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Organizing Facets of Self-Regulation: Goals, Process Phases, Obstacles and Mechanisms

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Abstract

Across psychology, literature on self-regulation provides a variety of different terms and conceptualizations. These perspectives converge in the general assumption that self-regulation embodies goal-directed behavior. Beyond, theoretical views diverge on multiple dimensions. The complexity of differences makes an integration into one narrow definition of self-regulation difficult. In contrast to many previous approaches, the present work takes a diversity perspective and frames different conceptualization as multiple facets of self-regulation. Differences between self-regulatory facets are thereby described along four key aspects: (a) the role and the nature of goals, (b) the temporal dynamics of goal-directed behavior, (c) the obstacles and target processes that may interfere with goal pursuit and (d) the mechanisms for overcoming obstacles and modulating target processes. I close by discussing the advantages of the diversity approach for conceptual, empirical and methodological questions of past and future research on self-regulation.

Keywords

Self-regulation, self-control, executive function, cognitive control, emotion regulation

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1 Introduction

An overwhelming amount of studies indicates that self-regulation relates to physical and mental health, as well as to academic and professional success (for a review see Vohs/Baumeister 2011). Based on this evidence, psychologists widely agree that self-regulation is one of the most important skills in humans. Therefore, self-regulation became a major topic in many disciplines of psychology during the last four decades. However, what self-regulation actually is, remains subject of an ongoing debate. Most researchers would agree that self-regulation describes what individuals choose to do and how they try to accomplish their goals. Beyond, these perspectives considerably diverge on a number of dimensions that have received only little systematic and explicit elaboration.

The variety of self-regulation definitions and models matches the large pool of heterogeneous research questions about self-regulation. Cognitive psychologists, for example, usually study the contributions and interactions of basic cognition, motivation and affect to goal-directed behavior. In turn, biopsychology focuses on the underlying physiological correlates. Developmental psychology investigates how and why goal-directed processes change with increasing age. Personality psychology examines the role of individual characteristics in explaining why some people usually do quite well in attaining their goals, whereas others fail to behave goal-directedly under comparable conditions. Social psychologists put more emphasis on the interplay between context and individual factors in order to explain when and how people fail to do what they want although they possess the necessary knowledge and opportunities and although they succeed on other occasions. Finally, applied domains of psychology are interested in the role of self-regulation for learning (pedagogical psychology), its role for the emergence, maintenance, remission and treatment of psychopathology (clinical psychology), and the implications of self-regulation for working life (work and organizational psychology) as well as health behavior (health psychology).

In the face of this heterogeneity, it seems little surprising that theoretical frameworks propose numerous facets of self-regulation (e.g. Nigg 2016). For example, general and social psychology refers to self-regulation (e.g. Caver/Scheier 1998; Bandura 1991); self-control (e.g. Hofman et al. 2012; Kotabe/Hofmann 2015), action control (e.g. Heckhausen/Gollwitzer 1987; Aizen 1985; Fishbein/Ajzen 2010; Hommel 2009), goal setting, goal striving and goal implementation (e.g. Locke/Latham 1990; Kruglanksi et al. 2002; Gollwitzer 1999; Gollwitzer/Brandstätter 1997), volition (e.g. Kuhl 1987, 2000; Kuhl/Goschke 1994; Goschke 2012; Gollwitzer 1990). Personality and temperament psychology addresses self-regulation, effortful control (e.g. Rothbart/Bates 2006; Eisenberg et al. 2011), persistence and engagement (e.g. Goldsmith et al. 1987); self-regulatory strength (e.g. Baumeister et al. 2007), resisting temptations and willpower (e.g.

Metcalfe/Mischel 1999). Cognitive (developmental) psychology deals with cognitive control (e.g. Munakata et al. 2012; Braver et al. 2014; Goschke 2012), attention control or executive attention (e.g. Rueda et al. 2005), executive functions (e.g. Diamond 2013; Garon et al. 2008), decision making (e.g. Byrne 1998), metacognition or self-reflection (e.g. Flavell 1979; Lai 2011; Lyon/Zelazo 2011). Clinical (developmental) psychology and other domains focus on emotion regulation (e.g. Gross/Thompson 2007; Holodynski et al. 2012; Cole et al. 2004), coping (Aldwin et al. 2011; Skinner/Zimmer-Gembeck 2007), stress regulation (Gunnar/Davis 2003), primary and secondary control (Heckhausen et al. 2010), and accommodation and assimilation (Brandstädter/Rothermund 2002).

Given this diversity, describing self-regulation as a unified concept remains difficult. One reason may lie in the inconsistencies in terminology. The multidimensionality of conceptual differences may be a second point. Relatedly, researchers' approach to cross-disciplinary integration was often convergent in nature. According to the convergent approach, self-regulation is seen as a narrow concept. From this perspective, integration means to find the one and only definition of self-regulation. This integrative definition is either based on a small number of features that all facets share (i.e. the intersection of facets) or it results from the prioritization of features in favor for one research field and thus is biased by the peculiarities of some few theories. Disadvantage of the convergent approach is that the idiosyncratic ideas of most of the theories get lost, although they would probably inspire novel research ideas in other domains. The diversity approach provides an alternative by viewing self-regulation as a broader concept that subsumes multiple facets. From this perspective, integration means to define only some global, but critical aspects of self-regulation. These key aspects draw a broad frame for all self-regulatory aspects and not all theories necessarily have to address all aspects explicitly. In this respect, the diversity approach allows for keeping the peculiarities of accounts from diverse fields of psychology. These critical aspects may then serve as a basis for a taxonomy that allows for a more precise and systematic communication about single facets and their relations. So far, there is no common agreement on critical aspects for the comparison of self-regulation facets.

In this article, my aim is two-folded. First, I aim to describe self-regulation from a diversity perspective. Therefore, I will illustrate the rich variety of self-regulatory facets strategically selecting a small group of common, but heterogeneous theories stemming from multiple disciplines of psychology. Second, I aim to illuminate these self-regulatory facets under consideration of four key aspects. These key aspects are: (a) the role and the nature of the goals that define when self-regulation is successful, (b) the phases that may unfold during the process of goal pursuit, (c) the obstacles that may interfere with goal attainment and make self-regulation necessary, and (d) the mechanisms of self-regulation to overcome possible obstacles. I will show how previous definitions of self-regulation differentially prioritized these four aspects, framing self-regulation as a certain type of goal, as a certain phase within goal-pursuit, as overcoming a certain type of obstacle, or as a specific tool that is helpful for goal-attainment. I suggest that these four key aspects may provide a broad framework for the conceptual diversity. This framework may help to systemize inter-facet relations and foster cross-disciplinary integration. For each key aspect, I will first describe the respective aspect in more detail. Subsequently, I will illustrate how different perspective on self-regulation referred to the respective issue.

2 Self-regulation as goal-directed behavior

In a complex and constantly changing environment individuals must always decide what they do and when they do something. They can do so based on reflexes, habits, learnt associations between reactions and consequences, or based on goals (Goschke 2012). Goal-directed behavior is what the majority of frameworks would broadly define as self-regulation (Caver/Scheier 1998; Bandura 1991). Goals describe what an individual wants to reach now or in the future including criteria, when this state is reached, i.e. when self-regulation is successful and when self-regulation has failed. In some theories, goals also entail what has to be done to reach this goal (Goschke 2012). Hence, many self-regulatory facets implicitly or explicitly address goals as a critical feature of self-regulation. According to this view, differences in self-regulation depend (a) on the content and features of the goals that individuals hold and (b) on the processes that are involved in goal activation, goal formation, and goal striving. In the following sections (section 2.1 and 2.2), I will focus on the first issue and turn to the second issue in the subsequent section (section 3).

In self-regulation theories goals' content range from narrow task demands focusing on the immediate present to life-long objectives with a broader temporal horizon (see Austin/Vancouver 1996 for detailed review on taxonomies of goals and goal dynamics). Some self-regulatory facets address goals in a specific domain, such as finding solutions for new cognitive problems (Zelazo et al. 1997; Munakata et al. 2012), reaching certain steps within one's life course and personal development (Brandtstädter/Rothermund 2002; Heckhausen et al. 2010), academic or professional success (Schunk/Zimmerman 1994; Locke/Latham 1990), changing one's immediate emotions (Gross/Thompson 2007), mastering threatening or challenging life conditions (Aldwin et al. 2011; Gunnar/Davis 2003), or changing one's behavior for example in order to promote long-term health (Fong/Hall 2010). Other facets conceptualize self-regulation in a broader sense and do not focus on goals in a certain domain (Caver/Scheier 1998; Bandura 1991; Kuhl 2000; Kuhl/Goschke 1994; Baumeister et al. 2007). Conceptually, goals unify features of mental representation that cognitive psychologist usually deal with (e.g. strength of representation, allocation of resources, abstractness) and features that are of particular interest in the psychology of motivation, social and personality psychology (e.g. values, control expectations). There is scientific consensus that both, cognitive and motivational goal features, interact and affect success of self-regulation, although they receive different amounts of attention depending on the origin of the respective self-regulation theory.

