF I am disappointed in a conversation, THEN I will forgive!”). This procedure was repeated for each behavior-situation pair, resulting in eight implementation intentions (four per goal) for each experimental participant. Before each phase of generation (generation of goal, behavior, situation, and formation of implementation intention) participants were given an example of to-be-generated items in order to clarify the task.

Control participants were yoked to experimental participants by being exposed to the situation- and behavior-words that the respective experimental participant had generated beforehand. Therefore, the computer program informed control-participants that they were going to be asked to make judgments on words, and instructed them to work on a following word list. Next to each presented word, participants were asked to write the word down, and in the case of spelling errors they were asked to correct the spelling when writing the word down. The word list contained the eight generated situation-words and eight behavior-words (hereinafter referred to as “critical” words) of the participant they were yoked to. To ensure equal encoding of the critical words in both conditions, these words appeared twice in the word list (participants in the experimental condition wrote each critical word down twice, first when generating the situation- and behavior-words, and second when forming the respective implementation intention). Further, an equal amount of “non-critical” words (i.e., 32) were included in

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6 The benefit of an implementation intention is to ensure execution of a goal-directed behavior by linking it to an environmental cue. Therefore, although within the structure of an implementation intention the opportunity antecedes the goal-directed behavior, the generation of both components requires the goal-directed behavior to be generated before the situation.
the word list, of which 50% (i.e., 16) were misspelled. The non-critical words were pre-assigned, differed from the critical (i.e., generated) situation- and behavior-words and never appeared in the experiment again. Hence, the word list for each participant differed in regard to critical words, not in regard to non-critical words\(^7\).

**Filler task.** Before administering the LDT, participants (experimental and control condition) were given a filler task that was introduced as an ostensible preparatory exercise for the following task. This second task consisted of finding typos in a text. Therefore, participants were given instructions on the computer screen to open an envelope that was lying next to the computer. In the envelope they found a sheet of paper with an excerpt of a factual description of nature\(^8\) and participants were asked to carefully read the text and circle any typo they would find with a pen. The rationale for including a task between the generation-phase and the LDT was to introduce a time-delay between the encoding of the critical words (by self-generation in the experimental condition or by exposure through a word list in the control condition) and the assessment of their accessibility. As activated goals and their related means produce a decay function that is slower than that of semantic priming (Goschke & Kuhl, 1993; Bargh et al., 2001; Förster, Liebermann, & Higgins, 2005), the filler task should lend to distinguishing between accessibility due to a functional relation of the critical words (i.e., the situation and the behavior) from accessibility that is due to a semantic relation of the critical words.

**Assessment of accessibility.** The third task was a lexical decision task designed to measure the accessibility of the mental representation of the specified situation and the goal-directed behavior comprised in implementation intentions. The LDT was introduced as a task on lexical judgments and as ostensibly unrelated to the first part of the experiment. Participants were told that letter strings would appear on the screen and were instructed to respond “yes” if the letter string they saw was a legal English word and “no” if it was not by pressing one of two keys on the computer’s keyboard. Participants were asked to respond as quickly and as accurately as they could. On each trial, a 750 ms fixation cross preceded each item’s presentation in the center of the monitor. The item disappeared when the participant responded and the next trial

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\(^7\) Before administering the word list to any control participant, the computer program automatically verified if any of the non-critical words matched a critical word. This never occurred.

\(^8\) The excerpt was taken out of natural science magazine.
immediately followed. Response latencies were measured in milliseconds (ms) from the onset of the words to the time participants pressed a key (i.e., made their response). The words were divided into six blocks\(^9\) and were preceded by six practice trials. The blocks were presented in random order across participants, whereas the words within each block were administered in a pre-determined order. Each participant had to respond to 96 trials, hereof 48 trials were existing words (i.e., the 16 critical words, each appearing 3 times) and 48 were orthographic non-words. For each participant in the experimental condition, the situations and goal-directed behaviors that they had generated in the first task (and with which they had formed implementation intentions) were used as critical targets. The non-words were obtained from words (that were not used in the task) by altering one or two letters and were matched for syllabic length to the critical words\(^{10}\). Hence, the words used in the lexical decision task differed for each participant in the experimental condition. Within the yoked control condition, the words in the lexical decision task corresponded to the materials of the participant in the implementation intention condition they were yoked to.

At the end of the experiment, participants were thoroughly debriefed. The debriefing indicated that participants were unaware of the hypotheses under investigation. Moreover, they did not perceive any connection between the different tasks.

2.1.3 Results and Discussion

The data set was first trimmed in order to reduce the effect of outlier latencies. First, all response times above 3000 ms and below 100 ms were cut. Second, an upper bound mean was calculated for each individual participant by adding 2.5 standard deviations to each individual's mean latency score. All response times that fell above a particular individual's upper bound score were cut. This trimming procedure resulted in the elimination of 0.03% of overall responses. Third, because the speed of participants’ incorrect responses would have been difficult to interpret in terms of accessibility (see Bargh, Chaiken, Govender, & Pratto, 1992), we excluded from the analysis incorrect

\(^{9}\) Each block contained the same amount of generated words and non-words.

\(^{10}\) As the critical words differed for each participant in the experimental condition (and therefore for each yoked control participant), the computer program automatically matched each critical word with a non-word out of a beforehand created non-word pool.
responses (2.5% of the responses). Finally, the response times were log-transformed (natural logarithm function) in order to adjust for the skewness of the original latency distributions (Winer, 1971); for the sake of clarity, however, non-transformed means are presented.

Response times were collapsed across the eight situation-words and the eight behavior-words\textsuperscript{11}. A 2 (condition: implementation intention vs. yoked control) x 2 (word type: situation-word vs. behavior-word) analysis of variance (ANOVA) on the mean of the transformed response latencies was conducted, with condition as a between-participant variable and word type as a within-participant variable. The analysis yielded a significant main effect for condition, $F(1,60) = 6.33$, $p < .05$. There was no significant main effect for word type, $F < 1$ and no significant word type $\times$ condition interaction, $F < 1$. Simple effect analysis showed that response latencies significantly differed between conditions for situation-words, $F(1,60) = 6.24$, $p < .05$, and for behavior-words, $F(1,60) = 5.9$, $p < .05$. Namely, participants in the experimental condition responded faster (in ms) to situation-words ($M = 634$) and behavior-words ($M = 632$) than participants in the yoked control condition ($M = 717$, $M = 708$, respectively). The results are presented in Figure 5. In addition, mean response times and their standard deviations are indicated in Appendix B.

The results of Experiment 1 support the predictions. First, applying the standard assumption that faster latencies reflect more activation, the reported faster response latencies for situation-words in the experimental condition compared to the yoked control condition replicate previous findings of implementation intention formation leading to heightened accessibility of the specified situation (Gollwitzer, 1993, 1996). However, this finding provides more straightforward evidence of heightened activation of the mental representation of the specified situation (upon having formed an implementation intention), as the measure of activation consisted of an indirect measure, namely lexical decision (whereas previous findings are based on direct measures such as attention, recall, and detection rates.)

\textsuperscript{11} Separate analysis for critical words associated to different goal-domains (health and interpersonal relation) did not reveal any significant differences on participants' response latencies. Therefore, data corresponding to both goals were collapsed and will not be discussed further.
Second, and of special interest, faster response latencies in the experimental condition compared to the yoked control condition were also found for behavior-words, indicating that the formation of an implementation intention not only enhances the accessibility of the specified situation, but also of the goal-directed behavior. Hence, this finding represents initial evidence that heightened activation of the then-component occurs upon having formed an if-then plan. In sum, the present findings indicate that linking a specified situation to a goal-directed behavior in an if-then format (i.e., forming an implementation intention) leads to enhanced activation of the mental representation of both components of an implementation intention (i.e., the specified situation and the goal-directed behavior). In addition, given that the shorter latencies for the situation- and behavior-words in the experimental condition compared to the control condition were found after a time-delay between the encoding of the words and the measurement of activation, these results are interpreted as evidence for persisting activation of the two components of an implementation intention related to their superior status, and not due to their semantic relation (as activation that results from a semantic relation of two constructs has a faster rate of decay than activation due to
constructs’ functional relation; e.g., Higgins, Bargh, & Lombardi, 1985; Srull & Wyer, 1979).

However, one could argue that this conclusion is premature. Although the basic design of Experiment 1 was plausible as starting point of primary investigation of a construct’s mental representation (namely of the mental representation of implementation intention’s components), it allows for alternative explanations of the results. First, one could argue that the higher activation of the situation- and behavior-words in the experimental condition compared to the yoked control condition is not a result of a superior status of the specified situation and the goal-directed behavior due to having formed an implementation intention, but rather a generation effect of the components. In other words, shorter latencies for the generated situation- and behavior-words in the experimental condition compared to the longer latencies for the provided situation- and behavior-words in the control condition might be a mere consequence of better encoding of these words due to their generation in the experimental condition. Second, an alternative explanation for the heightened activation of the specified situation and the goal-directed behavior in the experimental condition could be a sole consequence of goal activation. Kruglanski and colleagues (e.g., Kruglanski et al., 2002; Shah & Kruglanski, 2002, 2003) have demonstrated the capability of goals to prime (i.e., to activate) their attainment means and attributed this finding to the cognitive association of goals and means (see section 1.3.3 Goal Systems Theory herein). Therefore, one could argue that having asked participants in the experimental condition of Experiment 1 to generate personally relevant goals resulted in activation of possible attainment means (i.e., viable situations and goal-directed behaviors) independent of the formation of plans. In other words, participants that held a certain goal might have been more sensitive to situations and behaviors that could fulfill the goal, and therefore, the same findings (shorter latencies for the situation- and behavior-words compared to participants in the control condition) might have been attained without having participants in the experimental condition explicitly generate viable situations and goal-directed behaviors in order to form implementation intentions. Third, as the LDT only included critical words and non-words, but did not include any word controls to the critical words (i.e., other words that did not appear in the
implementation intentions)\(^{12}\), one might even argue that faster response times in the implementation intention condition for both critical word-types, namely for the situation- and behavior-words, do not indicate a heightened accessibility of the mental representation of both components, but rather a motivational effect that leads participants to an overall superior performance. Experiment 2 was designed to test the robustness of present findings by addressing their possible alternative explanations.

2.2 EXPERIMENT 2: PLAN ACTIVATION AS FUNCTIONAL RELATION AND SUPERIOR STATUS OF THE COMPONENTS

2.2.1 Overview

In Experiment 1, participants who formed implementation intentions in the service of a goal intention were quicker to make lexical decisions on the plans’ components (i.e., situation-word and behavior-word). This finding suggests that forming implementation intentions leads to activation of the mental representation of the specified situation and the goal-directed behavior. The reasons behind conducting Experiment 2 were multifold. First, the aim was to replicate findings of Experiment 1 by introducing assigned (vs. self-generated) implementation intentions. Introducing assigned implementation intentions instead of self-generated plans allowed for testing of the hypothesis that the heightened accessibility of implementation intentions’ components is due to the superior status of the anticipated situation and the goal-directed behavior upon being linked in an if-then format and not due to a generation effect of the components.

Second, to further investigate the superior status hypothesis, Experiment 2 used the same basic design as Experiment 1, but was augmented in the following ways. An equifinal goal-plan structure was used that included one goal only and several (i.e., six) implementation intentions. According to conventional goal architecture, lateral relations within a goal system are assumed to be primarily inhibitory (see section 1.3.3 Goal Systems Theory herein). Introducing several lateral relations on mean level by assigning

\(^{12}\) Word controls only serve their purpose if they are semantically unrelated to words for which they function as controls. As participants in Experiment 1 were asked to self-generate implementation intentions, it was not possible to pre-assess semantic un-relatedness of word controls.
multiple implementation intentions in the service of one goal should allow for conservative testing of the accessibility of the mental representation of the plans’ components (i.e., the specified situation and the goal-directed behavior). This, as in line with the phenomenon of means dissociation one could argue that the components of implementation intentions should be more susceptible to reciprocal inhibition if several plans are competing for activational resources in the face of one goal. Further, a new condition was added in which participants were assigned the same goal intention as participants in the implementation intention condition, but were not assigned any implementation intentions. Including a “goal-only” condition allowed addressing the question if holding a goal intention only might suffice to activate certain goal facilitating situations and behaviors, without the need of forming plans that specifically link viable situations to goal-directed behaviors in an if-then format.

Third, to provide more direct support for the argument that heightened activation of implementation intentions’ components is based on a functional relation between these components and not on merely a semantic relation, only semantically unrelated words were chosen for the situation and goal-directed behavior of to be assigned implementation intentions. Finally, to control for an activational versus a motivational interpretation of findings, a set of neutral words semantically unrelated to the critical words were introduced in the LDT (serving as within-subject controls), and in addition goal commitment was assessed as measure of differential motivation between participants holding a goal only and participants that had additionally formulated plans on how to achieve the goal (serving as between subject control).

It was predicted, that if the formation of an implementation intention leads to heightened accessibility of both its components based on the components’ functional relation and superior status, response latencies should be shorter for the situation-words and the behavior-words in the implementation intention condition compared to the goal-only condition and the control condition. The level of goal commitment was not expected to have an effect on response latencies for implementation intention and goal-only participants. Further, response latencies were expected to be shorter for the critical
words as compared to the neutral words predominantly in the implementation intention condition\textsuperscript{13}.

2.2.2 Method

Participants

Fifty-five students from New York University (32 women and 25 men) participated in the experiment for partial course credit in an introductory psychology course. Students were randomly assigned to the three experimental conditions. The data of 3 participants were excluded from the analyses due to computer failure. Of the 52 participants included in the data analyses, 18 comprised the implementation intention condition, 19 the goal-only condition, and 15 the control condition.

Design

This experiment used a 3 (condition: implementation intention vs. goal-only vs. control) x 4 (word type: implementation intention vs. goal-only vs. control) factorial design. The first factor varied between subjects, and the second factor varied within subjects. The dependant variable consisted of response latencies as measured by a lexical decision task.

Materials

One goal intention (in the form of “I will...”) plus six corresponding implementation intentions (in the form of “If..., then....”) were constructed. The study was conducted at the beginning of a fall-semester and most participants were students in their first year of university. Assuming that most students at that time are dealing with becoming integrated and forming new social relationships, the goal of “becoming socially integrated” was assigned as the goal intention. The implementation intentions were formulated to suit students and to serve the attainment of the goal intention (e.g., “If I am at the gym, then I will introduce myself to a fellow student.”). Each if-then plan contained two words for the LDT that corresponded to the situation (e.g., “gym”) and the goal-directed behavior (e.g., “introduce”). A word list was created that contained the

\textsuperscript{13} As participants in the goal-only condition and control condition had been exposed to the critical words via a word list but not to the neutral words, shorter response latencies for the critical words as compared to the neutral words were expected for them as well. However, this effect was expected to be stronger in the implementation intention condition.
situation- and behavior-words of the implementation intentions, as well as the same amount of additional words (12) unrelated to the situation- and behavior-words that never appeared in the experiment again (for a total of 24 words). Half of the additional words were misspelled words.

The LDT comprised three classes of items. First, it included the critical words, that is, the six situation-words and the six behavior-words of the implementation intentions. Each critical word was presented twice. Second, the LDT included the same number (12) of neutral but valid English words (hereafter called “neutral words”) that did not appear in the experiment and were matched in syllabic length to the critical words. Third, 36 orthographic non-words were included, such that the probability of word and non-word responses in the LDT was 50% each (for a total of 72 trials). The non-words were obtained from words (that were not used in the task) by changing one or two letters and were matched for syllabic length to the situation-, response- and neutral words.

Prior to running the Experiment, the situation-words, behavior-words, and neutral words were tested for semantic relatedness. To this end, 16 New York University undergraduate students were presented with initially selected critical and neutral words (presented in randomized order) and asked to generate as many associations to each presented word as possible. For each word, they were given 20 seconds to generate associations. Results revealed that 1 of the pre-chosen critical and 2 of the pre-chosen neutral words had been generated as association to another pre-selected word. These words were eliminated as stimulus material and further suitable words were created. In a second round of word testing, 14 New York University undergraduate students participated. No association was found between any of the pre-selected words. Hence, these results ensured semantic un-relatedness of critical words among each other, of critical words to irrelevant words, and of irrelevant words among each other.

Procedure

Participants were greeted at a waiting area and escorted to the experimental room, where each was seated in an individual cubicle in front of a computer. The experiment was described as entailing several unrelated tasks involving word-related
judgments. Participants were told that they would be given experimental instructions either on the computer screen or in paper and pencil form.