2.1 Cognitive features of goals

From a cognitive perspective, goals refer to mental representations of desired objectives (static or dynamic) and attainment means within hierarchically organized, associative networks (Kruglanski et al. 2002). At higher levels of hierarchy, superordinate goals are abstract and linked to concrete subordinate goals and specific attainment means on lower levels. Superordinate goals are global and decontextualized (e.g. healthy life style) in the form of principles that refer to the meaning and importance of an action (i.e. why an individual performs an action; described as 'be-goals' by Carver/Scheier 1998). In contrast, subordinate goals are more specific (e.g. eating more vegetables) and represent actions or behavioral programs that also convey 'how' an individual wants to attain

the goal within a certain context (described as 'do-goals' or 'motoric control goals' by Carver/Scheier 1998). Holding an abstract goal makes a goal independent from a certain context so that the individual becomes less distractible to situational obstacles, less impulsive so that pursuing the goal becomes more consistent and stable across time and contexts. Taking a more abstract level may also help to dissolve conflicts between two concrete sub-goals. In contrast, concrete goals specify guidelines what has to be done next within a specific context. Thus, sub-goals may make attainment easier and faster thereby enhancing motivation and self-efficacy. In a similar vein, they support success monitoring and evaluation by providing specific criteria for goal approach within the immediate situation. As goals at lower levels of hierarchy refer to the respective context for the next step, concrete goals make the individual more responsive to the environment and thereby enhance the detection of situational changes that otherwise would be missed. In contrast to abstract goals, concrete goals play a less critical role for the identity of an individual. Hence, a higher goal concreteness may facilitate to give up a goal and may have less negative impact if the individual does not attain the respective goal. The optimal level of abstraction depends on the specific circumstances. In this regard, flexibly shifting between levels can be seen as one mechanism of self-regulation, whereas general biases in the direction of global or concrete goals may lead to self-regulation failure (see section 5 for more details).

Beyond abstractness, theories also address other structural details of goal networks as critical for self-regulation such as the number, nature and strength of a goal's associations and its representation strength. Goals with a higher number of associated means and sub-goal influences are retrieved more often. The usual inhibitory links to alternative goals lead to the allocation of resources in order to attain this goal and to neglect other goals (Kruglanski et al. 2002). Stronger and more associations between goals and sub-goals or means ease flexible goal pursuit under changing conditions. Stronger goal representations make individuals less vulnerable to delays and distractors and thus make successful self-regulation more likely (Munakata et al. 2012).

2.2 Motivational features of goals

In motivational terms, goals circumscribe the force that drives behavior into a certain direction and sets the individual into a state of 'wanting' (Eccles/Wigfield 2002). In this context, several accounts distinguish between goals addressing the approach to an objective focusing on the advantages of this objective (promotion) and goals addressing the avoidance of an objective emphasizing the disadvantages of the objective (prevention: Carver/Scheier 1998; Higgins et al. 2007). Whether an individual forms a prevention or a promotion goal may depend on the context, but also on stable inter-individual differences. The motivational tendency or goal commitment varies in strength in that the driving force for some goals may be higher than for others. Goals with a stronger motivational tendency result in higher engagement, higher persistence in goal striving, and higher emotional reactivity to successful or unsuccessful striving (Locke/Latham 1990). The motivational strength of a goal results from the weighted combination of the subjective desirability and feasibility of a goal.

The desirability of a goal can be influenced by internal factors and external factors (e.g. Ryan/Deci 2001; Higgins 1987). These factors may be currently present (e.g. a currently activated motive, a task instruction by the experimenter) or an individual may

anticipate them proactively (e.g. while no external task is given and no motive is active; see also Goschke 2012; Bandura 1991). With regard to internal factors, motivation to attain a goal may arise from physical needs (e.g. for air, food, drink, shelter, warmth, sex, sleep) and motives such as safety (e.g. protection, limits, stability), belongingness (e.g. family, affection, relationships, work group), esteem (achievement, status, responsibility, reputation), and self-actualization (e.g. personal growth and fulfillment; see Eccles/Wigfield 2002 for an overview). These goals maybe motivated by positive affects that are linked to a certain goal (hedonic or pleasure-based) or by the personal importance of the goal for the individual's identity (eudaimonic or meaning-based: Ryan/Deci 2001). In this context, some theories of emotion regulation and coping point to the critical role of basic needs as a source for self-regulation (also called need-oriented coping: Aldwin et al. 2011; Gross/Thompson 2007) in that individuals strive to avoid harm and promote pleasure (but see Millgram et al. 2015). In turn, meaning-based motivation typically built on motives in relation to safety, belongingness, esteem and self-actualization (Austin/Vancouver 1996). Individuals' evaluations of goal desirability may also vary with the temporal frame that an individual takes (Fong/Hall 2010; Karniol/Ross 1996). A behavior may have valuable long-term consequences, but may be less attractive from a short-term perspective. In turn, external guidance for what is desired may have the form of prompts given by parents, acknowledgments of a life partner and friends, prohibitions, duties and rights defined by school, working place, political systems, religious institutions, or other explicit or implicit cultural conventions, but also tasks instructions given by an experimenter in the laboratory.

The distinction between external and internal sources of goals is artificial and not clear-cut. External demands may become an internal source for goals when individuals internalize a value and accept it as one's own (introjection) or if they identify themselves with the external demands and find them valuable and important for the self (integration: Ryan/Deci 2000). Whether or not an individual actually internalizes external requirements as personal goals largely depends on the individual's willingness to adhere to the respective demands, but also on individual's ability to detect what is required by others in a certain situation and to maintain this information. Difficulties in one of these domains results in a divergence between an individual's personal goals and external demands. Under these circumstances, theories differ in the evaluation of self-regulatory success. Self-regulation theories emphasizing external demands in goal formation usually rely on external evaluation criteria (Kopp 1982; Metcalfe/Mischel 1999; Kochanska 1991; Aldwin et al. 2011; Skinner et al. 2007; Gunnar/Davis 2003; Rothbart/Bates 2006; Eisenberg et al. 2011). These theories consider self-regulation to be important because it allows individuals to behave in accordance with external demands as defined by others (e.g. the current scientific opinion about what promotes psychological and physiological integrity, social norms about what are valuable goals such as positive social relationships, productivity, and achievement,). In this respect, internal factors may play a minor role in the evaluation of successful self-regulation. Other accounts, however, stress individual goals resulting from internal sources (Bandura 1991; Kuhl 2000; Kuhl/Goschke 1994; Goschke 2012; Gollwitzer 1990) or at least stress the independence of self-regulatory success from external criteria (Gross/Thompson 2007). Relatedly, Ryan/Deci (2000) distinguish between intrinsic and extrinsic motivation. Intrinsic motivation for a goal emerges from the benefits of goal pursuit (rather than from attaining it). These goals form from internal motives for esteem and self-actualization independent of the

social and physical environment (Ryan/Deci 2000). Actively pursuing intrinsic goals is usually associated with the experience of agency (Caver/Scheier 1998) and the experience of flow (Csíkszentmihályi 1990). In turn, extrinsic motivation for a goal results from external factors such as incentives, rewards, or positive evaluation of others that are dependent on goal attainment, whereas activities during goal pursuit may even be adverse.

Beyond desirability, goal motivation depends on at least two types of beliefs or expectations: self-efficacy and controllability (Bandura 1991; Ajzen 2002). First, self-efficacy is individuals' confidence that one has the cognitive, behavioral or social skills that are necessary to attain a certain goal (Bandura 1991). Individuals with higher self-efficacy are thought to set higher goals and to have higher commitment to their goals. Second, goal motivation depends on individuals' general or specific believes about whether goal attainment is under their control or controlled by external factors (Bandura 1991; Ajzen 2002). Individuals form control beliefs by attributing previous success or failure of goal attainment to internal factors or external factors that may be variable or stable. In everyday life, situations greatly vary in the degree to which goal attainment is up to the actor and this may influence the goals that individuals form. Individuals that usually attribute success to internal sources (e.g. effort, competence) and failure to external sources (e.g. task difficulty, accident) are more likely to set ambitious goals and to maintain engagement in the face of obstacles than individuals with an opposite attribution pattern. Similarly, 'locus of control' describes individuals' general belief that attaining outcomes is under control of external or internal factors.

2.3 Summary

Taken together, goal-directed behavior is at the heart of most conceptualizations of self-regulation. Goals may be seen as mental representation within hierarchically organized associative networks or as motivational force that directs behavior towards subjectively desired and attainable states. Hence, goals unify cognitive and motivational features that find different considerations across self-regulatory facets. Cognitive goal features such as the hierarchical organization in networks play a critical role for self-regulatory facets in some theories of cognitive (developmental) psychology (e.g. executive function and cognitive control: Zelazo et al. 2003; Munakata et al. 2012; Goschke 2012) as well as social, personality and general psychology (e.g. self-control and self-regulation: Kruglanksi et al. 2002; Caver/Scheier 1998; Bandura 1991) and clinical psychology (e.g. Watkins 2011). In contrast, they find only minor consideration in research on emotion regulation and coping (Gross/Thompson 2007; Cole et al. 2004). In turn, motivational goal features are deeply rooted in social, personality and general psychology (e.g. action control and goal setting: Heckhausen/Gollwitzer 1987; Gollwitzer 1999; Kuhl 2000; Kuhl/Goschke 1994; Aizen 1985; Fishbein/Ajzen 2010) and are also implicitly taken into account in some self-regulatory theories of clinical psychology (Gross/Thompson 2007; Cole et al. 2004; Gunnar/Davis 2003). However, self-regulation research in cognitive (developmental) psychology and temperament research rarely addresses goal motivation (Zelazo et al. 2003; Munakata et al. 2012; Rueda et al. 2005; Rothbart/Bates 2006; Eisenberg et al. 2011).

3 Self-regulation as the process of goal-directed behavior

Most researchers agree that self-regulation is or at least involves goal-directed behavior. Accordingly, successful self-regulation becomes obvious in successful goal attainment. However, individuals who hold a goal do not always attain it. Failed goal attainment can have many reasons during the course of self-regulation. To better understand where difficulties have occurred, some researchers break down self-regulation into a process with separate phases and thus consider the temporal dynamic of self-regulation. This process view is particularly common and explicit in social and general psychology (Kuhl 2000; Kuhl/Goschke 1994; Gollwitzer 1990; Heckhausen/Gollwitzer 1987; Aizen 1985; Fishbein/Ajzen 2010; Hommel 2009; Carver/Scheier 1998). A process-like character of self-regulation can also be found in some models of cognitive psychology in which self-regulation is framed as problem solving (Zelazo et al. 1997) and clinical research in which self-regulation aligns to the process of emotion generation and is interpreted as emotion regulation (Gross/Thompson 2007). Whereas these account look at the whole process, other accounts refer to single or some few process phases and interpret them as self-regulatory facet (e.g. goal setting: Locke/Latham 1990; goal implementation: Gollwitzer 1999; decision-making: Byrne 1998). One common way of grouping these phases is to sort them according to their time point of occurrence: before, during, or after action execution (e.g. Heckhausen/Gollwitzer 1987).

3.1 Before action execution

One way of describing the self-regulatory process is to start with an active goal. Individuals may (1) form new goals (goal setting or forming a goal intention: Gollwitzer 1990), (2) select a goal out of multiple other goals, or (3) internal and external cues may activate a goal within the goal network with or without individuals' awareness. To form a goal, individuals must recognize internal desires, motives or interests or they have to identify external demands. Identifying external demands or tasks (goal identification or problem analysis in cognitive psychology) can be seen as a critical step in self-regulation that requires specific operations compared to the pursuit of internally generated goals (Zelazo et al. 1997; Chevalier 2015).

Individuals set goals by weighing (a) desirability, (b) feasibility of a goal, and (c) individuals' temporal perspective on short-term in contrast to long-term consequences (Eccles/Wigfield 2002; Ajzen 2002; Hall/Fong 2010; Metcalfe/Mischel 1999; see also section 1). This calculation will result in a low to high motivation or commitment to a certain goal, i.e. a goal intention with the form 'I intend to reach Z' (Gollwitzer 1990). After setting a goal, individuals translate this motivational tendency into more concrete subgoals and means within the hierarchical structure of the goal network (see section 2), i.e. an implementation intention in the form of 'if X then I will do Y' (Gollwitzer 1999, see section 5). The transition from a goal intention into a more binding goal is often seen as the critical step from motivation to volition (Goschke 2012; Kuhl 2000; Kuhl/Goschke 1994; Heckhausen/Gollwitzer 1987). This goal may be in accordance or in conflict with other goals that individuals hold. At a given moment, individuals have to decide which of multiple available goals they prefer or prioritize, a topic that receives particular attention in organizational and consumer psychology (e.g. Dellaert et al. 2017; Neal et al. 2017). Some models describe this goal selection as motivational process similar to goal formation. Others describe goal selection in cognitive terms as the retrieval of a mental

representation based on internal or external cues. Goal activation thereby depends on the structural features within the goal networks (Kruglanski et al. 2002). For example, goals with more facilitating relations to subordinated goals and to means are more easily activated. In turn, a high number of inhibitory links to competing goals decreases the likelihood of goal activation. In this context, some researchers also see self-regulation as decision-making process. Decision making may thereby occur on different levels in that individuals choose among multiple goals, choose among (more or less risky) options to attain the goal (with more or less uncertain outcomes) and bring these alternative goals and options into a personal ranking order (Byrne 1998; see Reyna/Rivers 2008 for a review on models of decision-making).

Goal formation, implementation and selection receive particular attention in social, personality, and general psychology (Caver/Scheier 1998; Bandura 1991; Heckhausen/Gollwitzer 1987; Aizen 1985; Fishbein/Ajzen 2010; Kotabe/Hofman 2015) and may be even seen as self-regulatory facets by some researchers in this field (Locke/Latham 1990; Gollwitzer 1999). Similarly, goal implementation (also referred to as planning) is treated a self-regulatory facet in cognitive psychology (Zelazo et al. 1997; McCormack/Atance 2011; Diamond 2013; see section 5), whereas the formation or activation of a goal is typically neglected in cognitive research (but see Chevalier 2015 for some recent exceptions in developmental science). However, neither goal formation, nor goal implementation is in the focus of emotion regulation and coping research (see this section and section 4.1 for more details on this point). Respective models implicitly assume that the modulation of emotions or stress (e.g. decreasing negative affect to feel better) is the driving force of self-regulation per se independent of an abstract goal from another domain (Gross/Thompson 2007; Millgram et al. 2015).

3.2 During action execution

According to cognitive, general and social psychology, individuals compare the desired state to the current situation that they perceive once a goal has been set or is active (Caver/Scheier 1998; Bandura 1991; Heckhausen/Gollwitzer 1987; Aizen 1985; Fishbein/Ajzen 2010; Kuhl 2000; Kuhl/Goschke 1994). If individuals detect a mismatch, they respond to this discrepancy by recruiting self-regulatory mechanisms (e.g. Carver/Scheier 1998; Higgins 1987; see section 5 for more details). Self-regulatory mechanisms enable individuals to select and execute appropriate actions on the environment or on the individuals themselves to attain the desired outcome or to maintain the desired state (also called goal striving in social psychology; Carver/Scheier 1998; Bandura 1991). Thus, self-regulation becomes necessary because of the goal in a top-down manner.

In contrast, emotions and stress make self-regulation necessary in accounts of emotion regulation, stress regulation and coping. From this perspective, individuals perceive a certain situation (external or internal) that may elicit emotions if the individual attends to the emotion-eliciting features of the situation. Individuals appraise whether the event is harmful or beneficial for himself or herself (primary appraisal: Lazarus/Folkman 1984). Further, they evaluate the situation with respect to the effectiveness of potential coping options and his or her own efficacy to cope with the possible stressor (secondary appraisal). The appraisal process determines the intensity, the valence and the nature of possibly emerging emotions as well as resulting behavioral prepotencies and changes in

central or peripheral physiology. Analogous to recruitment of means for discrepancy reduction, the individual engages in strategies of coping or emotion regulation, i.e. self-regulation (see section 5 for more details on the mechanisms of self-regulation) with the aim to alter emotions at some level and to overcome the obstacle causing the potentially stressful situation. The execution of respective self-regulatory actions affects the environment or the individual itself and feeds back to an individual's perception of the discrepancy between the desired and the current state. As long as the individual still detects a discrepancy, the individual will initiate the respective actions, e.g. the next step in the plan or the adaption of the goal. If the current situation matches the desired state then the individual exits the loop of goal-comparison-execution-perception-goal-comparison. This recursive aspect of self-regulation receives particular emphasis in general and social psychology in form of feedback loops or regulatory cycles (e.g. Carver/Scheier 1998). Across disciplines, action execution or goal striving is an essential part of the self-regulatory process and thus part of most self-regulatory facets in contrast to goal formation and implementation.

3.3 After action execution

After action or plan enactment, the individual evaluates the success or the failure of the respective series of actions and reflects about the potential reasons in the form of causal attributions (Cunningham et al. 2007; Bandura 1991; Gross/Thompson 2007; Kuhl 2000; Kuhl/Goschke 1994; Zelazo et al. 1997). This evaluation process may elicit positive or negative emotions. In Bandura's view (1991) emotions may also result from individuals' experience of one's own mastery during goal pursuit rather than merely from the accomplishment of the respective sub-goal and this may in turn affect individual's self-motivation and self-efficacy (see also Deci/Ryan 2001). Hence, evaluative judgement of the previous regulatory attempts are seen as critical source for goal setting and goal implementation in the next regulatory cycle. For Caver and Scheier (1998), affect results from the comparison of the actual rate of progress towards the goal with the expected rate of discrepancy reduction. If the rate of discrepancy reduction is larger than expected, positive affect emerges. In all other cases, negative affect is the result. This affective information feeds back to the behavioral loop and causes the adaption of time and effort investment. Hence, possibly elicited emotions may influence how the individual decides to proceed (e.g. to stay on track, to change the strategy, the goal or the implementation plan, or to simply take the next step in the initial plan). Attaining superordinate goals usually requires multiple regulatory cycles involving multiple sub-goals and means. Hence, similar to goals, feedback loops of self-regulation are assumed to have a hierarchical structure. Evaluation and judgement processes that feed back to previous phases of self-regulation are common in social and general psychology (e.g. Bandura 1991; Carver/Scheier 1998; Kuhl 2000; Kuhl/Goschke 1994), as well as in some accounts in cognitive psychology (e.g. Zelazo et al. 1997).