**Assignment of the goal.** The first part of the experiment was presented in written form and was identical for the implementation intention and goal-only condition. First, participants were informed that a new semester was a good time to set personal goals and that they would be presented with a beneficial goal for students. Then, they were asked to read the goal and to silently say it to themselves. Next, to instill high commitment to and deeper encoding of the prescribed goal, participants were asked to write down the goal.

**Manipulation of implementation intentions.** At this juncture, the instructions started to differ for participants in the implementation intention and the goal-only condition. Participants in the implementation intention condition were asked to read several consecutively presented plans that were deemed by the experimenter as effective ways to reach the goal they had been previously presented with. Next, to make sure that the participants adopted these plans, they were presented each implementation intention again and asked to fill in blanks that denoted the situation- and behavior-words (e.g., “If I am at the ____, then I will ___ myself.”).

In order to ensure equal exposure and encoding to the critical words to be used in the LDT across conditions, participants in the goal-only and control condition were presented with the word list. Next to each word, participants were asked to write the word down and in the case of the spelling errors, they were asked to correct the spelling when writing the word down.

**Assessment of accessibility.** The following task was a lexical decision task designed to measure the accessibility of the mental representation of the specified situation and the goal-directed behavior of the implementation intentions. The LDT was introduced as a task on lexical judgments and was identical for all conditions. Instructions, sequence of a single trial (i.e., fixation cross, target-word), randomization of blocks, and measurement of response latencies were the same as in Experiment 1. The 72 trials were divided into four blocks and were preceded by six practice trials.

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14 As semantic un-relatedness among the critical words, the neutral words, and between the critical and neutral words was ensured by pilot-testing the words, there was no necessity to insert a distraction task (i.e., filler-task) between exposure to the critical words and assessment of their accessibility as in Experiment 1.
Post-experimental phase. As the effect of implementation intentions is contingent on the activation and strength of the underlying goal intention (see section 1.4.5 Implementation Intentions: A Cognitive Approach to Motivation herein), it was important to ensure participants’ importance of and commitment to the adopted goal. Therefore, participants in the implementation intention and goal-only condition completed a questionnaire with the following four items in regard to the previously assigned goal: “How disappointed would you be in case you were not achieving this goal?”, “How important is the goal to you?”, “How feasible or easy do you think it would be for you to carry out this goal?”, and “How committed do you feel to this goal?”. Participants were asked to rate each question on a scale of 1 (low) to 7 (high).

At the end of the experiment, participants were thoroughly debriefed. The debriefing indicated that participants were unaware of the hypotheses under investigation. No participant reported any suspicion about a connection between the different tasks.

2.2.3 Results and Discussion

Goal Commitment Check

Commitment to the assigned goal “to be socially integrated” was relatively high across all participants who were asked to adopt this goal (i.e., participants in the implementation intention and goal-only condition) in that mean responses on the four items tapping into participants’ commitment to the goal (“How disappointed would you be in case you were not achieving this goal?”, “How important is the goal to you?”, “How feasible or easy do you think it would be for you to carry out this goal?”, and “How committed do you feel to this goal?”) all scored above the mean of the 7-point scale ($M = 4.6$, $M = 4.9$, $M = 4.9$, $M = 4.3$, respectively). These results indicated that the goal assigned in this study was of significance to the present sample of students, therefore ensuring that the goal intention was activated.

Lexical Decision

The trimming and transformation of the data corresponded to the procedure in Experiment 1. The trimming procedure resulted in the elimination of (a) incorrect responses (2.7% of the responses), and (b) reaction times below 100 ms, above 3000 ms, and responses that were 2.5 standard deviations greater than the mean for each
individual's mean latency score (1.0% of the responses). Response time averages were assumed to be inversely related to activation levels such that the lower the average, the greater the activation.

The average response latencies on the situation-words and behavior-words were subjected to a 3 (condition: implementation intention vs. goal-only vs. control) between-participant × 2 (word type: situation-word vs. behavior-word) within-participant ANOVA. The analysis yielded a significant main effect for condition, $F(2,49) = 4.5, p < .05$. There was no significant main effect for word type, $F < 1$, and no significant word type × condition interaction, $F < 1$. Simple effect analyses showed that response latencies significantly differed between conditions for situation-words, $F(2,49) = 4.13, p < .05$, and for behavior-words, $F(2,49) = 4.47, p < .05$. Planned comparisons further revealed that participants’ responses to situation-words and behavior-words were faster in the implementation intention condition than in the goal-only condition, $F(1,35) = 6.9, p < .05$; $F(1,35) = 8.29, p < .05$, respectively, and in the control condition, $F(1,31) = 6.88, p < .05$; $F(1,31) = 6.01, p < .05$, respectively. There was no significant difference for situation- or behavior-words between the goal-only condition and the control condition (both $F$’s < 1). In line with the predictions, forming assigned implementation intentions leads to heightened activation of its both components, as indicated by shorter mean response times (in ms) to the situation-words and behavior-words in the implementation intention condition ($M = 564, M = 563$, respectively) compared to the goal-only condition ($M = 632, M = 643$, respectively) and the control condition ($M = 655, M = 646$, respectively). The results are presented in Figure 6 (mean response times and their standard deviations are indicated in Appendix C).

Taken together, then, the results of Experiment 2 replicate the observed findings of Experiment 1 (i.e., heightened accessibility of the specified situation and the goal-directed behavior upon having formed an implementation intention)\textsuperscript{15}, hereinafter referred to as “plan activation effect”. In particular, the results offer evidence that this effect is functional rather than semantic (as only semantically unrelated words were

\textsuperscript{15} The finding that mean response times in Experiment 2 were overall shorter than in Experiment 1 (see Appendix B and C) is attributed to the fact that reaction times vary according to length and frequency of words (e.g., Neely, 1977). In Experiment 1, words were self-generated and consequently included words of long length and low frequency. In contrast, in Experiment 2, words were pre-chosen and it was paid attention to choose words of high frequency and short to medium length.
used). Further, plan activation was found to be neither attributable to a generation effect of the components (as assigned implementation intentions were used), nor to a goal activation effect (as reaction times between the goal-only condition and the control condition did not differ), and is therefore interpreted as result of a superior status of the components of implementation intentions.

![Graph](image)

**Figure 6.** Response latencies on lexical decision for situation- and behavior-words as a function of condition in Experiment 2 (implementation intention condition \(n = 18\), goal-only condition \(n = 19\), control condition \(n = 15\)).

The “superior status” is further supported by the fact that the plan activation effect was found within an equifinal goal system of one goal with several, potentially reciprocal inhibiting, lateral relations on means level (i.e., six implementation intentions). The 1-goal – 6-plans structure did not attenuate the response latency advantage of the specified situations and the goal-directed behaviors. Comparing response latencies between the different plans revealed no significant differences (all \(p’s > .2\)) \(^{16}\), indicating that the strength (i.e., the activation) of one plan’s components was not weakened by the presence of other available plans linked to that goal. That plan

\(^{16}\) Response latencies between the six different implementation intentions were compared for situation- and behavior-words separately, as well as for response latencies collapsed across situation- and behavior-word for each plan.
activation seems to be independent of competition among different if-then plans and that the components within an implementation intention appear to be less susceptible to inhibition as means in a conventional sense, attests to the superior status of the specified situation and the goal-directed behavior by being linked in an if-then format.

**Dissociating Activational from Motivational Accounts**

Given that goals and their respective means are motivational entities, one possible alternate interpretation of the reported data is that the differences in response latencies were not a function of different activation, but rather differences in degree of motivation. Two measures were included in the design of Experiment 2 to rule out this alternative explanation, namely a questionnaire on goal commitment and neutral control words in the LDT. Each measure will be reviewed in turn.

One possible alternate interpretation is that the differences in the LDT performance between the goal-only condition and the implementation intention condition resulted not from differences in activation, but rather in degrees of the motivational factor of goal strength (i.e., goal commitment). Within goal systems theory, goal commitment is a key property of the motivational system. Goal commitment refers to the degree to which an individual is determined to pursue a goal and varies as a function of value assigned to the goal and its expectancy of attainment (cf. Oettingen & Gollwitzer, 2001; Kruglanski et al., 2002; section 1.3.3 Goal Systems Theory herein). As implementation intentions are formed in the service of superordinate goals and specify when, where, and how one intends to achieve the goal, one might argue that forming if-then plans heightens the motivational level (i.e., goal commitment) as the specificity accorded with implementation intentions might raise expectancy of attainment. Differences in latencies on the critical words between the goal-only and the implementation intention condition on the LDT may have therefore resulted from one group being more motivated to achieve the goal than the other. In other words, having formed implementation intentions (in addition to holding a goal) might have elevated participants’ level of motivation (as measured by higher commitment to the goal), and expressed itself in faster response times to the critical words on the LDT. In this case, we would expect higher goal commitment in the implementation intention condition compared to the goal-only condition as measured by the four goal commitment related items that we administered to participants at the end
of the experiments. However, simple effect analyses showed no significant differences between the implementation intention condition and the goal-only condition in any of the four commitment items (all $p$’s < .2). Hence, the two conditions did not differ in the magnitude of their commitment to the assigned goal.

Yet to further investigate the argument of an elevated motivational level due to having formed implementation intentions, univariate analyses of variance were performed on response latencies for situation-words and behavior-words using each of the goal commitment items as a covariate. In all cases, the results were nonsignificant (all $p$’s > .3). These results indicate that a higher level of motivation (as measured by goal commitment) due to having formed implementation intentions did not account for the shorter response latencies for critical words in the implementation intention condition.

Another possible alternate interpretation of the plan activation effect is that the differences in LDT performance between the implementation intention condition, the goal-only, and control condition resulted from differences on the level of energization. The above discussed motivational account specifically applies to components pertaining to a goal system (i.e., goals and means) and represents a classic motivational variable of the strength of a higher order goal (Gollwitzer & Moskowitz, 1996). In contrast, according to the energization theory of motivation by Brehm (Brehm & Self, 1989; Wright & Brehm, 1989), the concept of energization refers to a person’s readiness to exert effort in general and is directly determined by the perceived difficulty of the task at hand. Whereas motivation as property of goal systems results from commitment to a desired end-state and increases in strength over time until the goals are acted upon (see section 1.3 Goal Structure and Operation herein), energization results from general arousal (e.g., by being engaged in challenging or personally important tasks) and increases with task difficulty; however, the amount of energy mobilized decreases over time if task difficulty remains the same or becomes less difficult.

Recall while participants in the implementation intention condition were asked to form certain if-then plans to help them attain a goal of personal importance, participants in the goal-only and control condition were merely asked to read a word list
that had no personal importance\textsuperscript{17}. One might argue that participants in the implementation intention condition experienced the task as more difficult, and therefore generated more energy at the onset of the next task, compared to participants in the other two conditions. If differences between conditions on the LDT may have resulted from different levels of energization between participants, this effect would express itself in the overall performance on the task. Therefore, to address this alternative explanation of the plan activation effect, response latencies to the critical words were compared to response latencies to the neutral control words in the LDT. If shorter response latencies for the situation-words and behavior-words of implementation intentions are to be attributed to a heightened activation of the mental representation of these components, but not attributed to an increased energization due to having formed plans, then reaction times for the neutral words should not be faster in the implementation intention condition compared to the goal-only condition and the control condition. However, contrary to our prediction, mean response latencies (in ms) for the neutral words were lower in the implementation intention condition ($M = 630$) compared to the goal-only condition ($M = 711$), and the control condition ($M = 735$; see Figure 7; for mean response times and their standard deviations see Appendix D). Planned comparisons revealed that the difference of response times to neutral words for participants in the implementation intention condition compared to the goal-only and the control condition was significant, $F(1,35) = 8.29, p < .05$, $F(1,31) = 6.01, p < .05$, respectively. No such difference was found between the two latter conditions ($F < 1$).

Therefore, as a more stringent test for a possible energizational account of the plan activation effect, analyses on differences of response latencies to situation- and behavior-words between conditions were re-performed using response latencies to neutral words as a covariant. Results revealed that the previously found significant difference for response times to critical words between conditions vanished when adjusting for response times to neutral words ($F < 1$). According to these results, it seemed that our previously labelled “plan activation effect”, namely the finding of shorter latencies for situation-words and behavior-words due to having formed implementation intentions, may not only result from differences in activation, but as

\textsuperscript{17} Participants in the goal only condition had additionally been asked to adopt a goal, but as explicated earlier, this had no differential effect on the results and therefore was not considered as possible contributing factor to energization.
well from differences in the magnitude of energization the participants experience in the implementation intention condition. In other words, two different processes seemed to be underlying our results.

![Graph showing response latencies](image)

Figure 7. Response latencies on lexical decision for neutral words as a function of condition in Experiment 2 (implementation intention condition [n = 18], goal-only condition [n = 19], control condition [n = 15]).

The next question was how to possibly differentiate between processes due to activation and/or energization. Bargh et al. (2001) made use of a process dissociation paradigm to differentiate possible underlying processes of non-conscious goal activation (see section 1.3.2 Automaticity in Goal Pursuit herein). By introducing a 5-min time-delay, this paradigm allowed them to show that activated goals, before being able to act upon, increase over time. Therefore, in order to differentiate between processes underlying the present findings, it seemed viable to analyze the response times on the LDT at two different points in time by looking at the first and second half of the responses separately (and therefore introducing a quasi – as post-hoc – time-delay). As it took participants in the present study between 13.02 and 17.5 min to go through the entire LDT, the partition of the LDT in a first and second half afforded a quasi time-delay of a minimum of 6.5 min; a time-course that – in accordance with
Bargh et al.’s finding – was expected to be long enough to differentiate between processes (i.e., long enough for the effect of energization to wane). If a higher energization level of participants which had previously been engaged in a more difficult task, that is, forming personal plans (compared to participants that had only read a word list) were to be the only source of producing faster response times for critical and neutral words on the LDT, then this effect should wane over time as difficulty of the task at hand remained constant (or became easier due to habituation to the task). More specifically, examining accessibility of concepts by measuring response latencies on a LDT requires participants to give a response by pressing a “yes” or a “no” key – an action that involves a certain amount of effort (i.e., the LDT represents a performance measure). Hence, with continuous effort energization levels should drop and actions that benefit from this higher energetic level (such as pressing keys in a LDT) should slow down over time. On the other hand, response latencies on a LDT for concepts with a chronically high activation (as hypothesized for the components of implementation intentions) should not get slower over the course of time as they would be expected to persist in a state of heightened subthreshold activation.

Therefore, to differentiate between an activation and energization account, response times on the LDT were investigated over a time-course by analyzing the first and second half of the LDT separately. Block 1 represented the first 50% of trials that each participant had responded to, Block 2 the second 50% of trials (Block 1 and 2 therefore comprised 36 trials each). An energization effect was expected in Block 1 of the LDT such that response times for critical and neutral words in the implementation intention condition would be shorter compared to the goal-only and control condition. In addition, it was assumed that in Block 1 shorter response times to critical words than to neutral words in the implementation intention condition would show a plan activation effect. A 3 (implementation vs. goal-only vs. control) × 2 (situation-word vs. behavior-word) ANOVA on mean response latencies revealed a significant main effect of condition, $F(2,49) = 3.2, \ p = .05$. Results in Block 1 therefore indicated a plan activation effect in that response latencies to situation-words and behavior-words were shorter in the implementation intention condition ($M = 581, M = 577$, respectively) compared to the goal-only ($M = 685, M = 655$, respectively) and control condition ($M = 670, M = 671$, respectively; see Appendix E for means and standard deviations). Next,
addressing the energization account of previous findings, simple effect analysis showed that response latencies significantly differed between conditions for neutral words, $F(2,49) = 4.46, p < .05$. Response latencies to neutral words were faster in the implementation intention condition ($M = 617$) compared to the goal-only condition ($M = 746$) and control condition ($M = 753$; see Appendix E for means and standard deviations). Further, the introduction of response latencies to neutral words as covariate in the $3$ (condition) $\times 2$ (word type) ANOVA, neutralized differences between situation- and behavior-words in the implementation intention condition compared to the goal-only and control condition, the main effect of condition showed to be non-significant ($F < 1$). Hence, as expected, results in Block 1 indicated an energization effect in tandem with a plan activation effect.

In Block 2 of the LDT, it was expected that the energization effect would wane after a quasi time-delay reflected by converging latencies for only neutral words across conditions, and in tandem, the plan activation effect was expected to become more pronounced in Block 2 compared to Block 1 such that response times for critical words would remain shorter in the implementation intention condition compared to the goal-only and the control condition$^{18}$. The same steps of analyses performed on Block 1 were conducted on Block 2 of the LDT. A $3$ (condition) $\times 2$ (situation-word vs. behavior-word) ANOVA on mean response latencies revealed a main effect of condition, $F(2,49) = 4.84, p < .05$. Shorter response latencies to situation-words and behavior-words in the implementation intention condition ($M = 547, M = 548$, respectively) compared to the goal-only ($M = 607, M = 631$, respectively) and control condition ($M = 640, M = 620$, respectively; see Appendix F for means and standard deviations) indicated a plan activation effect. In regard to response latencies for neutral words in Block 2, simple effect analysis showed that they did not significantly differ between conditions, $p > .2$.