The self-regulatory process may become more complex if difficulties occur during goal pursuit (e.g. social pressure to engage in an alternative action). Some researchers even narrow their focus on goal-directed behavior in the face of obstacles. The perception of such difficulties (e.g. in terms of unexpectedly low rate of discrepancy reduction, negative affect, or conflict), may require individuals to adapt goals, sub-goals, means, or

effort. I will further elaborate possible obstacles in section 4 and will present self-regulatory mechanisms that individuals may use to overcome them in section 5.

3.4 Characteristics of the process

There is an ongoing debate about the nature of self-regulatory processes or single phases (Papies/Aarts 2016; Förster/Jostmann 2012). Some researchers characterize self-regulation and its phases as conscious, deliberate, intentional and explicit, controlled, and effortful top-down process (called explicit self-regulation in the following). This view is particularly common in cognitive psychology and has been proposed for self-regulatory facets such as executive functions, executive attention, cognitive control, metacognition, goal implementation, and effortful control (see section 5 on the mechanisms of self-regulation). The characterization of self-regulation as explicit can mean that individuals are consciously aware of their goal (focal or explicit goal), its effects on behavior, or the obstacles that may interfere with goal attainment (Zelazo et al. 1997; Goschke 2012; Braver 2012). Explicit can also imply that individuals are assumed to initiate self-regulatory (sub-)processes such as goal formation, planning, monitoring, and evaluation on their own and in advance or at least independent of situational affordances (e.g. Kuhl 2000; Kuhl/Goschke 1994; Bandura 1991; Munakata et al. 2012; Gollwitzer 1999). Similarly, individuals may actively process critical information in order to make accurate decisions (e.g. goal selection or response selection) and they may reflect on their own thoughts and decisions (deliberate and intentional). Describing self-regulation as explicit may also mean that individuals can control and alter these processes if they like to (controlled), that these processes consume mental resources (effortful) and require the neuronal activation of higher-order systems such as the prefrontal cortex (e.g. Zelazo).

However, other researchers suggest that some facets or sub-processes of self-regulation can be more implicit (Förster/Jostmann 2012; Kruglanksi et al. 2002; Papies/Aarts 2016; Gyurak et al. 2011). This view has its primary roots in social psychology and research on emotion regulation and coping. For example, internal and external cues may also activate goals, sub-goals and means in a bottom-up fashion mediated by lower-order systems such as parts of the limbic system or posterior regions. Thus, individuals may not be aware of the goal-related information or the regulating effect of this information on their behavior (background or implicit goals; e.g. if a movie activates the goal to become a famous singer). From this perspective, needs, emotions, or other affects may drive behavior even without individuals' awareness (Gross/Thompson 2007; Goschke/Bolte 2014). For example, implicit emotions may signal the personal relevance of a goal and constraints of achieving a goal during goal selection (e.g. in the form of pride and shame about the imagined future outcome). Emotions may also signal a deviation from the expected outcome during goal pursuit or they may prevent action execution (e.g. because of anticipated anxiety when visiting public spaces). Researchers describe implicit self-regulation as more spontaneous and automatic meaning that individuals' do not consciously initiate self-regulation and have less control over them. Compared to explicit self-regulation, implicit processes are assumed to be less resource-dependent.

Lately researcher called for leaving this strict separation and consensus developed that implicit and explicit processes may go hand in hand during the course of self-regulation. Instead of a dichotomy between explicit and implicit self-regulation Gross and Thompson (2007) propose that self-regulation ranges on a continuum from implicit to explicit as both may be involved in the process of goal pursuit (see also Kotabe/Hofmann 2015; Förster/Jongmann 2012). For example, emotion-regulation strategies used at an earlier stage may result from automatic processes (e.g. avoiding a park because of a dog phobia: implicit self-regulation). In later phases of the process, these automatic processes (fear of dogs) may become a target of explicit self-regulation (i.e. active effort to suppress crying when passing a dog). Similarly, some components of explicit self-regulation (action execution) may become automatized by purposefully using respective strategies (Gollwitzer 1999) or by a process from initiation to maintenance of behavior change (Rothman et al. 2004). In addition, Goschke (2012) states that the criteria distinguishing explicit from implicit self-regulatory facets (e.g. conscious awareness, intentionality, controllability and effortfulness) can dissociate, which makes a simple dichotomization unfeasible.

3.5 Summary

Taken together, self-regulation can be seen as process and some of its phases may be interpreted as self-regulatory facets. Goal setting, implementation, execution and evaluation usually operate in feedback loops or regulatory cycles, aiming at the reduction of discrepancy between current and goal state. However, in clinical psychology self-regulation dedicates to the modulation of emotions resulting from individuals' appraisals of external and internal conditions (rather than goals). Hence, whereas cognitive psychology focuses on goal implementation and plan execution, social and general psychology put additional emphasis on goal formation and evaluation. Research on emotion regulation and coping usually neglects goal formation and concentrates on appraisal and response execution. Theories make different assumptions to what degree self-regulation is conscious, intentional, controlled, and effortful. Whereas a top-down view on self-regulation dominates in cognitive psychology, accounts of social psychology and research on emotion regulation claim that self-regulation may also subsume some implicit, bottom-up processes.

4 Self-regulation as overcoming obstacles and target processes

Most researchers agree that self-regulation involves goal-directed behavior. However, some theories argue that individuals often enact their goals without exerting self-regulation. Hence, many theories narrow the concept of self-regulation to goal-directed behavior in the face of obstacles (e.g. self-control: Kobe/Hofmann 2015; cognitive control: Goschke 2012; executive functions: Diamond 2013; Garon et al. 2008; effortful control: Rothbart/Bates 2006; willpower: Metcalfe/Mischel 1999). Obstacles are characteristics of the person (e.g. low attention span; little knowledge within a domain) or the situation (e.g. noisy context; new task) that elicit target processes (e.g. attentional distraction away from a task, behavioral habits or routines). Target processes of self-regulation may be either insufficient for goal attainment (e.g. low goal commitment, ineffective planning) or they may interfere with goal attainment (e.g. attentional orientation to a task-

irrelevant information, habits that do not fit a new problem, current desire to do something else).

Target processes can become observable at different levels: at the level of biological processes in the central or autonomous nervous system, at the level of mental representations (e.g. thoughts, memories), at the affective-motivational level or the motoric-behavioral level and refer to different phases within the self-regulatory process. Respectively, accounts differ with regard to the goal-conflict type that they address (e.g. conflict of a goal with other goals, conflict of a goal with a desire; conflict of a goal with perceived stimuli or expectations, conflict of a goal with learned behavior or habits, conflict of an emotion with a need). Individuals have to modulate these target processes in order to obtain the goal. From this perspective, goal attainment is not the primary criterion for successful self-regulation alone, but overcoming the obstacles and modulating the target process (alone or in combination with goal attainment) on one of the multiple observation levels becomes critical (Cole et al. 2004; Gross/Thompson 2007). The existence and the nature of obstacles determine how the onset, intensity, quality, or duration has to be modulated to attain the goal (e.g. by initiating, up-regulating, broadening, maintaining, down-regulating, stopping, or narrowing). This modulation serves as an indicator of self-regulation rather than the existence and the nature of the obstacle/target process itself.

Obstacles may emerge from environmental factors that are not under the person's immediate control and that constrain the range of behavioral options within a given situation compared to another situation. Obstacles may also emerge from state-like characteristics of the person within or independent from the respective process of goal-pursuit (e.g. low commitment to the currently pursued goal or negative mood independent of current goal pursuit), or trait-like characteristics of the individual compared to other individuals (e.g. stable external locus of control, high reactivity). The consideration of situational obstacles implies that one person may attain a goal in a certain situation without requiring self-regulation, whereas the same person may need to self-regulate in another situation although the goal remains the same. Stressful situations, for example, may be one situational obstacle. Imagine an individual who successfully prepares the breakfast table as every Sunday morning at home and compare it to the same individual accomplishing the same task under time pressure during his or her exam as a hotel and catering assistant in a hotel. Both situations involve the same goal or task (preparing a table for breakfast), but in the latter case the specific circumstances (exam) likely elicit different target processes (increased arousal above the optimal level in the latter case) and so self-regulation may only be necessary in the latter case (to down-regulate the person's arousal) to support successful task completion. In turn, regarding characteristics of an individual as obstacle for goal pursuit would mean that one person has to self-regulate in a certain situation to attain a goal, although goal attainment may not require self-regulation for another person in the same situation. For example, when someone learns to play the piano he or she may need a lot of self-regulation, whereas an experienced piano player may play the piano piece for the first time with ease and with less self-regulatory engagement. Consequently, some self-regulatory facets are linked to obstacles regarding situations (e.g. self-control in social psychology), others may consider obstacles resulting from a person's states or traits (e.g. effortful control in developmental science). If situational conditions for goal attainment do not match the individual's characteristics, self-regulation may become necessary.