In particular, in the implementation intention condition, mean response times for neutral words in Block 2 ($M = 644$) slowed down compared to Block 1 ($M = 617$), clearly demonstrating a waning energization effect in Block 2. This is especially noteworthy as all other responses (i.e., to critical words across conditions, and neutral words in the goal-only and implementation intention condition) benefited from a practice effect in

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$^{18}$ It should be noted however, that due to a practice effect an overall increase in speed of response latencies was expected.
Block 2, expressed by a speed-up effect between Block 1 and Block 2. Further, introducing response latencies to neutral words as covariate in the 3 (condition) × 2 (situation word vs. behavior-word) ANOVA yielded a remaining significant main effect of condition when adjusting for response times for neutral words, $F(2,48) = 3.35, p < .05$.

In line with the prediction, plan activation became more pronounced in Block 2 compared to Block 1. Therefore, the separate analyses of reaction times for the first and second half of the LDT allowed for dissociation of an activational account of the plan activation effect from an energetic account. Accordingly, it cannot be argued that our assessment of implementation intentions’ components is more aptly described as an assessment of mere energization or that this energization may have ultimately produced the observed plan activation effect.

In sum, the results of Experiment 2 demonstrated the robustness of the plan activation effect found in Experiment 1. Findings further showed that this effect seems to be due to a functional relation between implementation intentions’ components and based on a superior status of the anticipated situation and the goal-directed behavior upon being linked in an if-then format. In addition, results of Experiment 2 revealed that forming implementation intentions has effects on a cognitive and an energetic level. Yet, the separate analysis of the first and second half of the LDT showed that while the effect of energization is rather short-lived, the activation effect persisted and can therefore be attributed to chronic accessibility. However, an important question that is posed by the latter result is whether the response latency advantage for implementation intentions’ components is an automatic effect or rather a process that is consciously controlled by the participants. The aim of Experiment 3 was to investigate this question.

2.3 EXPERIMENT 3: AUTOMATICITY IN PLAN ACTIVATION

2.3.1 Overview

The results of Experiment 1 and 2 showed that forming implementation intentions leads to a response latency advantage for both components of implementation intentions. In Experiment 2, the separate comparison of response times for critical words (i.e., the situation- and the behavior-word) to neutral words in the first and
second half of the LDT allowed for convincing attribution of this response latency advantage to an activational account (rather than to an energetic account). Taken together, these results are interpreted as evidence for a plan activation effect (i.e., that the formation of an implementation intention leads to heightened accessibility of the mental representation of both components of implementation intentions) that appears to become more pronounced over time.

However, thus far it is unclear if the cognitive advantage of implementation intentions’ components is contingent on the amount of available cognitive resources. It might be that upon forming an implementation intention, its components (i.e., the situation and the goal-directed behavior) initially become more salient, but that a consciously controlled process, such as for example the selective use of a strategy might be needed to then activate these components. It is conceivable, for example, that participants who had been asked to form implementation intentions were selectively rehearsing or imagining the if-then plans while responding to words in the LDT. This, because they might have wanted to make sure to remember the if-then plans, since these plans had been introduced as helpful for attaining a personal important goal. Therefore, the controlled process of applying a memory strategy or of keeping the components active via rehearsal in working memory might have led to the obtained effects. In this case, plan activation would be contingent on the amount of available cognitive capacity, in the sense that under conditions of high cognitive load the activation effect would not be expected to occur.

However, if the activation of implementation intentions’ components does not require a controlled process but rather runs off automatically upon forming an implementation intention due to the components’ superior status, then plan activation should be found even when mental load is high (i.e., cognitive resources are taxed). In line with the findings of the previous experiments, wherein the superior status of implementation intentions’ components has been supported, it is assumed that the plan activation effect is based on an automatic process. Specifically, findings of Experiment 1 and 2 can so far be interpreted as the plan activation process displaying two characteristics of automaticity, namely, the lack of conscious intent and immediacy (see sections 1.3.2 Automaticity in Goal Pursuit, 1.4.7 Component Processes of Implementation Intentions herein). First, the measure of activation in Experiment 1 and
Experiments consisted of an indirect measure (i.e., lexical decision), and debriefing of participants in Experiment 1 and 2 revealed that they did not suspect a connection between the forming of implementation intentions and the following LDT (i.e., satisfying the criteria of lack of awareness). Second, although the plan activation effect appeared to be more pronounced in the second half of the LDT of Experiment 2, it was found in the first half of the LDT as well (i.e., displaying the criteria of immediacy). In Experiment 1 and 2, however, cognitive load was rather low. Therefore, the hypothesis of plan activation being based on an automatic process required a demonstration that forming implementation intentions results in heightened activation of the components even under high mental load (i.e., fulfilling the third criteria of automaticity, namely, efficiency).

Therefore, the aim of Experiment 3 was to investigate if the effect of plan activation is based on a consciously controlled process (i.e., requiring cognitive resources), or if the activation effect is rather due to an automatic process that is characterized by its crucial features of immediacy, efficiency (i.e., not requiring much cognitive resources), and lack of conscious intent (Bargh, 1994, 1996, 1997; Bargh & Chartrand, 1999; Logan, 1992; Shiffrin & Schneider, 1977). Based on the design of Experiment 2, in Experiment 3, high levels of cognitive load were induced by using a dual-task paradigm. The primary task (i.e., a LDT) was therefore combined with a secondary task that consisted of participants having to remember appearing background patterns simultaneously to making lexical decisions.

2.3.2 Method

Participants

Thirty-eight introductory psychology students (20 women and 14 men) at New York University participated in the experiment in partial fulfillment of a course research requirement. They were randomly assigned across two conditions (corresponding to the implementation intention condition and the goal-only condition of Experiment 2)\textsuperscript{19}. Two participants were excluded from the analyses because of data loss. Of the 36

\textsuperscript{19} As results in Experiment 2 showed no significant differences in response times for critical and neutral words between the goal-only condition and the control condition, it appeared sufficient to only integrate the goal-only condition as between subject control to the implementation intention condition in Experiment 3.
participants included in the data analyses, 19 comprised the implementation intention condition and 17 the goal-only condition.

**Design**

This experiment followed a 2 (condition: implementation intention vs. goal-only) x 4 (word type: situation-word vs. behavior-word vs. neutral-word vs. non-word) factorial design. The first factor varied between participants, and the second factor varied within participants. The dependent variable consisted of response latencies as measured by a LDT under conditions of high cognitive load.

**Materials and Procedure**

Except for the added secondary task, materials, as well as the general procedure, were identical to Experiment 2. First, participants in the implementation intention condition and the goal-only condition were assigned the goal intention. Next, participants in the implementation intention condition were asked to adopt the six if-then plans; whereas participants in the goal-only condition were presented with the word list containing the critical words of the implementation intentions. The LDT followed immediately after the assignment of plans or adaptation of the word list. The word types in the LDT were identical to those in Experiment 2 (i.e., critical words, neutral words, and non-words), as were the instructions regarding the lexical decision. Cognitive load was introduced during the measurement of response latencies in Experiment 3 via a secondary task.

**The cognitive load task.** This task occurred concurrently with the LDT. Cognitive load was added by presenting the target words in the LDT with a background pattern (following Park, Hertzog, Kidder, Morrell, & Mayhorn, 1997).

![Figure 8](image)  
*Figure 8. Two examples for presentation of target words with background pattern in LDT of Experiment 3.*
The secondary task consisted of asking participants to remember how many different background patterns they saw during the entire LDT. Each word in the LDT was presented against one of 12 black and white background patterns (examples shown in Figure 8). Each background pattern appeared six times (i.e., in accordance with the 72 trials of the LDT), and the pattern changed every time a new word appeared.

Participants were given instructions for the pattern memorization task after the instructions and practice trials for the LDT. They were told that in addition to performing lexical decisions as their primary task, they would simultaneously be shown different background patterns and that their task would be to count how many different patterns they saw during the entire course of the LDT. To promote adherence to the secondary task, participants were further informed that they would be asked to make judgments about the patterns afterwards. After showing participants two examples of background patterns, they were asked to start the dual-task by performing both tasks (i.e., the lexical decision and the pattern memorization) at the same time.

The dual-task was followed by a pattern recognition task that served as a manipulation check for the dual-task. For the pattern recognition task, participants were presented with 24 different patterns after each other. Their task was to decide if they had or had not seen the presented pattern in the previous LDT by pressing one of two correspondingly assigned keys on the computer’s keyboard. All 12 patterns that appeared in the dual-task were integrated, plus 12 new patterns that had not appeared before.

Finally, a goal commitment questionnaire and a funneled debriefing were administered similar to the previous experiment. As usual, debriefing revealed that participants were not aware of a possible effect of the manipulation task on later performance.

2.3.3 Results and Discussion

Goal Commitment Check

As in Experiment 2, commitment to the assigned goal was relatively high across all participants in that mean responses on the four items tapping into participants’ commitment to the goal all scored above the mean of the 7-point scale (means ranged
between \( M = 5.0 \) and \( M = 5.3 \), see Appendix G). Therefore, activation of implementation intentions’ overarching goal intention could be presumed.

**Load Manipulation Check**

An increase in cognitive load via the introduction of a secondary task (i.e., pattern memorization) lead to a decrease in accuracy performance on the primary task (i.e., lexical decision) in Experiment 3 compared to Experiment 2 as evidenced by a higher percentage of incorrect responses on the LDT in Experiment 3 (4.2% of overall responses compared to 2.7% in Experiment 2). In addition, overall latencies on the LDT in Experiment 3 were between 150 ms and 400 ms faster than in Experiment 2. Taken together, this was interpreted as evidence that the introduction of the secondary task in Experiment 3 had the intended effect of adding cognitive load to the measurement of response latencies on the LDT.

Further, the manipulation of load did not have any differential effects on the implementation intention condition compared to the goal-only condition in terms of quality of performance. Neither the amount of mistakes on the LDT nor mistakes on the pattern recognition test differed between conditions (\( p’s > .2 \)), suggesting that for both conditions, the equal amount of cognitive resources was being taxed via the dual-task paradigm.

**Lexical Decision**

The trimming and transformation of the data corresponded to the procedure in the previous studies. The trimming procedure resulted in the elimination of (a) incorrect responses (4.2% of the responses), and (b) reaction times below 100 ms, above 3000 ms, and responses that were 2.5 standard deviations greater than the mean for each individual's mean latency score (1.4% of the responses). Response time averages were assumed to be inversely related to activation levels such that the lower the average, the greater the activation.

The average response latencies on the situation-words and behavior-words were subjected to a 2 (condition: implementation intention vs. goal-only) between-participant \( \times \) 2 (word type: situation-word vs. behavior-word) within-participant ANOVA. The
analysis yielded a significant main effect for word type, $F(1,34) = 14.35$, $p < .05^{20}$, as well as a significant main effect for condition, $F(1,34) = 8.99$, $p < .01$. There was no significant word type $\times$ condition interaction, $F < 1$. As predicted, a higher activation of implementation intentions’ components was also found under conditions of high cognitive load as indicated by shorter mean response times (in ms) to the situation- and behavior-words in the implementation intention condition ($M = 711, M = 744$, respectively) compared to the goal-only condition ($M = 962, M = 1056$, respectively). The results are presented in Figure 9 (see mean response times and their standard deviations in Appendix H).

![Figure 9](image)

*Figure 9. Response latencies on lexical decision under load for situation- and behavior-words as a function of condition in Experiment 3 (implementation intention condition [$n = 19$], goal-only condition [$n = 17$]).*

This latency advantage of the implementation intention condition compared to the goal-only condition proved to be significant for the situation-words, $F(1,34) = 6.85$, $p < .05$, and behavior-words, $F(1,34) = 9.3$, $p < .05$. Evidently, the plan activation

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$^{20}$ Further analysis revealed that the main effect for word-type was due to faster response times for situation-words than for behavior-words in the goal-only condition, $t(16) = -3.53$, $p = .003$. No such difference was found in the implementation intention condition, $p > .13$. As this finding does not have any implication for the present hypothesis, it will not be further discussed in this section. However, it will be discussed in the General Discussion section.
effect is based on an automatic process that does not require cognitive resources and is therefore characterized by efficiency.

However, results of Experiment 2 revealed that the formation of implementation intentions triggers two processes: a persisting activation effect for implementation intentions’ components, as well as an initial energization effect for overall performance. Therefore, in order to obtain more evident support for the finding of plan activation under cognitive load (i.e., for the automatic nature of the effect), it was necessary to dissociate the activational effect from a possible energization effect under cognitive load due to having formed implementation intentions. As according to Brehm’s theory of motivation (Brehm & Self, 1989; Wright, & Brehm, 1989) the level of energization increases with perceived task difficulty, an energization effect was also expected under conditions of high cognitive load (i.e., increased difficulty of the LDT). It remained uncertain however, if the persisting high level of cognitive resource consumption would shorten or lengthen the decay-rate of energization.

To differentiate between a plan activation effect and an energization effect under cognitive load, differences in response latencies for situation- and behavior-words between the implementation intention condition and goal-only condition were compared to response latencies for the neutral words in the LDT. The same procedure of statistical analyses was carried out as in Experiment 2.

**Dissociating Activation from Energization**

As in Experiment 2, mean response latencies for the neutral words were lower in the implementation intention condition \((M = 794)\) compared to the goal-only condition \((M = 1050; \text{ see Figure 10, for mean response times and their standard deviations see Appendix 1})\). Simple effect analyses revealed that this difference was significant, \(F(1,34) = 9.02, p < .05\). Consistent with the prediction, this result indicated that forming implementation intentions has an energetic effect on participants’ subsequent performance (i.e., lexical decision), even if measured under high mental load. Further, controlling for the influence of neutral words on the differences found for situation- and behavior-words between participants who had formed implementation intentions and who had not, resulted in a neutralized main effect of condition, \(p > .1\).

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21 As in Experiment 2, no significant differences between conditions were found for the four goal commitment items and will therefore not be discussed further.
Therefore, to differentiate between the effects of plan activation and energization, the same post-hoc analyses on the first and second half of the LDT were conducted as in Experiment 2. In Block 1, an energization effect was expected in tandem with a plan activation effect. A 2 (implementation vs. goal-only) × 2 (situation-word vs. behavior-word) ANOVA on mean response latencies yielded a significant main effect of condition, $F(1,34) = 8.54, p < .05$.

![Figure 10](image.png)

*Figure 10.* Response latencies on lexical decision task for neutral words as a function of condition in Experiment 3 (implementation intention condition [$n = 19$], goal-only condition [$n = 17$]).

Results in Block 1 therefore indicated a plan activation effect in that response latencies to situation-words and behavior-words were shorter in the implementation intention condition ($M = 744$, $M = 803$, respectively) compared to the goal-only condition ($M = 1025$, $M = 1124$, respectively; see Appendix J for means and standard deviations). Next, addressing the energization account, simple effect analysis showed that response latencies significantly differed between conditions for neutral words $F(1,34) = 9.02, p < .05$. Response latencies to neutral words were faster in the implementation intention condition ($M = 814$) compared to the goal-only condition ($M = 1108$; see Appendix J for means and standard deviations), indicating an energization effect in the first block for the implementation intention condition. Lastly, response
latencies to neutral words were introduced as covariate in the analysis of critical words. The main effect of condition showed to be non-significant, $F < 1$, indicating that controlling for the influence of response latencies to neutral words neutralized differences for situation- and behavior-words between the implementation intention condition and the goal-only condition. Thus, as in Experiment 2 and in line with the prediction, results in Block 1 indicated an energization effect in tandem with a plan activation effect due to having formed implementation intentions.

However, in Block 2, it was expected that with a constant high level of taxed resources the plan activation effect would (a) become more pronounced in contrast to a waning energization effect, and (b) would allow for clear dissociation between processes due to activation and energization. A 2 (condition) × 2 (situation-word vs. behavior-word) ANOVA on mean response latencies revealed a main effect of condition, $F(1,34) = 7.54, p < .05$, with shorter response latencies to situation-words and behavior-words in the implementation intention condition ($M = 678, M = 685$, respectively) compared to the goal-only condition ($M = 898, M = 988$, respectively; see Appendix K for means and standard deviations), indicating an effect of plan activation. Further, response latencies for neutral words in Block 2 remained significantly different between conditions, $F(3,58), p = .067$. This finding was in contrast to the prediction of a waning energization effect, however, differences for response times to neutral words between conditions attenuated from Block 1 to Block 2 ($p = .005, p = .067$, respectively), revealing a receding energization effect. Yet most importantly, including response latencies to neutral words as a covariate in the 2 (condition) × 2 (situation word vs. behavior-word) ANOVA yielded a remaining significant main effect of condition when adjusting for response times for neutral words, $F(1,33) = 3.58, p = .067$. Hence, in line with the hypothesis, the plan activation effect became more prominent from Block 1 to Block 2 and could be clearly separated from the energization effect. However, contrary to findings in Experiment 2, the energization effect did not wane from Block 1 to Block 2, but rather attenuated. The fact that the plan activation effect remained significant despite controlling for the remaining energization effect, can be interpreted in terms of an increasing accessibility of implementation intentions’ components over time (due to having formed an implementation intention). This result parallels findings on the gradual increase in goal-related accessibility (Bargh et al.,
2001; Förster, Liberman, & Higgins, 2005), and will be discussed in the General Discussion section.

In sum, the results of Experiment 3 closely replicate the plan activation effect found in Experiments 1 and 2. Forming implementation intentions leads to a heightened activation of the mental representation of the specified situation and the goal-directed behavior as indicated by shorter response times on a LDT to implementation intentions’ components. Specifically, Experiment 3 showed that – as predicted – the plan activation effect could be obtained reliably under high cognitive load. This finding strongly supports the assumption that the activation of implementation intentions’ components, due to having formed an implementation intention, is based on an automatic process that does not require cognitive resources. Taken together, the pattern of data obtained is well suited to fulfill the three criteria of automaticity: (a) immediacy (i.e., higher activation of implementation intentions’ components could be observed from the onset of activation measurement), (b) lack of conscious intent (i.e., participants were not aware of the relation between forming implementation intentions and the following LDT), and (c) efficiency (i.e., not requiring cognitive resources; Bargh, 1994, 1996, 1997; Bargh & Chartrand, 1999; Logan, 1992).

In addition, the energization effect due to forming implementation intentions demonstrated in Experiment 2 was also found under high levels of cognitive load in Experiment 3. By separately analyzing the first and second half of the LDT, results revealed that plan activation became more pronounced from the first half to the second half of the LDT in tandem with a decreasing energization effect. It appears therefore, that not only the plan activation effect, but also the energization effect does not require any conscious control or effort.
3. GENERAL DISCUSSION

3.1 THE PRESENT RESEARCH

The present research speaks to a relatively neglected aspect of planning in the form of implementation intentions: the mental representation of its components (i.e., the specified situation and the goal-directed behavior). In three experiments, forming implementation intentions lead to shorter response times on a lexical decision task for situation- and behavior-words (i.e., the if- and then-components of the previously formed if-then plans), relative to neutral words and relative to a condition in which only a goal intention was activated. Applying the standard assumption that faster latencies reflect more activation (e.g., Anderson, 1983; Ratcliff & McKoon, 1978), this finding implicates that the formation of an implementation intention (i.e., linking a situational cue and a goal-directed behavior in an if-then format) leads to a heightened activation of the mental representation of its both components. This finding was termed “the plan activation effect” and represents (a) more straightforward evidence of heightened activation of the specified situation as part of an implementation intention, and (b) first evidence of the goal-directed behavior of an implementation intention being mentally represented and highly activated upon formation of an if-then plan.

Specifically, in Experiment 1, self-generation of implementation intentions was found to result in heightened activation of both components of implementation intentions, compared to a condition in which no plans were generated. Experiment 2 and 3 replicated the plan activation effect with assigned implementation intentions implying that the heightened activation is a result of a superior status of the if- and then-component (as part of an implementation intention), and not due to a generation effect of the components. The superior status of the components of if-then plans was further supported by Experiment 2 and 3 where it was demonstrated that (a) assigning (i.e., activating) a goal intention only, without corresponding plans, did not suffice to activate certain goal facilitating situations and behaviors (rather, plan activation was contingent on assignment of implementation intentions in addition to an underlying goal intention), and that (b) the plan activation effect could be obtained under conditions of several plans competing for resources in the face of a shared goal. In addition, Experiment 2 and 3 provided evidence that forming implementation intentions leads to heightened
activation of the specified situation and the goal-directed behavior as a result of their functional relation (i.e., having been linked in an if-then format), rather than due to their semantic relation. This finding was afforded by assigning implementation intentions with semantically unrelated components. Lastly, the results of Experiment 3 demonstrated that the plan activation effect could be reliably obtained under conditions of high cognitive load, implying that the activation of implementation intentions’ components upon forming an if-then plan is due to an automatic process that does not require cognitive resources.

Together, the experiments demonstrate the following cognitive features of the mental representation of the anticipated situation and the goal-directed behavior as components of an implementation intention: (1) Both elements are cognitively represented as knowledge structures; (2) the formation of an implementation intention (i.e., linking the situation and the goal-directed behavior in an if-then format) enhances the activation of both components, thereby demonstrating a plan activation effect; (3) the heightened accessibility of implementation intentions’ components is a result of (a) an automatic process due to their superior status and (b) a functional relation between the components due to having been linked in an if-then format.

3.1.1 Additional Results in the Experiments and Implications for Future Research

In addition to the predicted effect of heightened activation of implementation intentions’ components due to linking them in an if-then format, the comparison of response latencies between the critical words (i.e., situation- and behavior-words) and neutral words in Experiment 2 and 3 revealed two unpredicted effects.

Energization Effect

First, in addition to the activation effect of the components, the formation of implementation intentions revealed an energization effect that expressed itself in faster response times to not only critical words (i.e., situation- and behavior-words), but also relatively faster response times to neutral words on a LDT for participants who had formed implementation intentions compared to participants who had not formed such

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1 “Relatively faster” as response times to critical words were shorter than response times to neutral words within the implementation intentions condition.
plans. However, in both experiments, a separate analysis of the first and second half of the LDT allowed for dissociation between the effect of energization and the effect of activation, revealing that the effect of activation becomes more pronounced over time, whereas the energization effect decays rapidly. In Experiment 2, the separate post-hoc analysis revealed an energization effect in the first half of the LDT only, no such effect was found in the second half. In Experiment 3, however, the energization effect was still detectable in the second half of the LDT, but decreased from the first to the second half. This difference in decay of energization is attributed to the difference in task difficulty between Experiment 2 and 3 and is consistent with Brehm’s (Brehm & Self, 1989; Wright & Brehm, 1989) view of energization as a direct function of experienced task difficulty: “the human organism is an energy system that easily stores energy and releases that energy to perform work as situational requirements – the difficulty of instrumental behavior – demand” (p. 201). Experiment 2 and 3 used the same basic design, yet in Experiment 3 task difficulty while measuring activation was higher than in Experiment 2, as cognitive load was added to the LDT. So in both experiments, participants who had formed the same implementation intentions (in the service of a goal intention) seemed to have generated a certain amount of energy. However, as task difficulty during measurement of activation in Experiment 3 was higher than in Experiment 2, more energy was released at the onset of the LDT in Experiment 3, and thus, the energization level should be expected to take longer to decay in comparison to the lower amount of energy released in Experiment 2. According to the present argument, it was expected that with further elapse of time, the energization effect in Experiment 3 would wane as was the case in Experiment 2. However, future research is needed to systematically inquire the trajectory of the energization effect in regard to formation of implementation intentions.

The emergence of an energization effect within the present research yet raises the question if the generation of energy is a direct function of forming implementation intentions or if it might rather be an artifact of measuring activation of motivational properties (i.e., goals and means) with performance measures, such as a lexical decision. The former might be suggested by the fact that the energization effect in Experiment 2 and 3 was only found for participants who had formed implementation intentions, but was not found for participants who had only formed a goal intention.
However, the latter is supported by recent research of Förster, Liberman, and Higgins (2005) who investigated accessibility of goal-related constructs in an experimental design comparable to present Experiment 2. In their first study (Study 1), participants were given a goal to search for a target stimulus among other stimuli. Activation of goal-related words as well as of control, unrelated words was measured via a following lexical decision task at two consecutive points in time (i.e., after two equally long blocks of LDT) before the goal was fulfilled. They found that accessibility of goal-related words was enhanced prior to finding the target (i.e., while goal was activated) for participants in the goal condition relative to a no-goal condition in the second block of the LDT, evidenced by a larger difference in response latencies between goal-unrelated words and goal-related words in the goal condition. However, of special interest to the current research, comparing absolute mean response latencies revealed faster response times (in ms) to neutral words for participants with a goal compared to participants without a goal in Block 1 of the LDT ($M = 753$, $M = 849$, respectively), and in Block 2 of the LDT ($M = 695$, $M = 756$, respectively), indicating an energization effect for participants holding a goal that attenuated relatively from Block 1 to Block 2\(^2\). Thus, having a goal enhanced the accessibility of goal-related constructs, but as well, enhanced performance on goal-unrelated constructs.

Taken together, Förster et al.’s (2005) finding that energization can occur when measuring activation of activated goals closely replicates the energization effect of the present research for activated plans. Hence, it does not appear that the present evidence of energization is an artifact of forming implementation intentions. Rather, it appears that this finding is due to measuring activation of motivational properties with performance measures, such as lexical decision. Apparently, when activation of a motivational property (i.e., goals or plans) is being measured and this measurement requires effort, the construct releases a certain amount of energy that spreads to other unrelated constructs. This argument can also explain the findings in the present Experiments 2 and 3 that an energization effect was only evidenced for participants who had formed implementation intentions (and a goal intention), but not for participants who had only formed a goal intention. As activation of implementation intentions was being measured, but not that of goals, energy was only released for participants who had

\(^2\) The relative decrease is evidenced by the difference of response times for neutral words between the goal and no-goal condition that is smaller in Block 2 compared to Block 1.
formed if-then plans. On the other hand, according to the present argumentation, if the activation of the underlying goal were to be measured in Experiment 2 and 3, an energization effect would be expected for all participants holding a goal (i.e., for participants holding a goal only and for participants holding a goal and plans).

Interestingly, the “energizational” finding in Förster et al.’s (2005) research was not explicitly mentioned or analyzed but could be inferred from the displayed table of means (p. 225, Table 1). Whereas the phenomenon of energization has been considered in respect to its influence on goals’ inherent motivational properties (e.g., Wright & Brehm, 1989, have investigated energization in regard to goal valence), it seems that so far this phenomenon has obtained little or no attention in the research of motivational entities (i.e., goals and means) as knowledge structures, that is in respect to its influence on the cognitive properties of motivational phenomena. However, the possibility of an energization effect is an important aspect to consider not only in future research on implementation intentions, but as well in goal theory and social psychology in general. This, as an energization effect might easily conceal differential activation from motivational properties.

**Increase of Plan Activation Effect**

The separate analysis of the first and second half of the lexical decision task in Experiment 2 and 3 revealed a further unexpected effect, namely that the plan activation effect became more pronounced, that is stronger, from the first to the second half of the LDT. The finding of increased accessibility of implementation intentions’ components over time was most evident in Experiment 3. Here, in the first block of the LDT, an effect of plan activation and of energization was detected. As expected, the activation effect waned when controlling for the influence of the effect of energization. In the second block of the LDT, the energization effect prevailed (different to Experiment 2, in which it had waned). However, despite the prevailing energization effect, when controlling for its influence on the activation effect of implementation intentions’ components a significant plan activation effect remained. This finding was interpreted as evidence for increasing plan activation over time after having formed implementation intentions.

The finding of an increasing accessibility of implementation intentions’ components is consistent with an established phenomenon within goal research: goal
activation produces a gradual increase in goal-related accessibility prior to goal fulfillment (e.g., Bargh, et al., 2001; Förster et al., 2005). Therefore, the present finding should not be surprising, because just as goals, implementation intentions represent motivational entities and can be expected to evidence similar properties. As implementation intentions are formed in the service of goal intentions and thus become cognitively linked to the goal, it is conceivable that the feature of goal tension spreads from the mental representation of goals to the linked attainment means, such as implementation intentions. However, to the best of the author’s knowledge, a gradual increase of activation in goal attainment means has not been demonstrated before and would necessitate further exploration in order to clarify its role in goal attainment. An interesting avenue for further research would be to more directly investigate the trajectory of activation of implementation intentions’ components specifically, and to explore if this finding might not apply to goal attainment means in a general sense. Such comparison might provide additional insights into the beneficial status of implementation intentions in regard to self-regulation.

3.2 LIMITATIONS OF PRESENT EXPERIMENTS AND IMPLICATIONS FOR FUTURE RESEARCH

The first limitation of the present research is that the additional results documented above (i.e., energization effect and increase of plan activation) were not obtained through experimental manipulation, but by a post-hoc measure, namely a subsequent separate analysis of the first and second half of a lexical decision task that had been administered in two seamless blocks. One might argue that the results obtained by a post-hoc introduced time-delay are not convincing as they are rather a matter of trying to confirm a hypothesis that had been rejected in line with the experimentally induced manipulation. However, it is important to note that the object of the present research, that is, the mental representation of implementation intentions had not been investigated before. Therefore, the design of the experiments can be viewed as partly explorative and should allow for post-hoc measures in order to advance the understanding of the question under investigation. This is the case in the present research. Adding a post-hoc measure, allowed us to further understand the mental
representation of implementation intentions’ components and therefore represents an important contribution to implementation intention research. In addition, Förster et al.’s (2005) results corresponded to the present findings (due to post-hoc measures) of increased accessibility of goal-related constructs and decreased energization over time, and were obtained by experimentally induced separation of a LDT. Therefore, it is argued that presented results obtained by post hoc analyses do not represent post hoc fallacy. However, future research on implementation intentions as knowledge structure and on means in general should take the temporal factor of present findings into account and should more directly examine the trajectory of implementation intention components’ activation and other possibly related effects of forming implementation intentions (e.g., energization) over time.

The second limitation of the present research is that the energization effect found in Experiment 2 and 3 might not be related to measuring activation of a motivational property (i.e., implementation intention) – as herein assumed –, but might rather be an artifact of the experimental procedure, reflected in a difference of task difficulty between conditions. In Experiment 2 and 3, participants in the implementation intention condition were asked to adopt six implementation intentions by first reading each plan carefully one after the other and by subsequently filling in blanks of incomplete represented implementation intentions. To ensure equal exposure to the critical words of the implementation intentions, participants in the control conditions (i.e., goal-only and no goal condition) were asked to read a word list that contained the critical words, to write each word down and to correct for any eventual misspelling. Clearly, the task in the implementation intention condition was more elaborate than in the other two conditions. As energization has been postulated to be a direct function of experienced task difficulty (cf. Brehm & Self, 1989; Wright & Brehm, 1989), one might argue that the obtained energization effect for participants in the implementation intention condition in Experiment 2 and 3 might be due to the difference in task difficulty. However, in line with the discussion on energization in the previous section (3.1.1 Additional Results in the Experiments), it appears more likely that the present finding of an energization effect is to be attributed to measuring activation of motivational properties and not to a difference in task difficulty. To settle this matter, it would yet be
necessary for future research to control for an equal elaboration level across conditions whilst ensuring equal exposure to critical words.

The third caveat of current findings relates to the goal-plan structure underlying Experiment 2 and 3. Research within the framework of goal systems theory has demonstrated the importance of taking into account vertical and lateral relations between goals and means when measuring activation of any component within a goal system (e.g., Shah and Kruglanski, 2002). Accordingly, in Experiment 1, the activation of implementation intentions’ components (i.e., specified situation linked to goal-directed behavior) was explored in a complex goal structure. This was realized by asking participants to generate two goals in different domains and to additionally form two implementation intentions for each goal. However, in Experiment 2 and 3 a simpler goal-plan structure with high competition on ‘means’ level (i.e., one goal and six implementation intentions) was chosen to investigate that the plan activation effect is a result of a superior status of implementation intentions’ components. According to goal systems theory (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2003) lateral relations within goal systems (i.e., between alternative competing goals, or alternative competing means) are assumed to be primarily inhibitory (Shah, Kruglanski, & Friedman, 2003). As the plan activation effect was found despite means dissociation (i.e., several implementation intentions competing for activational resources of one goal), the finding was interpreted as supporting the hypothesis of superior status of implementation intentions’ components.