4.1 Obstacles for goal-directed behavior in psychology

Novel tasks require self-regulation for multiple reasons. In the face of new tasks, individuals have few experiences in anticipating costs and benefits of accomplishing the task so that cognitive target processes that may contribute to goal formation have to be modified (e.g. Diamond 2013; Goschke 2012). This may be particularly true for solving novel problems of extrinsic motivation, when the external demands are only subtle or ambiguous and goal pursuit involves unpleasant activities. In these situations goal formation requires top-down modulation to increase motivation or goal activation. In the face of new problems, individuals usually have only little domain-specific and domain-general knowledge to plan necessary steps in their correct order and to link them to cues for situational opportunities to execute them.

Even in the absence of previous task experiences, self-regulation may enable individuals to evaluate goal approach, whereas in well-known task individuals may monitor in a more automatic manner. For similar reasons, self-regulation may also be critical in contexts that do not provide feedback about success at all or in contexts in which the feedback is subtle or misleading. Self-regulation may also support individuals' reactions to possible failures in two ways and this seems important as failures may occur more likely when working on a new task. First, problems in accomplishing a new task may elicit frustration during goal striving and without self-regulation, this frustration may disrupt further solution attempts. In turn, failures in goal attainment may also require the revision of the initial goal or the original plan. Self-regulation will enable individuals to detect this need and will enable individuals to flexibly choose and apply respective means. Even if the task is novel, well-known contexts may trigger automatic motor responses or strong habits that are in conflict with the intended action and thus are not helpful to solve the novel problem. Self-regulation may enable individuals to overcome these impulsive responses. Similar arguments may apply to complex and difficult tasks (e.g. running a company efficiently) and to situations that require the individual to coordinate multiple tasks with regard to their temporal priority and potential inter-goal conflicts (e.g. doing innovative research and being a good mother; see Neal et al. 2017).

Difficulties in enactment that require self-regulation may also emerge from factors that promote individuals' state orientation in contrast to action orientation (Kuhl/Goschke 1994). In contexts that facilitate state orientation individuals' focus on fixed aspects of the past, present and future (e.g. rumination) instead of executing actions that change external or internal states. Factors stimulating a state orientation promote reactive responses to external cues rather than proactive and self-initiated actions because individuals concentrate on the goal without enjoying goal pursuit. Further, factors that lead to an ill- or under-defined link between goal and its sub-goals and means make a state orientation more likely so that the individual is indecisive and self-regulatory strategies are blocked.

Goal-directedness under changing conditions may also require self-regulation. Individuals may overcome perseveration, when self-regulation supports them to modulate cognitive and motivational target processes that are involved in goal commitment, planning, execution and evaluation (e.g. Goschke 2012; Diamond 2013). Changing conditions can range from complex to simple changes and from changing internal processes to changing external circumstances. For example, the loss of resources with increasing age may make some goals unattainable and is an internal, complex change, whereas the

introduction of time constrains or the reversal of reward contingencies in a laboratory task are examples for external and simple changes. Self-regulation may also play a role (i) when internal distractors (e.g. mind-wandering, memories, or cognitive biases) and external distractors (threatening events, meaningless noise, or novel stimuli) may redirect individual's attention away from the goal and task-relevant information thereby hampering their active maintenance or (ii) when individuals perceive information that conflict with representations within the goal-network.

For the pursuit of more complex and temporally extended goals, (e.g. becoming surgeon), distractors and conflicting information are also typical obstacles due to the longer temporal distance to goal attainment (e.g. Hall/Fong 2010; Metcalfe/Mischel 1999). Self-regulation is important for delayed goals as their formation often involves the anticipation of non-present desires, independent of feedback and perceptions within the current situation (Suddendorf/Redshaw 2013; Parker et al. 2010). Further, long-term predictions of events, behavioral consequences and upcoming desires may be difficult and erroneous, particularly if environmental conditions are unstable and unpredictable without self-regulation (Gilbert/Wilson 2007). Similarly, intertemporal choices between a small reward now versus a large reward later (also called delay of gratification) and the attainment of delayed intentions (also called prospective memory) or higher-order, long-term goals are difficult due to interfering desires that may become short-term temptations (e.g. presentation of food cues to dieters). Desires set individuals in a state of wanting and direct individuals toward an immediate, rewarding stimulus. A desire emerges if the evaluation of external stimuli by subcortical reward processing regions and subsequent fast associative processes promise pleasure or relief (i.e. reward) with regard to internal need states and individual's learning history. Cognitive elaboration maintains the desire in working memory and thus may undermine concurrent cognitive activities associated with higher-order goals. Overcoming these desires, i.e. these motivational target processes, requires self-regulation. This facet of self-regulation is usually term 'self-control' (Kotabe/Hofmann 2015).

Beyond contexts of temptation, self-regulation is also critical for goal attainment in 'hot' situations. 'Hot' situations may be circumstances that individuals appraise as threat, stress or challenge and that may elicit affects or even trigger psychopathological symptoms such as rumination or anxiety depending on individuals' appraisal of the current context or ongoing internal processes. These situations may be of short duration as for the self-regulatory facets of emotion regulation and stress regulation (e.g. an exam, a vaccination, or an approaching stranger). For the self-regulatory facet of coping, however, 'hot' situations usually refer to more temporally extended periods in life and involve life stress events (e.g. illness) or developmental transitions (e.g. from adolescence to adulthood, from working life to retirement). In general psychology and cognitive research, 'hot' situations may also contain motivational features such as goals of high personal importance or the delivery of performance-contingent rewards and punishment or from situational cues that directly induce affectively valenced subjective experience, but are not necessarily in the focus of an ongoing task (positive or negative: Inzlicht et al. 2015; Chiew/Braver 2011). Affective target processes arising from these different types of 'hot' context can become obvious in motivation tendencies (e.g. avoidance in order to feel better) and motor prepotencies (e.g. the expression of anger or flight that may not be in accordance with social norms), but also in very levels of physiological

arousal, the experience of negative or positive feelings, and cognitions such as happiness, catastrophizing or self-devaluation.

Importantly, some individuals may be more prone to react to the obstacles described above (e.g. delayed goals, tempting contexts, stressful situations, situations of affective significance) than other individuals. Individuals differ in the ease with which emotion, motor activity, endocrine, and attention are aroused. As these responses may interfere with the goal in some cases, highly reactive individuals may be more likely to produce interfering target processes faster (due to lower thresholds of reactions). They may produce target processes that are more intensive and last longer so that goal attainment requires self-regulation more often and to a higher extend. Consequently, individuals' reactivity may become an obstacle itself, whereas differences in reactivity can vary as a state between persons and occasions and as trait (Derryberry/Rothbart 1997).

In sum, self-regulatory facets with their origin in social, temperament and clinical research usually address affective target processes arising from tempting or 'hot' situations (Diamond 2013). This is what some authors define as the essence of self-regulation and what is part of the definition of self-regulatory facets such as self-control (Kotabe/Hofmann 2015); effortful control (Rothbart/Bates 2006; Eisenberg et al. 2011), willpower or delay of gratification (Metcalfe/Mischel 1999), coping, stress or emotion regulation (Gross/Thompson 2007; Aldwin et al. 2011; Skinner/Zimmer-Gembeck 2007; Gunnar/Davis 2003). Some theories of emotion regulation and stress regulation even frame overcoming affective target processes and related obstacles as the primary goal of self-regulation. These models assume that regulating emotions or stress results from the immediate desire to avoid harm in the form of unpleasant levels of arousal or negative feelings (rather than from an independent, abstract goal). Hence, without the obstacles that trigger stress or affect, there would be no goal-directed behavior, but affective target processes are the reason for the initiation of goal-directed behavior in this domain. In contrast, frameworks of cognitive psychology usually addresses obstacles such as novel problems, changing circumstances, time constraints and multiple-goal conditions that are beyond individual's immediate control. Historically cognitive models focused more on the regulation of thoughts, attention and action as target processes thereby widely neglecting the role of emotion or motivation that have been in the focus of social psychology, personality and temperament research (Diamond 2013). Recently, cognitive psychologists became more interested in 'executive functions' and 'cognitive control' within motivationally and emotionally significant contexts, i.e. the interaction between affective aspects and cognition.

4.2 Beyond the role of emotion and motivation as interfering target processes

In many theories of self-regulation (particularly in cognitive psychology), emotional and motivational processes are seen as interfering with goal attainment or as a transient, maladaptive state that has to be changed (Rothbart/Bates 2006; Zelazo/Carlson 2012; Metcalfe/Mischel 1999; Skinner/Zimmer-Gembeck 2007). Hence, self-regulatory facets usually serve to down-regulate affective target processes. Models that take this view, usually built on assumptions of so-called dual-process accounts (e.g. Metcalfe/Mischel 1999; Rothbart/Bates 2006). Researcher in this tradition assume that affects and desires emerge from a different system than self-regulation. Desires and affects emerge from

lower-order systems ('bottom-up') that produce automatic responses triggered by internal or external cues that may be out of the individual's awareness (reactive). Desires and affects involve fixed and inflexible action patterns and individuals usually have problems to control their emergence and their execution. Lower-order system allow for fast and dirty information processes and for an immediate reaction to possible threats or opportunities. These automatic reactions require only minimal resources.