However, it could be argued that this finding is limited in the sense that competition of resources was only investigated on a mean level, but not on a goal level. A criticism that is valid especially in regard to everyday life, in which people usually hold several goals at the same time. In this matter, Shah and Kruglanski (2003), investigating the lateral relation between competing goals, found that in the case of alternatives being unrelated to the focal goal do they pull resources away from the goal, whereas alternatives facilitatively related to a focal goal draw resources toward it (see 1.3.3 Goal Systems Theory herein). Therefore, the finding of a plan activation effect might be less likely if activation of implementation intentions’ components were investigated for plans that are linked to two (or more) unrelated goals. On the other hand, in the case of facilitatively related goals each furnished with one plan only, the
plan activation effect might be expected to become more pronounced. Future research should systematically analyze possible activational interferences on implementation intentions’ components in a framework of competing unrelated and facilitatively related goal intentions that have each been furnished with implementation intentions.

3.3. THEORETICAL IMPLICATIONS AND EXTENSIONS FOR IMPLEMENTATION INTENTION RESEARCH

Implementation intentions represent a self-regulatory tool that is aimed at enhancing the realization of goal intentions. As noted in the introduction, a bulk of research has demonstrated the beneficial effects of implementation intentions on goal attainment and shown that these plans are effective for various self-regulatory problems in goal pursuit (overviews by Gollwitzer, Bayer, & McCulloch, 2005; Gollwitzer & Sheeran, in press). Further, recent research has found empirical support for so far postulated component processes (i.e., superior processing of the specified situation and automatic initiation of the goal-directed behavior; overview by Gollwitzer & Sheeran, in press) as well as for implementation intentions’ effects being conditional on the strength and activation of their underlying goal intentions (Sheeran, Webb, & Gollwitzer, 2005). However, despite the significant contribution of research on implementation intentions in intention-behavior relations and the field of self-regulation, implementation intentions have so far theoretically and empirically been merely treated as a concept.

To remedy this neglect, an underlying theoretical framework that incorporates the basic processes of implementation intentions’ components, the special characteristics of implementation intentions as a self-regulatory device, and the features regarding the interplay between implementation intentions and their underlying goal intentions needs to be explicated. Such framework would allow a systemic view and

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3 By no means is this meaning to suggest that the concept of implementation intentions lacks theoretical underpinning. Quite the contrary, implementation intentions are theoretically derived from the established model of action phases (Gollwitzer, 1990; Heckhausen, 1991; Heckhausen & Gollwitzer, 1987). However, the model of action phases was designed to differentiate motivational from volitional phases during goal pursuit. Therefore, in regard to implementation intentions, the model only lends to assigning implementation intentions to the corresponding phase in which they facilitate goal pursuit (i.e., the preactional, volitional phase). Missing is a theoretical framework that differentiates and incorporates the cognitive and motivational properties of implementation intentions to allow insights into their function.
investigation of a network of interconnected implementation intentions and goal intentions, and would further foster an integration of so far separately treated (theoretical and empirical) findings in the field of implementation intentions.

In line with the theory of goal systems (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2003), the cognitive properties that motivational phenomena (such as implementation intentions and goal intentions) share with other cognitive systems, are understood to set the constraints within which the phenomena’s uniquely motivational properties may express themselves. Therefore, outlining the cognitive structure of implementation intentions and goal intentions would be a necessary first step towards outlining a systemic model on self-regulation. The mental representation of goal intentions is evident in line with goal systems theory. The current work further allows for laying out the cognitive map of implementation intentions and provides knowledge about the basic cognitive properties of its components.

Therefore, on the basis of herein presented research, I want to propose an outline of a theory of self-regulation networks that incorporates present and past findings on the cognitive and motivational properties of goal intentions and implementation intentions. The proposed theory is in skeletal form based on the empirical findings present in the current research, and like any other good theory will need future experiments to establish its explanatory power. It is assumed that the model has the potential to broaden the knowledge about the processes that underlie effective self-regulation on the way to goal attainment via implementation intentions. The theory is outlined on the basis of the theory of goal systems (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2003) and therefore shares goal systems’ substantial aspects. However, what make the proposed model unique are the idiosyncratic characteristics of implementation intentions as self-regulatory tool.

3.3.1 Proposition of a Theory of Self-Regulation Networks

The proposed theory understands itself as positioned in the “motivation as cognition” paradigm. Its content is the functioning of self-regulation networks, composed of the mental representations of interconnected goal intentions and implementation intentions. The functional properties of implementation intentions and their respective goal intentions are incorporated as proposed by Gollwitzer (1993, 1996,
Self-regulation networks are assumed to share the basic structure and properties of goal systems as proposed by the theory of goal systems (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2003). They differ from goal systems in the specificity, structure, and content of the components that facilitate goal attainment. Within goal systems any kind of mean that is assumed to afford effective goal pursuit is considered as mentally represented and may be directly connected to the corresponding goal (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2003; see 1.3.3 Goal Systems Theory herein). Differently, in the proposed self-regulation network, links are formed between goal intentions and implementation intentions through an act of conscious will that is intentionally aimed at mastering potential self-regulatory problems during goal pursuit and therefore enhancing goal attainment. Implementation intentions further differ from conventional means in that they represent a knowledge structure that is composed of two components, namely the mental representation of a specified situation and of a goal-directed behavior. Implementation intentions become effective as self-regulatory tool upon linking the two components in an if-then format, and therefore represent a functional unit within self-regulation networks.

Self-regulation networks incorporate the cognitive and motivational properties of their components. It is assumed that self-regulation phenomena within the network are determined jointly by both sets of properties. In the following section, the basic cognitive and the motivational properties, as well as the structure of self-regulation networks will be presented. The next section will then continue to discuss further assumptions within the system along with implications for future research within self-regulation networks.

**Cognitive Properties**

Within self-regulation networks, goal intentions are hierarchically superordinate to implementation intentions. Goal intentions are cognitively connected to implementation intentions that were formed in the service of their realization. Alternative implementation intentions may be connected to the same goal, and as well may the same implementation intention be connected to different goals.

Implementation intentions depict a unique cohesive knowledge structure in that they consist of jointly connected mental representations of a specified situation and a goal-directed behavior that function as a unit. Within the network structure, both
components are represented laterally. Due to the format in which implementation intentions are formed, that is, by linking the specified situation and the goal directed behavior in an if-then format, the components become functionally connected and derive a superior status (cf. present results). The superior status of the components causes both components to become highly activated after formation of an implementation intention, an effect referred to as “plan activation effect”. The chronic activation of implementation intentions’ components further results in an enhanced accessibility over conventional means such that the regular inhibition that occurs in having multiple means connected to one goal (i.e., means dissociation; see 1.3.3 Goal Systems Theory herein) does not apply to implementation intentions. In the case of multiple implementation intentions being connected to one goal intention, the components of implementation intentions were found to be resistant to reciprocal inhibition, as they did not evidence any loss of activation4.

Within the network, implementation intentions that were formed in the service of a goal intention are assumed to be cognitively linked to the respective goal intention. The relation between goal intentions and implementation intentions, as well as the relation between implementation intentions’ components is assumed to be based on a functional (rather than on a rigid) relation between the components. These assumptions are based on the findings of Sheeran, Webb, and Gollwitzer (2005). They found that the effects of implementation intentions are conditional on the activation of the respective goal intention. Upon encountering the situational cue specified in the if-component of an implementation intention, the goal-directed behavior (i.e., the then-component) is only initiated if the underlying goal intention is activated. This implies that forming an implementation intention does not mean that behavior is elicited by situational cues in a mechanistic fashion, rather is the rate of control of the goal-directed behavior by the specified cues (engendered by forming implementation intentions) moderated by the corresponding goal intention. It follows therefore, that the interplay between goal intentions and implementation intention, as well as between plans’ components is based on a functional relation.

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4 Although this assumption is based on findings within the present research, future research will be needed to explicitly investigate the allocation of activational resources within self-regulation networks.
The functional relation between the components is assumed to originate from their joint motivational function. Further, as the joint motivational function of the constructs may vary greatly depending, for example, on individuals idiosyncratic self-regulation history or on the situational context, the system-inherent cognitive properties (i.e., their activation level) are assumed to be dynamic in nature. Therefore, the self-regulatory facilitatory connections between implementation intentions’ components and goal intentions are assumed to represent a dynamic network. A proposed self-regulation network is depicted in Figure 11.

*Figure 11.* A self-regulation network of goal intentions and implementation intentions.
**Motivational Properties**

The basic cognitive properties of self-regulation systems are not unique as they characterize all cognitive systems. What makes the network unique is its composition of motivationally relevant entities, that is, of goal intentions and implementation intentions.

The motivational properties that drive goal pursuit in regard to the goal intention correspond to those of conventional goals systems (e.g., goal commitment and increase in goal activation over time before fulfillment of the goal; see 1.3.3 Theory of Goal Systems herein). The specific motivational properties of self-regulation networks relate to implementation intentions. analogue to the property of goal tension in goals, increased activation of implementation intentions’ components over time has been documented before encounter of the specified situation and execution of the goal-directed behavior (cf. present research). A further motivational property of implementation intentions is the commitment to the plan itself. Plan commitment is described as the degree to which an individual is determined to perform certain goal-directed behaviors when the critical situation is actually encountered (Gollwitzer, 1996). It is assumed to vary as a function of the value assigned to the plan as beneficial to goal attainment and the expectancy of being able to carry out the respective behavior.

In addition, due to current findings in Experiment 2 and 3, energization in the sense of actual motivational arousal (Brehm & Self, 1989; Wright & Brehm, 1989) might be a further motivational property to be considered in self-regulation networks. Although it remains upon future research to determine the specific source of herein documented energization effect, its consideration is assumed as important aspect of future investigation of motivational self-regulatory phenomena.

### 3.3.2 Self-Regulation Networks: Further Assumptions and Implications for Future Research

In the previous section, the cognitive map of implementation intentions, their components, and goal intentions has been laid out along with their basic cognitive and motivational properties. The outline of the theory of self-regulation networks can now be used as framework to further investigate the associative links between the elements, the motivational properties inherent in the elements, as well as the interplay of the
cognitive and motivation properties within the system. In consideration of present and past findings within the research field of implementation intentions, the following section will outline several further assumptions along with implications for future research within the proposed self-regulation networks.

**Structural Aspects**

**Mental link between goal intentions and components of if-then plans.** The findings of the current experiments provide evidence for a superior activational status of components of if-then plans (i.e., the specified situation and the goal-directed behavior) compared to situations and goal-directed behaviors that are not part of an implementation intention. This finding can possibly extend the understanding of the functional relation between goal intentions and their respective implementation intentions by investigating the cognitive link in a “bottom up” fashion.

Shah and Kruglanski (2003) have found that means, as cognitive entities, are capable of priming (i.e., activating) the goals they serve (see 1.3.3 Goal Systems Theory herein). They reasoned that means contribute to goal attainment at least in part through activating their respective goal as they may serve in keeping one’s “eyes on one’s objective,” thus ensuring the continuance of one’s goal-related strivings. In line with Shah and Kruglanski’s (2003) findings, it is conceivable that implementation intentions, due to their superior status, might entail keeping the respective goal intention at a superior level of activation. Therefore, implementation intentions might attribute to goal achievement in a “bottom up” fashion of spreading activation by mere virtue of being linked to an implementation intention.

The functional advantage of a superior level of goal activation might be that it puts a goal in a state of easy to be activated. Similarly, Förster et al. (2005) have argued that goals might create a “conditional accessibility” of goal-related constructs, which is triggered by an appropriate cue, rather than (or in addition to) enhancing accessibility of such constructs overall. As a consequence, goals that do not require current action can be put “on hold,” or in a state in which goal-related accessibility is not necessarily high overall, but rather can be easily enhanced by appropriate cues. Förster et al.’s (2005) argument comes from a “top down” perspective regarding the flow of activation between goals and means. However, from a “bottom up” perspective, if-then plans could possibly represent “appropriate cues” to facilitate the goal’s “conditional
accessibility”, and in consequence foster goal attainment. Future research could test the possibility of increased goal accessibility due to the formation of implementation intentions through a priming procedure in which a goal intention would serve as target and the components of their respective implementation would serve as primes.

**Mental link between the if-part and then-part of implementation intentions.**

The results of three experiments presented herein provide evidence that both components of implementation intentions (i.e., the specified situation and the goal-directed behavior) are mentally represented and become highly activated upon formation of the if-then plan. The separate investigation of each part was a necessary first step to understanding the basic cognitive processes that underlie the functioning of implementation intentions (i.e., to understand how each part of implementation intentions operates). However, the next subsequent question in regard to the mental representation of implementation intentions pertains to its cognitive structure as a compound unit. Do the components of an implementation intention become directionally represented in the sense of a production rule following a logic if-then structure? Or do they become mentally represented as a (non-directional) unit according to their representation as a functional unit within self-regulation networks?

Given that implementation intentions have the same if-then format as a production rule (Anderson, 1983, 1992; see 1.1 Mental Representations, 1.5 Implementation Intentions as Mental Construct herein), one might infer a corresponding directional representation in the sense that the second part (i.e., then-component) is contingent upon the first part (i.e., if-component). However, implementation intentions differ from production rules in that only a single mental act is necessary to lay the ground for automatic action initiation (also referred to as ‘automatic action control’; Gollwitzer, 1993, 1996; see 1.4.7 Component Processes of Implementation Intentions herein). Conversely, production rules require frequent and consistent pairing of the stimulus with the relevant behavior to become automatic (e.g., Anderson, 1992; Bargh, 1997; Logan, 1988). It might therefore be inferred that the link between implementation intentions’ components is not directional, but rather that upon formation of an implementation intention, both components become represented as a unit. For example, Hayes-Roth’s (1977) classic paper on the “evolution of cognitive structures” describes how the mental representations of associated component operations can become
“unitized” as a functionally single element. Upon activation, the operations subsumed under this single representation then run off in an all-or-none fashion.

The latter is supported by the finding of the current research that both components of an implementation intention (i.e., the if- and then-part) became highly activated upon formation of the if-then plan. If the representation of both components were directional, analogous to a production rule, a high activation of the specified behavior (i.e., the then-part) would only be expected upon encounter of the situation. That is, the activation of the then-part would be contingent upon the activation of the if-part. However, in all three studies, simple contrasts showed that for participants who had formed implementation intentions, the response latencies to the if-part (i.e., the specified situation) of the implementation intentions did not significantly differ from the latencies to the then-part (i.e., the goal-directed behavior; in all three experiments, $p > .1$). As no difference in activation between implementation intentions’ components was found, this result can be interpreted as indication for implementation intentions being represented as a unit. However, to provide more convincing evidence for this assumption, future research would have to test the link between implementation intentions’ components using priming procedures. If the unit-hypothesis were to be confirmed, then no difference in activation would be expected between priming the if-part with the then-part and vice versa.

**Strength of the cognitive links.** In addition, the evidence of mental representation of both components of an implementation intention enables the systematic investigation of a further cognitive property of if-then plans waiting to be explored: the strength of the link between (a) the specified situation and the goal-directed behavior, and (b) implementation intentions’ components and their respective goal intention. Till now, effects of link strength could only be indirectly investigated on a behavioral level. For example, Sheeran, Webb, and Gollwitzer (2005) found that behavioral effects of implementation intentions only emerged when participants had strong goal intentions: implementation intentions had no effect if the underlying goal intention was weak. In terms of strength of the link between implementation intentions and goal intentions, this can be interpreted as implementation intentions are only effective if the cognitive link between these two elements is strong. However, this
assumption remains to be directly examined within the self-regulatory framework posited here.

Further, it has been argued that the strength of the mental link between the if-part and the then-part of an implementation intention should affect the beneficial consequence of forming an implementation intention (Gollwitzer, Bayer, & McCulloch, 2005). Forming a strong link between the if- and then-part of implementation intentions may be achieved in one mental act, but should additionally benefit from deeper encoding, such as mental rehearsal (Gollwitzer, 1999). This assumption can now be experimentally examined by comparing the activation of implementation intentions’ components for participants who have only formed the implementation intention once, compared to participants who have strengthened the link by for instance being asked to visualize the if-then plan.

In addition, considering the strength of associative links within a self-regulation network can also help interpret past findings. For example, implementation intentions have been shown to be most beneficial the more difficult it is to initiate the goal-directed behavior. Implementation intentions were more effective in completing difficult as compared to easy goals (Gollwitzer & Brandstätter, 1997, Study 1). This could be interpreted in terms of differences in links’ strength between potential goal-directed behaviors and the goal intention. According to goal systems theory, any mean that is capable of facilitating goal attainment is cognitively represented (Kruglanski et al., 2002; Shah, Kruglanski, & Friedman, 2003). In the case of goal-directed behavior being difficult to initiate, the strength of the link between the goal and the means would be assumed to be weaker than in the case of an easy to-be-initiated behavior. Forming an implementation intention, that is combining a goal-directed behavior with a specified cue (in order to facilitate execution of the behavior by handing over control to the cue), results in the representations of the behavior and the situation as single unit, and in tandem strengthens the link between the goal intention and the implementation intention. Therefore, in the case of a goal-directed behavior being strongly linked to a goal before forming an implementation intention, the additional strength of the link between the means and the goal (due to forming an implementation intention) should not have any further beneficial effect. Whereas in the case of a weak link between a goal-directed behavior and a goal, forming an implementation intention should result in
fortifying the link between the goal and the self-regulatory mean (i.e., the implementation intention), resulting in easier realization of the goal-directed behavior.

**Configurational patterns.** What the proposed structure of a self-regulation network further allows is to investigate excitatory (i.e., facilitative) versus inhibitory connections between elements within different configurational patterns. As mentioned in a previous section of the General Discussion (3.2 Limitations of Present Experiments and Implications for Future Research), future research is needed to explore activation of implementation intentions’ components not only in relation to one goal intention, but in a complex structure of several competing goals.

**Motivational Properties**

**Goal and plan commitment.** The interplay between commitment to the goal intention and effects of implementation intentions has obtained considerable empirical attention (see Gollwitzer, Bayer, & McCulloch, 2005). For example, Orbell, Hodginks, and Sheeran (1997) reported that the beneficial effects of implementation intentions on compliance in performing a breast examination were observed only in those who strongly intended to perform breast self-examinations. This finding suggests that implementation intentions are conditional on a high commitment to the underlying goal.

However, besides goal commitment, commitment to the implementation intention is a further motivational property to be considered within self-regulation networks. For example, Gollwitzer, Achtziger, Schaal, & Hammelbeck (2002) have found that the strength of the commitment to the formed implementation intention had effects on their beneficial influence on goal attainment. In their Study 3, the strength of commitment to the plan was varied by telling the participants (after an extensive personality testing session) that they were the type of people who would benefit from either rigidly adhering to their plans (i.e., high commitment) or staying flexible (i.e., low commitment). The latter group showed lower implementation intentions effects (i.e., lower cued recall performance for selected opportunities) than the former. Therefore, low plan commitment could also be expected to emerge in lower activation of implementation intentions’ components. To test this issue, plan commitment would have to be manipulated when measuring the accessibility of if-then plans.

**Is the then-part within implementation intentions restricted to behaviors only?** It has been argued that the if-part in an implementation intention can involve several
different cues, such as internal cues (e.g., a strong feeling) or external cue (e.g., a particular place, object, person, or point in time; Gollwitzer & Sheeran, in press). On the other hand, although the specification of the then-component of an implementation intention has been described as being able to take many different forms (Gollwitzer & Sheeran, in press), the then-part has been restricted to being represented by a (goal-directed) behavior.

This first exploration of the then-part component of an implementation intention frees the goal-directed behavior (as a mental construct) from the notion of being contingent upon the encounter of the anticipated situation (i.e., the then-part becomes activated upon formation of an implementation intention). In addition, this evidence opens up further insights to the specific content of the then-part within an implementation intention. The present research showed that the then-part becomes highly activated before the situation is encountered, that is, before the behavior runs off. Hence, the basic cognitive properties of implementation intentions’ components (i.e., their high activation upon formation of an if-then plan) that underlie the functioning of implementation intentions appear to be independent of action per se. In other words, it might be that the content of the then-part is not limited to behaviors, but rather that other means, such as for example strategies, could function as goal attainment enhancing ‘then-part’ of an implementation intention. Confirming evidence for the exchangeability argument of the content of the then-part has been obtained only recently by Bayer and Gollwitzer (unpublished manuscript). In two of their studies, forming implementation intentions in which a critical situational cue was linked to a motivational intervention (i.e., favourable self-beliefs) allowed for controlling of motivational problems in goal striving. Therefore, the then-part within implementation intentions does not appear to be restricted to behaviors only.

**Interplay Between Cognitive and Motivational Properties**

*A functional view of associations within self-regulation networks.* Central to the outlined self-regulation network is the assumption of a functional association between goal intentions and implementation intentions, as well as between the components of an implementation intention. This functional relation is attributed to the interplay between the inherent cognitive and motivational properties of the elements.
As mentioned previously in this section, the two components of implementation intentions are assumed to be represented as a unit upon formation of the if-then plan. However, due to the components’ motivational property, which may vary depending on the situational context or current environment, it is not assumed that an implementation intention that is cognitively linked to a goal intention will run off in an ‘all-or-none’ fashion irrespective of its functionality. Although the assumption of a unified representation of the if- and then-component (i.e., upon formation of an if-then plan) implies that the representation of an implementation intention is retrieved as a whole when activated as a part (i.e., when the situation is encountered), the goal-directed behavior is assumed to run off only if the current context is appropriate to execute the goal-directed behavior. That implementation intentions are conditional to an activated goal intention has been demonstrated – as previously mentioned – by Sheeran, Webb & Gollwitzer (2005). In their Study 2, participants’ conscious task goal was to solve a series of puzzles as accurately as possible. Participants formed either an implementation intention to respond quickly or an irrelevant implementation intention and were either primed or not primed with the goal to respond quickly. The results indicated that forming an implementation intention only produced a speed-up effect if participants had been primed with the goal to respond quickly. This finding was interpreted as evidence that implementation intentions have an effect (i.e., affect performance) only when a corresponding goal intention is activated.

From a self-regulation network perspective, what this results shows, is that implementation intentions have to be cognitively connected to a goal intention to have an effect. However, there might be conditions in which a goal intention and an implementation intention are cognitively linked (i.e., a corresponding goal intention is activated), but when the specified cue is encountered, showing the goal-directed behavior in that specific point in time might be counterproductive in the larger scheme of the self-regulation network. For example, a person might have set the goal of leading a healthier life. In addition, let’s assume that the person has formed the plan of walking up the stairs (goal-directed behavior) whenever she finds herself heading to the elevator when entering a building (situation). For several days, every time this person has entered the building when getting to work, the plan has successfully been implemented by automatically (i.e., without conscious effort) opting for walking up the stairs instead
of getting on the elevator. However, one morning this person unfortunately trips over the carpet in the apartment after getting up, resulting in a swollen ankle. Therefore, in the next few days walking up the stairs would be counterproductive to the healing of the swollen ankle and therefore counterproductive to the overall goal of taking care of one’s health. Due to the functional relation of implementation intentions’ components, as long as showing the goal-directed behavior is counterproductive to the overall goal, encountering the specified situation would not be expected to elicit the behavior (i.e., the person would be assumed to take the elevator).

In addition, the functional view of the relation between elements within the self-regulation networks might have a unique implication in regard to the goal-directed behavior (as part of an implementation intention) enhancing goal attainment. Imagine that the previously described person, who has formed the plan to take the stairs instead of an elevator in order to attain her goal of leading a healthier life, is on her way to a party. She arrives at the building and has been informed that the party is taking place in the third floor. She finds herself walking up the stairs, as the building has no elevator. In this case, even though the specified cue of her plan (i.e., seeing an elevator upon entrance into a building) was not encountered, the execution of the goal-directed behavior (i.e., walking up stairs) might activate the underlying goal intention of leading a healthier life and might in turn influence subsequent behavior related to the goal. ‘Our’ person might therefore opt for the vegetables with dip rather than for the chips when deciding what to eat at the party. This possible aspect of the role of the goal-directed behavior within a self-regulation network corresponds to the previously mentioned notion of implementation intentions’ components being able to activate the respective goal intention in a “bottom up” fashion.

**Accessibility of implementation intentions’ components proportional to the strength of goal commitment.** Present and past research has shown that forming implementation intentions is not associated with changes in goal commitment (e.g., Brandstätter, Lengfelder, & Gollwitzer, 2001; present findings). However, the strength of goal commitment as motivational property might have effects on the activation of implementation intentions’ components. In this vein, Förster, Liberman, and Higgins (2005) found that accessibility of goals varies as a function of the value and expectancy of the goal (i.e., goal commitment). Manipulating the expectancy of fulfilling a goal, the
payment associated with achieving the goal (i.e., value), and a combination of expectancy and value, respectively, resulted in enhanced accessibility of goal-related constructs only for participants in the high goal commitment condition. Although in the present research, controlling for the same level of goal commitment between conditions was necessary to rule-out alternative explanations of the plan activation effect (i.e., that the results might be due to changes in motivation), it would be interesting to investigate whether the accessibility of implementation intentions is proportional to the motivation to fulfill the goal. In terms of an assumed functional relation between the goal intention and the respective implementation intention, such effect would be expected. Accordingly, activation of implementation intentions’ components would be expected to vary according to a person’s commitment to the plan.

**Extension of Strategic Automaticity in Implementation Intentions**

The results of the present findings placed within the framework of a self-regulation framework are assumed to offer potential explanations and expand the understanding of automaticity in regard to implementation intentions. Up to now, implementation intentions have been shown to represent a case of (a) strategic automaticity (i.e., although forming an implementation intention is an intentional controlled process, once the specified cue is encountered, the goal-directed behavior is initiated automatically), and (b) goal-dependant, but flexible automaticity (i.e., although action control by if-then plans exhibits features of automatic processes, these effects are conditional on the strength and activation of the respective goal intention; see 1.4.7 Component Processes of Implementation Intentions herein). However, there have been no efforts of explanation in regard to the underlying processes of this automaticity.

According to the findings in Experiment 3, upon formation of an implementation intention both components (i.e., the if-part and the then-part) become highly activated as a result of an *automatic process*. This conclusion is based on the result that the plan activation effect was reliably obtained under conditions of high cognitive load. As automatic action initiation in regard to implementation intentions is the result of a single mental act that does not require frequent practice or repetition (Gollwitzer 1993, 1996, 1999), it can therefore not be attributed to a process or condition subsequent to encounter of the situation. Rather it appears that – based on the present findings – what underlies automaticity of action initiation afforded by
implementation intentions is the automatic activation of the plans’ components. This automatic plan activation effect is in turn attributed to a superior status of implementation intentions due to linking a specified situation to a goal directed behavior in an if-then format.

Further, the goal-dependent automaticity of implementation intentions is assumed to be a result of the dynamic between the currently demonstrated cognitive properties (i.e., automatic plan activation effect) and the motivational properties inherent in implementation intentions. This assumption has implications for the functioning of implementation intentions in regard to a possible interrupted course of implementation intentions and will be discussed in the following section.

**Plan Activation as Function of the Status of Goal Intentions and Implementation Intentions.** The focus of the present research was to investigate the basic cognitive properties of if-then plans; therefore, activation of the plans’ components was measured after formation of implementation intentions, but before their execution (i.e., before the situation was encountered and before the behavior was triggered). However, an interesting avenue for future research of implementation intentions would be to examine the cognitive properties of if-then plans upon fulfilment of the plan, as well as upon fulfilment of the underlying goal intention.

Past research on motivational sources, such as goals and intentions, has shown that accessibility of motivation-related constructs is a function of the source’s status (Goschke & Kuhl, 1993; Marsh, Hicks, Bink, 1998; Marsh, Hicks, & Bryan, 1999; Förster, Liberman, & Higgins, 2005). For example, Goschke and Kuhl (1993) found that accessibility from intentions persists as long as the intention is active. They made participants rehearse a series of actions and then informed them that they will either perform the actions (an intention) or observe another person performing them (no intention). Using a recognition test, they found faster and more accurate responses to the actions in the goal condition than in the no-goal condition, even when rehearsal of the actions was not possible in the intervening time. These results were interpreted as supporting the notion of persisting activation due to uncompleted intentions. Marsh, Hicks, and Bink (1998) extended the paradigm of Goschke and Kuhl and used a lexical decision task to examine the accessibility of intended actions both prior to and after completion, as well as for interrupted, uncompleted intentions. Replicating Goschke and
Kuhl, they found that before completion, accessibility of intended actions was enhanced relative to non-intended (i.e., to-be-observed) actions. The same enhanced activation was found for partially completed activities relative to non-intended actions. In addition, they found that once an intention is fulfilled, it is inhibited relative to more neutral material about which no intention has been formed. Förster, Liberman, and Higgins (2005) recently demonstrated the same effects in regard to active and fulfilled goals. In their studies, participants searched for a target stimulus among other stimuli. Lexical decision and Stroop measures of accessibility showed that accessibility of target-related words was enhanced prior to finding the target and reduced after finding it, relative a control, no-goal condition and relative to a condition in which the goal was not fulfilled. These findings were interpreted as evidence that goals enhance accessibility of goal-related constructs, which is maintained as long as the goal is active, and that goal fulfilment inhibits accessibility of goal-related constructs.

Within the present research, high activation of both parts of implementation intentions (i.e., the if- and then-component) was found for active (i.e., formed but not yet executed) implementation intentions and active (i.e., assigned but not fulfilled) goal intentions. The above mentioned findings raise the question if the level of activation of implementation intentions’ components would change (a) as a function of the respective goal intentions’ status as either unfulfilled or fulfilled and (b) as a function of implementation intentions’ status as either uncompleted, interrupted, or completed.

In reference to the proposed self-regulation network, the level of activation of any element within the system is assumed to be dynamic, due to the interplay of cognitive and motivational properties of the respective constructs, as well as due to the functionality of accessibility within the system. Therefore, and in line with above mentioned findings, it would be expected that activation of implementation intentions’ components remains as long as the respective goal intention is activated. Further, the activation of both components within an implementation intention would be expected to become inhibited (i.e., actively reduced) upon fulfilment of the goal. Inhibition is assumed to occur irrespective of the fact if the implementation intention itself had been executed or not (i.e., as remaining activation of the implementation intention would no longer be functional upon goal fulfilment and could potentially interfere with other, more necessary tasks the individual faces). In line with this prediction, Gollwitzer,
Trötschel, and Sumner (2002, Study 3) found that the beneficial effects of implementation intentions on a person’s recall of the specified could no longer be observed when the respective goal intention had been fulfilled (i.e., the participants were told that the assigned goal intention need no longer be realized as it had been performed by some other person). However, it remains to be experimentally explored if the fulfilment of the goal has a “cancelling” effect of the respective implementation intention not only on a behavioral level, but as well on an activational level.

Yet what is to be expected in terms of activation of implementation intentions’ components as a function of their own status? According to the present findings, upon formation an implementation intention, that is, before the goal-directed behavior becomes automatically triggered by encountering the specified situation, both components become highly activated, and activation strength appears to increase over time. In line with findings on intentions, it is expected that activation will remain as long as the implementation intention is active, that is, before it runs off. Following the trajectory of an implementation intention from its formation to its complete execution, the next stage of an implementation intention is its interruption by a person encountering the specified situation, but the execution of the goal-directed behavior being prevented. For example, the person with the goal of leading a healthy life and the plan to walk the stairs (goal-directed behavior) whenever standing infront of the elevator after entering a building (situation), enters the building and sees the elevator (i.e., encounters the situation). However, before the person can start walking up the stairs, a colleague enters the building and engages her in a conversation. What happens after the conversation? Will the goal-directed behavior still be activated and therefore realized even in the face of a time-delay between encountering the situation and eliciting the behavior? In line with present evidence that activation of the then-part of an implementation intention is not conditional on encounter of the if-part and is based on an automatic process that does not necessitate controlled effort, it is therefore assumed that the then-part will remain activated until it is fulfilled, even under conditions of delayed action.

One might argue however, that in the case of the present example, the behavior will not run off because the goal of living healthier becomes overridden by another goal (i.e., the social goal of being conversational). Hence, the goal of leading a healthier life,
and in turn the goal-directed behavior of walking up the stairs, becomes deactivated (i.e., inhibited). Yet, even in the case of deactivation of the primary focal goal (i.e., leading a healthier life) due to a “new” focal goal (i.e., social goal), it could be argued that the goal-directed behavior nevertheless stands the chance of becoming executed. Remember the previous discussion on a goal’s possible “conditional” activation, where it was argued that goals might be easily reactivated due to being linked to an implementation intention. In this vein, it is conceivable that after fulfilment of the social goal (i.e., after the colleagues finish their conversation and continue to go their own separate way), the inhibited health goal becomes reactivated through the still activated goal-directed behavior, and in turn the person does end up opting for the stairs instead of the elevator.

The next stage of an implementation intention is its fulfillment upon execution of the goal-directed behavior. In regard to the findings of Marsh et al. (1998, 1999) that once an intention is fulfilled it becomes inhibited, one might expect that the same would apply to implementation intentions (i.e., that both parts of the implementation intention become inhibited once the plan is fully executed). However, in regard to the notion of the functionality of accessibility within a self-regulation network, one might argue that as long as the goal intention, in whose service the implementation intention was formed, remains active, it would be functional for the implementation intention to remain activated (at least if repeated execution of the same implementation intention is possible and desirable).