According to dual-process approaches, self-regulation enables individuals to recognize desires and affects as undesirable and helps individuals to inhibit automatic responses as interfering target process. Self-regulatory facets result from a higher-order system ('top-down') that produces reflective responses based on deep information processing. Individuals are not only aware of these processes (conscious), but individuals even intentionally initiate reflective responses independent of current external stimulation (deliberate, purposeful) and can flexibly adapt their modulation and execution to changing contexts (controlled, voluntary). Reflective responses take more processing time, consume more resources (effortful) and develop later in ontogeny. In turn, according to dual-process models, reflective responses are associated with cognitive processes that dominate in 'cool' (i.e. neutral) contexts, whereas impulses result from affective processes that emerge in 'hot' (i.e. personally relevant) contexts. Goal-directed behavior becomes possible when the reflective system wins the constant struggle with the impulsive system.

Several lines of research contradict this rigorous distinction. They claim for a more differentiated discussion of emotion-cognition interactions (Kotabe/Hofmann 2015) and a more balanced view on the advantages and disadvantages of emotional and cognitive processes. First, evidence cumulates that cognition-emotion interactions are more complex than suggested by dual-system models. Hence, researchers argue for an integration of motivation, emotion and cognition in self-regulation (Kotabe/Hofmann 2015; Goschke 2012). For example, from a process view even for a 'cognitive' task, individuals have to form a goal to accomplish the task and there may be implicit intrinsic or extrinsic rewards that may affect performance. Hence, there is no purely 'cognitive' task that can be solved without the involvement of any affective aspect. This also becomes obvious in the prominent role of motivation within process models of social psychology, for example (Bandura 1991; Carver/Scheier 1998; Kuhl/Goschke 1994; Ryan/Deci 2000).

The current state of research suggests that the links between cognition and emotions are bidirectional (Blair/Ursache 2011), whereas dual-process approaches usually stress the relation from reflective responses (or cognitions) to impulsive responses (or emotions). Respectively, psychobiological models suggest to frame self-regulation as the integration of multiple systems that refer to cognitive, attentional, emotional, stress-physiological, and genetic processes (Blair/Diamond 2008; Geva/Feldman 2008; Tucker et al. 2000). The systems have a vertical arrangement with more automatic genetic processes at lower levels and more controlled cognitive processes at higher levels. Self-regulation mechanisms involve cognitive processes in promoting attention, emotion, stress physiology, and genes. In turn, self-regulation comprises also the regulating influence of genes, stress physiology, and emotions on attention and cognition. Importantly, functioning of one system at a given level (e.g. stress physiology) influences functioning of systems on other levels not only at this time point (e.g. infancy) within the given context (e.g. stressful context), but may also influence systems on other levels (e.g. cognition) later in time (e.g. adulthood) within other contexts (e.g. non-stressful context). These

complex interactions are also addressed in theories of emotion regulation and temperament that ascribe unique regulatory function to emotions and are also considered in neuropsychological models (Derryberry/Rothbart 1997; Gross/Thompson 2007; see section 5 for details on regulatory functions of emotions).

Second, emotion and motivation cannot only interfere with goal-directed behavior, but they may also enhance cognitive processes and goal-directed behavior in some situations (Pessoa 2009; Bovotnick/Braver 2015; Braver et al. 2014). Third, cognitions can emerge automatic and do not necessarily indicate top-down self-regulation. Respectively, the self-regulatory process has been found to comprise automatic processes as well and this may also involve automatic cognitions. Situational or internal cues may trigger attention, appraisal, biased thoughts and memories in a non-conscious and non-intentional manner. These automatic cognitions may support or hamper goal attainment (see also section 3.4 on the nature of the self-regulation process; Papies/Aarts 2016; Förster/Jongmann 2012). Fourth, in the tradition of dual-process approaches researchers sometimes highlight the adaptive value of the reflective system while neglecting context-dependent advantages of the impulsive system and the context-dependent disadvantages of the reflective system. However, constant top-down control is not identical with adaption and well-being. Respectively, other theories of self-regulation stress the importance of a balance between giving in immediate desires and pursuing abstract long-term goals. Accordingly, reflective as well as impulsive reactions may be adaptive depending on the respective circumstances (Kuhl/Goschke 1994; Goschke 2012). Too much self-regulation in the form of chronic suppression of desires may have negative consequences for psychological well-being, although self-regulation is important for behaving in accordance with social norm and attaining long-term goals.

4.3 Summary

Self-regulation can be seen as process that enables individuals to pursue goals in the face of obstacles. Obstacles can be features of the situation or the person that elicit target processes. When individuals modulate these target processes (in order to attain a goal), this is called self-regulation. Psychological disciplines deal with obstacles and target processes such as novel task, changing conditions, environmental distractors, delayed goals, strong habits, interfering desires, or affects. Social, personality and temperament psychology put emphasis on interfering desires and affects, whereas cognitive psychology rather described emerging target processes in ‘cognitive’ terms. Dual-process models also mirror this arbitrary categorization of cognition versus emotion in self-regulation research. However, cross-disciplinary evidence indicates (i) that self-regulatory facets range from more automatic (affective, stress physiological) to more controlled processes (cognitive, attentional) on a continuum, (ii) that affects can not only influence, but also promote future goal-directed behavior, and (iii) that the adaptive value of automatic versus non-automatic responses is dependent on the current context, so that a balance between both most likely promotes well-being in the long run.

5 Self-regulation as mechanisms of goal-directed behavior

In the previous sections, I characterized self-regulation as a process of goal-directed behavior in the face of interfering obstacles. In the following section, I will describe self-regulation as the mechanisms that (a) allow individuals to accomplish the phases of the

self-regulation process and that (b) allow individuals to modulate target processes in the service of goal attainment. A rich variety of self-regulatory mechanisms has been suggested. Although there seems to be considerable overlap among them, researchers only recently began to link different views on self-regulatory mechanisms across disciplines. So far, there are no common taxonomies for self-regulatory mechanisms, but some comprehensive overviews within each discipline (Karoly 1993; Diamond 2013; Gross/Thompson 2007; Skinner et al. 2003). As for target processes, theoretical frameworks refer to mechanisms at different levels such as cognitive, emotional, motivational, behavioral, and physiological. The level of mechanisms and the level of target processes thereby often diverge (e.g. cognitive control to overcome routine behavior; cognitive reappraisal to down-regulate anger; fear that biases attention). Self-regulatory mechanisms can range from basic components to more complex components and strategies.

5.1 Core executive functions as basic mechanisms of self-regulation in cognitive psychology

In cognitive psychology, researchers focus on executive functions as a group of means that may serve goal-directed behavior. Executive functions (also called executive control or cognitive control) are basic cognitive processes that are effortful, triggered by endogenous signals (rather than external stimulation) and allow for top-down control (e.g. of goal-directed behavior and target processes). There are many different taxonomies of executive functions (e.g. Denckla 1996; Garon et al. 2007; for an overview see Banich 2009). The most common taxonomy builds on empirical data and distinguishes between working memory updating, inhibitory control, and shifting (also called cognitive flexibility: Miyake et al. 2000). Working memory is the ability to actively maintain goal-relevant information, update these representations if external circumstances change and manipulate these representations if a task requires it (e.g. relate an idea to another; Garon et al. 2008). Inhibition comprises manifold aspects, such as individuals' ability to withhold or delay a prepotent or automatic response on demand or in the service of a more abstract, long-term goal (also called self-control or self-discipline) and to initiate a subdominant response instead (Carlson/Moses 2001; Friedman/Miyake 2004; Munakata et al. 2012; Nigg 2000). It also comprises interference control including the suppression of thoughts and attention (also called selective or focused attention, executive attention or goal shielding: Diamond 2013). Shifting is the ability to flexibly adapt behavior to changing context conditions (e.g. arbitrary stimuli-response rules) and goals (e.g. tasks) including the ability to see one issue from many perspectives and generating ideas (sometimes also called divergent thinking: Garon et al. 2008).

With few exceptions, there is consensus about the multidimensionality of executive functions (but see narrowing accounts: Baddeley 1992; Barkely 1997). In some frameworks executive sub-functions are relatively independent (broadening accounts: Carlson/Moses 2001), whereas other models propose at least some overlap (unity in diversity accounts: Friedman/Miyake 2004). Recently, Diamond (2013) has suggested a hierarchical structure: On the first level, basic skills such as working memory and inhibition contribute to cognitive flexibility on the second level. In turn, the core executive functions on level 1 and 2 enable more complex, higher-level executive functions such as planning, monitoring, problem solving and reasoning. Different sources have been pro-

posed to underlie the overlap between executive functions and to drive the developmental progression in executive sub-functions from childhood to adulthood. In this context researchers hypothesize about the role of executive attention in contrast to orienting or alertness (Posner 2012; Rueda et al. 2005). Other models focus on the strength and abstractness of active memory representations in working memory (Munakata et al. 2012; Morton/Munakata 2002). Active representations are thereby contrasted with latent representations stored in long-term memory or elicited by currently perceived information and allow for more flexible, self-initiated and proactive behavior (Munakata et al. 2012; Morton/Munakata 2002). A third group of theories stresses the importance of iterative processing and symbolic thinking (including language) as common source for executive functions as both allow for reflection, hierarchically organized rule systems, explicit, conscious meta-representations about one's own and others' thoughts, intentions, emotions and goal-directed actions (Zelazo 2015, 2004; Marcovitch/Zelazo 2009; Holodynski et al. 2012).