Taken together, exploring the activation of implementation intentions’ components in consideration of the status of the implementation intention itself, as well as of the respective goal intention, remains to be another insight-promising research area on the mental representation of implementation intentions within self-regulation networks.

3.3.3 Summary

The aim of the outlined theory was not only to rid implementation intentions of their “concept” status, but also to understand how the self-regulatory tool operates as a part of a network composed by interconnected goal intentions and implementation intentions. The present section illustrates the potential of the proposed theory of self-
regulation networks to incorporate and advance the current understanding of how and why implementation intentions help overcome self-regulatory challenges on the way to goal attainment.

On the basis of present and past results, the theory incorporates: (a) the basic cognitive properties of each element within the network (i.e., goal intentions, and implementation intentions as compound structure of a specified situation and a goal-directed behavior), (b) the elements’ motivational properties, and (c) the interplay between the cognitive and motivational properties. Moreover, the results help to explicate several self-regulatory characteristics of implementation intentions in regard to each component (i.e., the specified situation and the goal-directed behavior) and their connection to respective goal intentions. In addition, the underlying cognitive perspective on motivational phenomena allowed for identifying several implications for future research within the framework of self-regulation networks. A further promising aspect of the proposed model lies in its potential to consolidate the enormous amount of existing findings on implementation intentions within the threefold interface between cognition, motivation, and action.

In sum, the proposed theory of a self-regulation network appears to have the potential to provide a promising theoretical framework for future research within the field of implementation intentions. Admittedly, however, the model constitutes merely a fruitful start, and additional conceptual and empirical efforts will be needed to further consolidate the value of the present outline.

3.4 POTENTIAL APPLICATIONS

In addition to their theoretical significance, the present findings have interesting application potentials. A first area of application is the workplace that is often characterized by the demands of complexity (Dörner, 2005; Pfiffner, 2004). People normally must manage multiple concurring tasks and objectives, often under conditions of multiple external inputs and distractions (e.g., by being seated in an open-space cubicle environment compared to one’s own office with a door to shut). The present results of implementation intention effects’ underlying cognitive processes (i.e., high activation of implementation intentions’ components) could be obtained under
conditions of high competition of means (Experiment 2), as well as under conditions of high cognitive load (Experiment 3). In other words, the formation of implementation intentions leads to a cognitive advantage despite a high level of internal (Experiment 2) and external (Experiment 3) noise. In both cases, the chronic activation of implementation intentions’ components effectively shielded the plans from different possibly distracting stressors. Therefore, the experimental conditions can be interpreted as reflecting “real life” situations that are replete with distractions (high external noise) and cognitively competing to-be-executed tasks (Experiment 3). Forming implementation intentions might therefore help to structure the diversity of demands, to secure the timely execution of work tasks and to shield one self from becoming overwhelmed by multiple stressors. In sum, these plans represent a promising tool to effectively master the challenges of increasing complexity.

A second field of application is the area of employee development. Although enormous sums are spent in this area, many people fail to reach their goals efficiently, thereby impacting the performance and successes of organizations and their business (Rust, 2004; Stahl, 2004). A common – and mostly legitimate – criticism in regard to the disparate employee development market is the very short-lived effect of “improvement,” with long-term effects being rather an exception. This shortcoming has often been attributed to the fact that personal development programs focus either solely on motivation, the tactics (i.e., strategies), or the objectives (i.e., goals) in order to enhance personal productivity and self-efficacy, along with organizational efficacy (Kets de Vries, 2004; Storch & Kruse, 2003). Missing in this regard are tools and systems that address and incorporate all three essential components in order to foster persistent goal striving and effective goal attainment. The proposed theory of self-regulation networks could therefore be turned into a promising platform for the development of effective personal and business consulting programs, as well as instruments that can drive long-term business results. The model exemplifies the different motivational and cognitive processes involved in effective goal attainment through the implementation of a self-regulatory tool that has empirically been proven to be effective, namely implementation intentions. Therefore, self-regulation networks incorporate the essential aspects and implications necessary for the design of programs and systems that incorporate motivational aspects, goals, and strategies.
3.5 CONCLUSION

The present research first and foremost attests to the enormous potential insights into motivational phenomena that follow from a cognitive perspective on motivation (Kruglanski, 1996; Shah & Kruglanski, 2000; Shah et al., 2002). It was herein postulated that both components of implementation intentions (i.e., the specified situation and the goal-directed behavior) are mentally represented and become highly activated upon formation of an implementation intention. The results of three experiments are consistent with this postulate. These results cast a novel light on the role of the specified then-component in implementation intentions and allow for additional insights on the operation of implementation intentions at the interface of cognitive and motivational properties. Furthermore, this research marks the first attempt to map out plans – in the form of implementation intentions – as knowledge structure (i.e., as cognitive representation characterized by particular contents and particular functions) and consequently, has set the basis for proposing a theory of self-regulation networks. The model depicts a systemic approach to incorporating present and past findings of motivational and cognitive aspects of implementation intentions and their respective goal intentions.

Taken together, the current investigation affords new empirical and theoretical insights into the current understanding of the functioning of implementation intentions and their role in enhancing goal attainment. Besides the significance of the present research to the field of implementation intentions, it is assumed to further provide implications for self-regulation research and theory.
4. REFERENCES


References 110

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American Psychologist, 54, 462-479.


5. **APPENDIX**

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C  Experiment 2: *Mean response latencies on lexical decision task for situation-, behavior-, and neutral words in implementation intention condition, goal-only condition, and yoked control condition.*
D  Experiment 2: *Mean response latencies for division of lexical decision task into two separate blocks.*
E  Experiment 3: *Results of questions on goal commitment*
F  Experiment 3: *Mean response latencies on lexical decision task for situation-, behavior-, and neutral words in implementation intention condition, goal-only condition, and yoked control condition.*
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M  Experiment 2 & 3: *Instructions for assignment of goal*
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Figure 11. A self-regulation network of goal intentions and implementation intentions.
Appendix B

Experiment 1

_Mean Response Latencies as a Function of Condition and Word Type in a Lexical Decision Task for Experiment 1 (N = 62)_

<table>
<thead>
<tr>
<th>Condition:</th>
<th>Implementation Intention Condition</th>
<th>Yoked Control Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Types:</td>
<td>(n = 31)</td>
<td>(n = 31)</td>
</tr>
<tr>
<td>Situation-Words</td>
<td>634 (93)</td>
<td>717 (154)</td>
</tr>
<tr>
<td>Behavior-Words</td>
<td>632 (101)</td>
<td>708 (129)</td>
</tr>
</tbody>
</table>

*Note.* Response Latencies in Milliseconds, Standard Deviations in parenthesis.
### Appendix C

#### Experiment 2

*Mean Response Latencies on a Lexical Decision Task as a Function of Condition and Word Type (Experiment 2, $N = 52$)*

<table>
<thead>
<tr>
<th>Word Types:</th>
<th>Implementation Intention Condition ($n = 30$)</th>
<th>Goal-Only Condition ($n = 28$)</th>
<th>Yoked Control Condition ($n = 15$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation-Words</td>
<td>564 (60)</td>
<td>632 (102)</td>
<td>655 (126)</td>
</tr>
<tr>
<td>Behavior-Words</td>
<td>563 (69)</td>
<td>643 (100)</td>
<td>646 (107)</td>
</tr>
<tr>
<td>Neutral Words</td>
<td>630 (96)</td>
<td>711 (104)</td>
<td>735 (153)</td>
</tr>
</tbody>
</table>

*Note.* Response Latencies in Milliseconds, Standard Deviations in parenthesis
Appendix D

**Experiment 2**

**Block 1**

*Mean Response Latencies on First Half of a Lexical Decision Task as a Function of Condition and Word Type (Experiment 2, N = 52)*

<table>
<thead>
<tr>
<th>Word Types:</th>
<th>Implementation Intention Condition (n = 30)</th>
<th>Goal-Only Condition (n = 28)</th>
<th>Yoked Control Condition (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation-Words</td>
<td>581 (88)</td>
<td>658 (141)</td>
<td>670 (138)</td>
</tr>
<tr>
<td>Behavior-Words</td>
<td>577 (85)</td>
<td>655 (104)</td>
<td>671 (149)</td>
</tr>
<tr>
<td>Neutral Words</td>
<td>617 (96)</td>
<td>746 (140)</td>
<td>753 (190)</td>
</tr>
</tbody>
</table>

*Note.* Response Latencies in Milliseconds, Standard Deviations in parenthesis

**Block 2**

*Mean Response Latencies on Second Half of a Lexical Decision Task as a Function of Condition and Word Type (Experiment 2, N = 52)*

<table>
<thead>
<tr>
<th>Word Types:</th>
<th>Implementation Intention Condition (n = 30)</th>
<th>Goal-Only Condition (n = 28)</th>
<th>Yoked Control Condition (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation-Words</td>
<td>547 (66)</td>
<td>607 (81)</td>
<td>640 (129)</td>
</tr>
<tr>
<td>Behavior-Words</td>
<td>548 (78)</td>
<td>631 (108)</td>
<td>620 (92)</td>
</tr>
<tr>
<td>Neutral Words</td>
<td>644 (127)</td>
<td>675 (100)</td>
<td>718 (151)</td>
</tr>
</tbody>
</table>

*Note.* Response Latencies in Milliseconds, Standard Deviations in parenthesis
Appendix E

Experiment 3: Results for Questions on Goal Commitment

Means collapsed across implementation intention condition and goal-only condition for goal commitment questionnaire (7-point scale)

Question 1
“How disappointed would you be in case you were not achieving this goal?”
$M = 5.08$

Question 2
“How important is the goal to you?”
$M = 5.31$

Question 3
“How feasible or easy do you think it would be for you to carry out this goal?”
$M = 5.28$

Question 4
“How committed do you feel to this goal?”
$M = 5.00$
Appendix F

Experiment 3

*Mean Response Latencies on a Lexical Decision Task Under Load as a Function of Condition and Word Type (Experiment 3, N = 36)*

<table>
<thead>
<tr>
<th>Word Types:</th>
<th>Implementation Intention Condition (n = 19)</th>
<th>Goal-Only Condition (n = 17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation-Words</td>
<td>711 (204)</td>
<td>962 (338)</td>
</tr>
<tr>
<td>Behavior-Words</td>
<td>744 (204)</td>
<td>1056 (371)</td>
</tr>
<tr>
<td>Neutral Words</td>
<td>795 (280)</td>
<td>1050 (312)</td>
</tr>
</tbody>
</table>

*Note.* Response Latencies in Milliseconds, Standard Deviations in parenthesis
Appendix G

Experiment 3

Block 1

*Mean Response Latencies on First Half of a Lexical Decision Task as a Function of Condition and Word Type (Experiment 3, N = 36)*

<table>
<thead>
<tr>
<th>Condition:</th>
<th>Implementation Intention Condition</th>
<th>Goal-Only Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Types:</td>
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<td>(n = 17)</td>
</tr>
<tr>
<td>Situation-Words</td>
<td>744 (262)</td>
<td>1025 (378)</td>
</tr>
<tr>
<td>Behavior-Words</td>
<td>803 (258)</td>
<td>1124 (369)</td>
</tr>
<tr>
<td>Neutral Words</td>
<td>814 (297)</td>
<td>1108 (290)</td>
</tr>
</tbody>
</table>

*Note.* Response Latencies in Milliseconds, Standard Deviations in parenthesis

Block 2

*Mean Response Latencies on Second Half of a Lexical Decision Task as a Function of Condition and Word Type (Experiment 3, N = 36)*

<table>
<thead>
<tr>
<th>Condition:</th>
<th>Implementation Intention Condition</th>
<th>Goal-Only Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Types:</td>
<td>(n = 19)</td>
<td>(n = 17)</td>
</tr>
<tr>
<td>Situation-Words</td>
<td>678 (218)</td>
<td>898 (327)</td>
</tr>
<tr>
<td>Behavior-Words</td>
<td>685 (190)</td>
<td>988 (407)</td>
</tr>
<tr>
<td>Neutral Words</td>
<td>775 (311)</td>
<td>992 (380)</td>
</tr>
</tbody>
</table>

*Note.* Response Latencies in Milliseconds, Standard Deviations in parenthesis
Appendix H

Experiment 1: Instructions for Generation Task (in German)
(All instructions appeared on the screen)

1. Generation of goals

Hallo!

Wir möchten Sie in diesem Experiment bitten einige Aufgaben durchzuführen, in denen Sie entweder bestimmte Sätze und Worte bilden sollen oder Ihr Urteil zu bestimmten Wörtern abgeben sollen.

Die Instruktionen zu jeder Aufgabe erhalten Sie vom Versuchsleiter entweder auf dem Bildschirm oder auf Papier. Falls Ihnen bei den Instruktionen irgendetwas unklar sein sollte, fragen Sie bitte ohne zu zögern nach. Der Versuchsleiter beantwortet gerne jede Frage! Sobald Sie allerdings mit einer Aufgabe angefangen haben, ist es wichtig, dass Sie diese nicht durch Fragen unterbrechen!


Im nächsten Schritt sollen Sie dieses Ziel dann zu einem Wort zusammenfassen. Dabei können Sie entweder ein Substantiv oder ein Verb verwenden. In unserem Beispiel würden Sie daher entweder "Prüfung" oder "bestehen" als Wort angeben. Welches Wort Sie verwenden sollte sich danach richten, welches Ihrer Meinung nach Ihr Ziel am besten beschreibt.

Bitte nicht vergessen:
Das von Ihnen genannte Ziel sollte
- ein Ziel sein, welches Sie zur Zeit haben,
  d.h. welches im Moment für Sie aktuell ist!
- innerhalb des Bereiches den wir Ihnen vorgeben, sollte
dieses Ziel das Wichtigste sein!

Instructions for fitness goal:
Wir möchten Sie im ersten Teil dieser Aufgabe bitten sich innerhalb des Bereichs 'Fitness' ein Ziel zu überlegen, welches Sie zur Zeit haben. Unter Fitness können alle Tätigkeiten die mit einer gesunden Lebensweise zu tun haben gemeint sein. Ziele innerhalb des Bereichs 'Fitness' könnten dementsprechend Tätigkeiten wie z.B. 'ernähren', 'bewegen', 'pflegen' oder 'trainieren' sein.

Nehmen Sie sich Zeit, um an Ihr aktuelles Fitnessziel zu denken, und vergessen Sie bitte nicht, dass es sich um Ihr wichtigstes Fitnessziel handeln sollte!

Instructions for interpersonal goal:
Wir möchten Sie im zweiten Teil dieser Aufgabe bitten sich innerhalb des Bereiches 'zwischenmenschlicher Beziehung' ein Ziel zu überlegen, welches Sie zur Zeit haben. Unter zwischenmenschlicher Beziehung kann entweder eine intime Partnerschaft (Ziel innerhalb der Partnerschaft oder Ziel eine Partnerschaft einzugehen), eine platonische Freundschaft oder die Beziehung zu einem Familienmitglied gemeint sein.
Ziele innerhalb des Bereiches 'Beziehung' könnten dementsprechend Tätigkeiten wie z.B. 'kennenlernen', 'verbessern' oder 'versöhnen' sein.

Nehmen Sie sich Zeit um an Ihr aktuelles Beziehungsziel zu denken, und vergessen Sie bitte nicht, dass es sich um Ihr wichtigstes Beziehungsziel handeln sollte.

Schreiben Sie jetzt Ihr Ziel im Bereich 'Fitness/Gesundheit' als Satz nieder. „Ich will... __________________________!“
Beschreiben Sie Ihr Ziel jetzt bitte in einem Wort: _______________

2. Generation of goal-directed behaviors and situations

Im nächsten Schritt möchten wir Sie bitten sich Handlungen bzw. Verhaltensweisen zu überlegen, welche Ihnen dabei helfen könnten Ihr soeben genanntes Ziel zu realisieren. Im Falle des Ausgangsbeispiels (Studienziel: 'bestehen') könnten z.B. 'lernen' oder 'konzentrieren' zielrealisierende Handlungen darstellen. Denken Sie bitte auch hier daran, dass Sie nur ein Wort angeben!

Nennen Sie jetzt nacheinander 4 Handlungen bzw. Verhaltensweisen, welche Sie zu Ihrem Fitnessziel führen könnten. (Formulieren Sie die Handlungen in einem Wort!)

1. _______________
2. _______________
3. _______________
4. _______________

Als nächstes bitten wir Sie, sich zu den genannten zielrealisierenden Handlungen jeweils eine relevante Situation zu überlegen, in welcher Sie diese Handlung ausführen wollen. Im Falle des Beispiels könnte für die zielrealisierende Handlung 'lernen' z.B. die 'Bibliothek' oder ein 'Schreibtisch' eine relevante bzw. günstige Situation darstellen, um auf die bevorstehende Prüfung zu lernen.

Wir werden Ihnen jetzt nacheinander die von Ihnen vorhin genannten Handlungen nochmals zeigen und Sie jeweils bitten, eine relevante Situation für die Handlung zu nennen.

Nennen Sie jetzt bitte zu jeder der von Ihnen genannten zielführenden Handlung eine relevante Situation, in welcher Sie diese Handlung zeigen könnten. (Nennen Sie jeweils nur ein Wort!)

Zielführende Handlung: _______________
Relevante Situation: _______________

3. Formation of implementation intentions

Im letzten Teil dieser Aufgabe werden wir Ihnen nacheinander die von Ihnen genannten Handlungen mit jeweils dazu aufgeführten Situationen zeigen.
Ihre Aufgabe wird es sein, die jeweilige Situation und Handlung in einem
“**Und immer wenn** Situation X, dann werde ich sofort die Handlung Y ausführen!” Format in einen vollständigen Satz zu schreiben.

Im Falle unseres Beispiels würden Sie demnach folgendes sehen:

Situation: **Schreibtisch**
Handlung: **lernen**

Sie würden dann z.B. folgendes in die gekennzeichnete Leerzeile schreiben: “**Und immer wenn ich an meinem Schreibtisch sitze**, dann werde ich sofort **lernen**!”

Achten Sie bitte darauf, dass Sie im formulierten Satz die *genau gleichen* Wörter wie für die ‘Situation’ und die ‘Handlung’ verwenden!!! (Falsch wäre dann z.B. wenn Sie als Handlung ’laufen’ genannt hätten und in der “**Und immer wenn…, dann…**” Formulierung ’zu Fuss gehen’ verwenden würden.)

Bitte schreiben sie jetzt die von Ihnen genannten Situationen und Handlungen für Ihr Beziehungsziel jeweils in einen vollständigen Satz nach folgendem Format:

**Und immer wenn** Situation X, dann werde ich sofort Handlung Y ausführen!

Situation:
Handlung:

**Und immer wenn** ________________________________,
dann werde ich sofort ______________________________.
Appendix I

Experiment 1: Instructions for Word-List (in German)

Hallo!

Wir möchten Sie in diesem Experiment bitten einige Aufgaben durchzuführen, in denen Sie Ihr Urteil zu bestimmten Sätzen und Worten abgegeben sollen.

Die Instruktionen zu jeder Aufgabe erhalten Sie vom Versuchsleiter entweder auf dem Bildschirm oder auf Papier. Falls Ihnen bei den Instruktionen irgendetwas unklar sein sollte, fragen Sie bitte ohne zu zögern nach. Der Versuchsleiter beantwortet gerne jede Frage! Sobald Sie allerdings mit einer Aufgabe angefangen haben, ist es wichtig, dass Sie diese nicht durch Fragen unterbrechen!

In dieser Aufgabe werden Sie nacheinander einzelne Worte auf dem Bildschirm sehen. Die Worte sind entweder richtig oder falsch geschrieben. Unter jedem Wort befindet sich zudem eine Leerzeile.

Lesen Sie bitte zunächst das präsentierte Wort und entscheiden Sie dann, ob es falsch oder richtig geschrieben ist. Wenn das Wort richtig geschrieben ist, übertragen Sie es bitte auf die darunter stehende Linie. Für den Fall, dass das Wort falsch geschrieben ist, korrigieren Sie bitte die Rechtschreibung beim Übertragen des Wortes. Anschliessend fahren Sie nach demselben Schema mit dem nächsten Wort fort.

Seien Sie bitte so sorgfältig wie möglich!
Appendix J

Experiment 1: Instructions for Lexical Decision Task (in German)

Willkommen zum nächsten Teil des Experiments!

In diesem Abschnitt wird untersucht, wie schnell und wie genau Personen bestimmte Worte erkennen.


Aufgabe in diesem Experiment ist es, so schnell als möglich zu entscheiden, ob das Item, das auf dem Bildschirm erscheint, ein Wort ist oder nicht.

Während grundsätzlich in solchen „Wortentscheidungsaufgaben“ untersucht wird, wie schnell Worte von Nichtworten unterschieden werden, wollen wir mit dieser Aufgabe herausfinden, wie schnell persönlich bedeutungsvolle Wörter im Durchschnitt erkannt werden.

Um Ihnen die Aufgabe zu erleichtern, werden die Worte verwendet, welche sie im ersten Teil des Experiments genannt haben.

Der Ablauf der Aufgabe sieht folgendermaßen aus: Zunächst wird ein Kreuz (+) in der Mitte des Bildschirm erscheint. Als nächstes wird entweder ein Wort (Koffer) bzw. zwei Wörter (Beifall klatschen) oder ein Nichtwort (Kleig) bzw. zwei Nichtwörter (Huld stneichln) auf dem Bildschirm erscheinen.

Ihre Aufgabe ist es entweder: die D-Taste/K-Taste zu drücken wenn es sich um ein WORT bzw. zwei WÖRTER handelt, oder die K-Taste/D-Taste zu drücken wenn es sich um ein NICHTWORT bzw. zwei NICHTWÖRTER handelt. Es ist wichtig, dass Sie so SCHNELL und SORGFÄLTIG wie möglich reagieren!

Sobald Sie Ihre Antwort abgegeben haben, wird das Item verschwinden und der nächste Durchgang wird beginnen.

Nochmals zur Wiederholung:
Zuerst sehen Sie ein Kreuz (+).
Danach ein WORT (Koffer) bzw. zwei WÖRTER (Beifall klatschen)
or ein NICHTWORT (Kleig) bzw. zwei NICHTWÖRTER (Huld stneichln).

Sie drücken die D-/K-Taste, wenn es deutsche WÖRTER sind oder Sie drücken die K-/D-Taste, wenn es NICHTWÖRTER ist. Und Sie reagieren so schnell und genau wie möglich!!!

Sie werden zunächst einige Probendurchgänge erhalten, um sich mit der Aufgabe vertraut zu machen.
Appendix K

Experiment 2: Instructions for Pilottesting of Words

For this experiment, we will ask you to read a series of words and write down the first few things that "pop" into your mind after you have read each one.

So for instance, you read the word:

"Ball"

then you write down as many things as you can think of after reading Ball, such as:

    team
    racket
    basket
    play

You will be given 20 seconds to write down the words that pop into your mind.

Please write the words down in the order they come into mind in a descending order from top to bottom. So, in the above example, team is the first thing that came into mind, racket is the next thing and so on.

Then, the experimenter will ask you to turn the page and start on the next word. Please repeat this process until you reach the end of the booklet.

IT IS IMPORTANT that you write down what simply comes into your mind after reading each word. DO NOT try to be creative. If you find yourself unable to generate more than a few responses to particular words, that is fine. It is assumed that you will have a different number of responses to each word.

***The experimenter will signal when it is time to begin***
Appendix L

Experiment 2 & 3: Materials for Goal and Plan Assignment

Goal Intention: "I want to be socially integrated."

Implementation Intentions:

1. "If I hear about a **party** that sounds cool, then I will **find** someone to join me."
2. "If I am told about a **fundraiser** for charity, then I will **participate.**"
3. "If I am at the **gym**, then I will **introduce** myself to a fellow student."
4. "If I see a **student** sitting alone, then I will **approach** her/him."
5. "If I meet a **person** who's troubled, then I will **offer** my advice."
6. "If there is a **show** on TV that's boring, then I will **call** my parents."

To-Be-Completed Implementation Intentions:

1. IF I hear about a ______ that sounds cool, THEN I will ______ someone to join me!
   
   List 1  List 2
   A. movie  A. find
   B. car  B. turn
   C. party  C. write
   D. wine  D. collect

2. IF I am told about a ______ for charity, then I will ______!
   
   List 1  List 2
   A. flyer  A. believe
   B. gathering  B. participate
   C. roller-coaster  C. hesitate
   D. fundraiser  D. procrastinate

3. IF I am at the ______, THEN I will ______ myself to a fellow student!
   
   List 1  List 2
   A. gym  A. bump
   B. store  B. compare
   C. doctor’s  C. suggest
   D. theatre  D. introduce
4. IF I see a ______ sitting alone, THEN I will ______ her/him!

<table>
<thead>
<tr>
<th>List 1</th>
<th>List 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. lady-bug</td>
<td>A. approach</td>
</tr>
<tr>
<td>B. student</td>
<td>B. ignore</td>
</tr>
<tr>
<td>C. confederate</td>
<td>C. support</td>
</tr>
<tr>
<td>D. stranger</td>
<td>D. advice</td>
</tr>
</tbody>
</table>

5. IF I meet a ______ who’s troubled, THEN I will ______ my advice!

<table>
<thead>
<tr>
<th>List 1</th>
<th>List 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. lawyer</td>
<td>A. take</td>
</tr>
<tr>
<td>B. controller</td>
<td>B. keep</td>
</tr>
<tr>
<td>C. hammer</td>
<td>C. offer</td>
</tr>
<tr>
<td>D. person</td>
<td>D. succeed</td>
</tr>
</tbody>
</table>

6. IF there is a ______ on tv that’s boring, THEN I will ______ my parents!

<table>
<thead>
<tr>
<th>List 1</th>
<th>List 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. candy</td>
<td>A. ask</td>
</tr>
<tr>
<td>B. poster</td>
<td>B. call</td>
</tr>
<tr>
<td>C. show</td>
<td>C. present</td>
</tr>
<tr>
<td>D. glare</td>
<td>D. find</td>
</tr>
</tbody>
</table>
Appendix M

Experiment 2 & 3: Instructions for Assignment of Goal

Hello! Today we will be asking you to participate in a few tasks involving word-related judgments.

You will be given all of your directions for each task either on sheets of paper distributed by the experimenter or over the computer screen. Please always feel free to ask questions regarding the task instructions, as sometimes people do have questions. However, once the tasks have started please do not interrupt the task by asking questions.

Starting a new semester is a good time to set personal goals. In your first task you will be reading a phrase that denotes a helpful goal for students. Please adopt the following goal!

Please read the below goal phrase very carefully

"I want to be socially integrated."

Next, please silently say the goal to yourself.

Now we would like you to please write down the goal phrase as accurately as possible in the space provided below.

"________________________________________________________________________"
Appendix N

Experiment 2 & 3: Instructions for Assignment of Plans

Welcome to the next task!

Research has shown that forming specific PLANS is a very effective way to fulfill a goal.

In this task, you will be seeing specific PLANS. Each PLAN will appear on the screen one at a time for a duration of 10 seconds each. Once the 10 seconds are up, the computer will present the next effective PLAN.

Please read each word of the PLAN carefully, and then say the PLAN silently to yourself. Take the entire 10 seconds on each PLAN as you might be asked questions about it later.

- appearance of plans (see Appendix L) -

Those are all of the PLANS! For your next task, you will be seeing the PLANS you just saw again, presented one at a time. However, this time 2 words from each PLAN will be missing. Below the plans you will see 2 sets of words.

Say you saw this plan in the previous task: "If it is raining outside, then I will bring my umbrella."

Now in this part of the task you will be seeing the same plan with a couple of words missing, along with two word lists.

"If it is ___(1)___ outside, then I will ___(2)___ my umbrella."

<table>
<thead>
<tr>
<th>List 1</th>
<th>List 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. burning</td>
<td>A. open</td>
</tr>
<tr>
<td>B. raining</td>
<td>B. hide</td>
</tr>
<tr>
<td>C. sunny</td>
<td>C. forget</td>
</tr>
<tr>
<td>D. cold</td>
<td>D. bring</td>
</tr>
</tbody>
</table>

You will note that each blank corresponds to a particular list (e.g. Blank 1 goes with List 1). Your task is to choose the word from each list that corresponds to the plan that you just saw in the first part of the task. Please select the correct word from List 1 before selecting from List 2. You will not be able to move on until you select the correct words in the proper order.

So in this case you would first hit the "B" key for blank (1), and then hit the "D" key for blank (2).

- appearance of to-be-completed plans (see Appendix L) -
Appendix O

Experiment 2 & 3: Materials for Word List

(Order of words was randomized.)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>subtrakt</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>import</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>call</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>person</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>applicater</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>fundraiser</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>show</td>
<td>19</td>
</tr>
<tr>
<td>8</td>
<td>offer</td>
<td>20</td>
</tr>
<tr>
<td>9</td>
<td>participate</td>
<td>21</td>
</tr>
<tr>
<td>10</td>
<td>annimal</td>
<td>22</td>
</tr>
<tr>
<td>11</td>
<td>gym</td>
<td>23</td>
</tr>
<tr>
<td>12</td>
<td>biscuit</td>
<td>24</td>
</tr>
</tbody>
</table>
Appendix P

Experiment 2 & 3: Instructions for Word List

1. Instructions for goal-only condition

In this next task you will be seeing a series of words. The words are either spelled correctly or incorrectly. Next to each word you will find a blank line. First, please read the first word in the list, then decide if it is misspelled or not. If the word is spelled correctly, please copy the word on the line next to it. In the case of a misspelled word, please correct the spelling when writing the word down. After this continue with word number 2 and follow the same procedure. Please be as accurate as possible!

2. Instructions for control condition (this one only applies to Experiment 2)

Hello! Today we will be asking you to participate in a few tasks involving word-related judgments.

You will be given all of your directions for each task either on sheets of paper distributed by the experimenter or over the computer screen. Please always feel free to ask questions regarding the task instructions, as sometimes people do have questions. However, once the tasks have started please do not interrupt the task by asking questions.

In this task you will be seeing a series of words. The words are either spelled correctly or incorrectly. Next to each word you will find a blank line. First, please read the first word in the list, then decide if it is misspelled or not. If the word is spelled correctly, please copy the word on the line next to it. In the case of a misspelled word, please correct the spelling when writing the word down. After this continue with word number 2 and follow the same procedure. Please be as accurate as possible!
Appendix Q

Experiment 2 & 3: Instructions and Materials for Questions on Goal Commitment

Now we would like you to answer a couple of questions about the goal: "I want to be socially integrated."

Please read the following questions very carefully and answer as honestly and thoughtfully as you can. You will indicate your answer to each question by using the rating scale below each question. Please circle the number that indicates your answer.

"I want to be socially integrated."

1. How disappointed would you be in case you were not achieving this goal?

   low  medium  high
   1------2------3------4------5------6------7

2. How important is the goal to be socially integrated to you?

   low  medium  high
   1------2------3------4------5------6------7

3. How feasible or easy do you think it would be for you to carry out this goal?

   low  medium  high
   1------2------3------4------5------6------7

4. How committed do you feel to this goal?

   low  medium  high
   1------2------3------4------5------6------7
Appendix R

Experiment 2 & 3: Instructions for Lexical Decision Task

In this part of the experiment, you will be asked to judge as quickly as possible whether certain items that appear on the screen are words or not.

First, you will see a cross (+) appear on the center of the screen.

Then, a word (roof) or a non-word (lart) will appear on the screen and you will either:
Press the YES key if the item is a WORD
Press the NO key if the item is a NON-WORD.

Remember to respond as quickly and accurately as possible!

When you make your response, the item will disappear from the screen and a new trial will begin.

Remember: First, you will see a cross (+). Next, a WORD (roof) or a NONWORD (lart). You will press the YES key if it is an English word or you will press the NO key if it is not. And respond as quickly and accurately as possible!

Now, you will have 6 practice trials to familiarize yourself with the task.
Appendix S

**Experiment 3: Instructions for Pattern Memorization Task**

(Instructions for the pattern memorization task were preceded by instructions for the lexical decision task, see Appendix R)

In addition to the previous task, you will have another task to perform at the same time.

In this task, you will be seeing different background patterns appearing on the screen. Your task will be to **count how many DIFFERENT patterns you have seen.** You will be asked to make judgments about the patterns later.

Here are a couple examples of these background screens.

```
[Example background pattern]
```

Remember, your task is to count the different backgrounds for later decisions. Instructions for these decisions will appear later in the experiment.

The experimenter will now give you the real trials with both tasks. If you have any questions, please take this time to ask the experimenter before continuing.

You will be performing both tasks we just described - the word task and the pattern task - at the same time.

In other words, while you are making **WORD** and **NON-WORD** decisions, you will also be counting how many different **background patterns** occur.

Please remember to be as quick and accurate as possible!!!
Appendix T

Experiment 3: Instructions for Pattern Recognition Task

Now, we would like you to make decisions about the background patterns you saw and counted.

Specifically, we would like you to:

- Press the 'YES' key if you saw the pattern before (in the experiment) and
- Press the 'NO' key if you did not.

Please be as accurate as possible!