As stated above, research on basic executive functions historically focused on the modulation of cognitive, behavioral or attentional target processes in motivationally neutral contexts. More recently, cognitive scientists started to consider the interaction between cognitive processes and affective-motivational processes arising from contexts of high personal importance, promised incentives and rewards, or the presentation of emotional stimuli (e.g. Braver et al. 2014; Goschke/Bolte 2014; Pessoa 2009). Meanwhile, there is consensus that there are two types of top-down control processes: 'cool' and 'hot' executive functions. 'Cool' executive functions support goal-directed behavior in motivationally neutral contexts, whereas 'hot' executive functions are additionally required for goal-directed behavior in motivationally significant contexts. 'Hot' executive functions serve flexible reappraisal of the affective or motivational significance of a situation and thus enable individuals to modulate stimulus-controlled affective target processes at cognitive, emotional, motivational, behavioral, or physiological level (Zelazo/Carlson 2012, see section 4). As an alternative to the search for distinctive sub-functions of executive control, Braver (2012) suggested two modes of cognitive control: proactive control and reactive control that vary in the temporal dynamic of the activation and maintenance of goal-relevant information. Reactive control mechanisms imply that individuals do not activate and actively maintain goals and goal-relevant information (sub-goals, means) before a discrepancy actually occurs or before contextual cues signal that cognitive control is required (e.g. going the supermarket when seeing the empty refrigerator). Proactive control describes the effortful and self-initiated activation and maintenance of goals and related information in advance to external cues and thus requires individuals to act before discrepancy occurs (e.g. going to the supermarket to buy food for tomorrow even though the refrigerators contains enough food for today). A similar distinction has been suggested for other self-regulatory strategies in social and general psychology (Kotabe/Hofmann 2015), emotion-regulation (Gross/Thompson 2007), and coping research (Aspinwall/Taylor 1997) depending on whether individuals use the strategy before or after the occurrence of obstacles (emotion, stress, temptation) or discrepancies to the goal. The qualitative view on executive function ('cool' vs. 'hot') and cognitive control (proactive vs. reactive) contrasts with the traditional quantitative analyses of executive sub-functions.

5.2 Mechanisms of goal setting and implementation in general and social psychology

General and social psychologists are particularly interested in how individuals set and implement goals. Hence, they have proposed several strategies that can support these phases. Forethought broadly refers to anticipating internal and external instances that are not yet present, but may become obvious in the far future (see also Goschke 2012; Bandura 1991). In this way, forethought enables individuals to form goals independent of feedback from of the current context. Different forms of forethought have been specified with regard to the content (e.g. affects, outcome vs. process) and nature (e.g. episodic) of future-oriented thoughts. For example, outcome simulation refers to imagining desired states and visualizing the (positive) consequences of goal attainment (in contrast to process simulation described below: Taylor et al. 1998). Affective forecasting focuses on pre-experiencing affective consequences of achieving a goal and this may influence goal motivation or the planning of necessary steps (Wilson/Gilbert 2007). Episodic future thinking refers to a certain way of thinking about the future, rather than referring to the content of prospections (affect or outcome). When episodically foreseeing, individuals mentally simulate a specific event of one's future including details about the place, the time, the persons that are involved, others' and one's own actions, thoughts, and feelings, including possible alternative versions of the event (Suddendorf/Redshaw 2013). As episodic foresight means to flexibly adapt mental simulations to the specificity of a concrete event, it allows individuals to prepare for new or complex conditions of pursuit in situations in which rigid schemata or routines are not sufficient for goal approach anymore.

Beyond forethought, mental contrasting is another strategy of goal setting. During mental contrasting (Oettinger/Gollwitzer 2010), individuals use their fantasy to imagine the attainment of a desired future (e.g. becoming a famous singer) and elaborate their current situation and the obstacles that may stand in the way of attaining the desired future (e.g. high competition) independent of external feedback. Contrasting a desired future with the reality that impedes its realization creates expectancy-dependent goal commitment and opposes to one-sided elaborations such as focusing only on the positive future or the negative reality. Linking the future to the present in this way (rather than comparing it) selectively influences how the individual perceives the feasibility of reaching their goal. This may keep them aware of possibly unreachable goals (when no engagement would be most efficient) and results in strong commitment for reachable goals, thereby protecting resources such as time, energy, and money. From a motivational perspective, mental contrasting promotes selective goal commitment and regulates energization, effort mobilization, and persistence in this way. From a cognitive perspective, viewing the negative aspects of reality may also stimulate individuals to prepare for upcoming obstacles. Hence, individuals may not only anticipate possible problems, but may also plan how to overcome them, a strategy called implementation intentions (Gollwitzer 1999).

Forming an implementation intention can be described as making an if-then plan. Implementing an intention means that individuals identify an upcoming opportunity to pursue the goal in a future situation. Further, individuals have to identify a situational cue that indicates this opportunity and makes the intention easily accessible. In intentionally linking this cue to a response, implementation intentions specify when, where

and how a person plans to turn the intention into action (whereas goal intentions specify desired states). Hence, in the critical situation, goal-directed behavior is executed in a relatively automatic (quick, efficient, resource-independent) manner. The intention execution is triggered by the predefined cue and thus does not require a further explicit decision how to act. In this regard, implementation intentions are thought to foster self-regulation by making goal-directed behavior more independent of self-states (i.e. mood, and low resources), rather than by making threats and irritations less likely due to strengthening the self or willpower. Taken together, implementation intention and mental contrasting are strategies to support selective goal commitment and goal implementation by simulating the *process* (rather than the outcome) of goal attainment and possible obstacles that may *negatively* affect goal attainment (in contrast to positive outcome consequences: Taylor et al. 1998).

5.3 Mechanisms of goal striving across disciplines of psychology

Even if a person has formed a goal with a respective plan this does not necessarily mean that she or he will initiate self-regulation. One factor that is thought to influence goal striving beyond goal formation and implementation is individual's motivation to exert control (Kuhl 1987, 2000; Fujita 2011; Muraven/Slessareva 2003). Exerting self-regulation consumes resources and people usually experience this as taxing and unpleasant (Chevalier 2017; Westbrook et al. 2013; Kool et al. 2010; Botvinick/Braver 2015). Thus, individuals' motivation must be high enough to mobilize self-regulation (e.g. by a conflict between a desire and a higher-order goal, the deviation from the desired state, or the deviation from the actual rate of progress in goal pursuit: Kuhl 2000). Control motivation's strength thereby depends on several factors such as the subjective importance of the goal, the probability of attaining it, the individuals' perception of how effective a self-regulatory strategy is and what benefits and costs are linked to using this strategy. A high motivation to exert self-regulation results in the activation of self-regulatory strategies that make successful action execution more likely.

A second factor that may influence goal striving are individuals' resources to exert control (Baumeister et al. 2007; Heatherton/Wagner 2011). Individuals' control resources are described in terms of executive functions in cognitive psychology. In social psychology, control resources are described as a general regulatory strength that is thought to work analogous to a muscle. Active self-regulation consumes regulatory strength and a state of reduced self-regulatory strength (called ego depletion) links to self-regulatory failure (Baumeister et al. 2007).

As a third determinant of goal striving, basic core and complex executive function are recently getting more and more attention in the process perspective of general and social psychology (Hofmann et al. 2012). For example, working memory is assumed to support goal maintenance and updating if task demands change. Selective attention helps to inhibit goal-irrelevant information and thus to shield the goal from interference. Inhibitory control may enable individuals to suppress motor responses that results from immediate habits or affects and thus supports persistence. In turn, cognitive flexibility becomes important when circumstances change. In these cases, cognitive flexibility allows for the adaptation of the goal, the plan, effort investment, evaluations of failed or slow goal approach, internal standards and control beliefs.

The overlap between complex executive functions and self-regulation as process of goal-directed behavior is even more obvious. In social and general psychology, planning is explicitly seen as one phase of self-regulation (also called goal implementation). Planning subsumes the generation of possible sub-goals and concrete responses, selecting among them by anticipating responses' effects and bringing them in the correct temporal order (Zelazo et al. 1997; Gollwitzer 1999; McCormack/Atance 2011). In cognitive psychology, problem solving is usually framed as goal-directed process (with similar phases as described in section 3) aiming at solving a problem that is currently present and externally defined (rather than delayed goals resulting from an internal desire) in motivationally neutral contexts. Usually, solving the problem requires inductive and deductive logical reasoning. Hence, individuals have to figure out the abstract relations underlying analogies in forming new abstract rules from currently perceived information or applying already existing rules to currently perceived information (Carter et al. 1997; Munakata et al. 2012).

Monitoring (also called self-observation: Bandura 1991; or input: Carver/Scheier 1998) may occur on different levels during the self-regulatory process. Individuals may monitor the context and themselves. Monitoring enables individuals to detect when the situation provides an opportunity for approaching the goal, whether potential changes of conditions occur, whether a response was executed as planned, whether the response had the anticipated effect, and whether the outcome matches the overall goal at the end. The different aspects of monitoring have usually in common that they involve input from the environment, which is compared to an internal reference value (represented as expectation) what may result in an error signal in the case of deviation (also called discrepancy: Carver/Scheier 1998) or uncertainty. Inspired by neurosciences (Botvinick 2001), current theories in social psychology assume that monitoring a goal-desire conflict is experienced as negative affect or stress. These affects may motivate recruitment of other self-regulatory mechanisms that serve cognitive and behavioral adjustment to resolve the conflict (also called self-reactions: Bandura 1991) and they may motivate the evaluation of how much control will be necessary (Inzlicht et al. 2013; Kuhl 2000). Monitoring may benefit from individual's domain-specific and domain-general metacognitive knowledge about when conflicts may occur (e.g. between a long-term goal and desire; or the activation of an emotion) and what means may be effective to prevent or solve this conflict (i.e. knowledge about self-control strategies or emotion regulation: Gross/Thompson 2007; Holodynski et al. 2012).

Metacognitive monitoring competence (involving thinking about one's self-regulation) plays also an important role when individuals have to keep a balance between the antagonistic demands of a constantly changing environment (Goschke 2012). For example, in some situations individuals have to ensure the fulfillment of desires, whereas other situations require the suppression of interfering desires in the service of long-term goals (desire versus anticipation dilemma). Similarly, individuals have to shield their goals from distraction at some time, but have to skip a goal and to flexibly form an alternative goal in other cases (stability versus flexibility dilemma). Relatedly, some situations require individuals to narrow their attention, whereas individuals would benefit from being open for new experiences under other circumstances (shielding versus monitoring dilemma). Different metacognitive parameters have been suggested such as the updating threshold, the breadth of attention, the temporal discounting rate, the degree of noise in neural representations, and the learning rate.

5.4 Mechanisms of overcoming obstacles across disciplines of psychology

Under some conditions, goal attainment requires to overcome obstacles and to modulate interfering target processes as becomes obvious in the self-regulatory facet of self-control (Hofmann et al. 2012), emotion regulation (Gross/Thompson 2007), stress regulation, and coping (Aldwin et al. 2011; Skinner/Zimmer-Gembeck 2007; Gunnar/Davis 2003; Heckhausen et al. 2010). One proactive strategy of addressing obstacles is situation selection meaning that individuals avoid situations that likely elicit interfering emotions (e.g. by avoiding woods if one suffers from fear of spiders) or that may unfold as temptation (e.g. by avoiding sweets shops when being on a diet). Individuals may also prevent interference from obstacles by modifying aspects of the situation (e.g. by seeking for help, by covering a tempting stimuli, making a waiting situation more comfortable by taking an interesting book with oneself: Gross/Thompson 2007; Kuhl 2000). Another strategy of self-regulation is to adapt information processing to the process phases of goal pursuit. Taking a deliberate mindset is thereby assumed to support goal formation. A deliberate mindset becomes obvious in an openness for multiple goals and for information that are relevant for goal selection, and an unbiased and realistic evaluation of advantages and disadvantages of alternative goals (Heckhausen/Gollwitzer 1987; Gollwitzer 1999). After selecting a goal, individuals should favor information that are relevant for goal attainment and elaborate them in more detail (Kuhl 1987; control of elaboration). Individuals with an implemental mindset have a narrow and optimistic focus on the selected intention and its positive consequences, ignore irrelevant and distracting information about alternative goals and their positive consequences (control of attention: Kuhl 1987, 2000), and prefer intention-relevant information such as opportunities to execute the intention (Heckhausen/Gollwitzer 1987; Gollwitzer 1999). With regard to the regulation of emotion, individuals may direct their attention towards or away from different situational aspects and emotion-relevant features (e.g. by distraction, rumination, or mindfulness: Gross/Thompson 2007). In the face of a tempting situation, motivation control helps individuals to stay on track by focusing on incentives or the positive long-term consequences and away from tempting stimuli (Kuhl 1987, 2000). Once the individuals attended to emotion-relevant features in a situation, individuals can reactively influence the interpretation of the situation by changing the way how they think about the situation (e.g. by viewing the situation as a challenge or as a threat, by accepting the situation, or by reframing potential negative events in a positive way; also called reappraisal). Individuals may also give a new meaning to the situation by altering the way how they appraise their capacities to manage situational demands (also called self-efficacy: Bandura 1991). Individuals' cognitive appraisal of the situation may give raise to an emotional response. Individuals can regulate the expressions of emotions at the experiential, physiological and behavioral level (Gross/Thompson 2007; Kuhl 1987; control of emotions). To alter emotion expression, individuals may share their emotion with others, enact them as verbal or physical aggression, consume drugs, suppress spontaneous expressions, direct emotional impulses to a substitute object, execute controlled breathing, use self-soothing strategies such as thumb suckling or they may communicate with others to receive help. However, emotion control also includes the generation of emotions that promote the realization of an intention (e.g. a good mood).

Models of developmental psychology further consider behavioral strategies of other individuals that aim to support children's self-regulation (i.e. co-regulation: Pauen/EDOS group 2016).

In the face of obstacles with a broader temporal horizon, two coping strategies have been proposed in developmental and clinical psychology: primary control (also called accommodation, and similar to problem-focused coping) and secondary control (also called assimilation and similar to emotion-focused coping: Heckhausen et al. 2010; Aldwin et al. 2011; see also Brandstädter/Rothermund 2002). Primary control enables individuals to affect changes in the external environment (in anticipation or in reaction to a situation). Primary control ensures persistence and stability in goal pursuit by mobilization of intentional efforts to modify the actual life situation in accordance with one's goal (i.e. to remove external obstacles). Primary control strategies comprise finding a new problem solution by seeking more information, by asking for help, and by increasing effort (e.g. to go to school with a group of friends to get rid of some bullying pupils from higher classes). In addition, primary control also subsumes strategies that already have been addressed above such as planning, proactive avoidance, and tuning of information processing. Individuals employ secondary control strategies to achieve direct change within the individual in order to (re-)gain primary control. Secondary control is about overcoming failure and allows for flexibility if individuals' resources or the context constraints primary control, i.e. secondary control enables compensation. Strategies of secondary control promote the adjustment of goals to internal or external constraints by de-connecting the hedonic link between goal and current circumstances. For example, individuals may select simpler goals, they may reappraise the actual situation in a positive manner, and they may redirect attention to alternative goal (also called motivation control: Kuhl 2000). Whereas 'control'-accounts of secondary control assume, that primary control is in general more superior and adaptive, 'fit'-accounts assume that strategy adaptiveness depends on an interaction between the current circumstances and an individual's current resources.

Psychological distancing is another way of overcoming obstacles. Psychological distancing means that individuals take another perspective that goes beyond their immediate perception. Individuals can do so by representing a possibly tempting, affect-loaded situation or object (e.g. a marshmallow) in a more abstract, schematic and decontextualized manner (e.g. compares to cotton wool) compared to a more concrete, unstructured and contextualized construction (e.g. would taste sweet, which would correspond to a concrete and episodic perspective: Metcalfe/Mischel 1999; Trope/Liberman 2010). Other theories see describe a self-regulatory mechanism that becomes obvious in the flexible regulation between lower, concrete and higher, abstract levels of construal (regarding goals, actions or events) depending on the context and the phase in the goal pursuit process (e.g. Watkins et al. 2011; Gollwitzer/Bayer 1999; see also section 2.1). One way of creating psychological distance is to use symbolic systems such as imagery, language and representational actions. Mental images, words or symbolic actions (e.g. gestures, pretend play, drawings) can represent or substitute actual situations, emotions, and actions without actual experience and thus create distance or space for alternative situations, emotions, and actions (analogous to the critical role of abstract representations in cognitive psychology). Labeling situations, emotions, and actions is also assumed to influence self-regulation by activating associated meanings and related information (what may be helpful for generating alternative views or solutions)

and in terms of self-directed speech which supports (self-)reflection and meta-representation (Winsler et al. 2009; Bandura 1991; Zelazo 2015, 2004; Marcovitch/Zelazo 2009; Holodynski et al. 2012).

5.5 Emotions as self-regulatory mechanism across disciplines of psychology

Some theories of self-regulation interpret emotions as mechanisms of self-regulation as already mentioned in some of the previous sections (e.g. in section 4.2). These accounts assume that emotions have multiple regulatory functions themselves. Emotions' regulatory functions have become known as implicit emotion regulation, reactive self-regulation, automatic self-regulation, emotional action regulation, or need-oriented coping (Gross/Thompson 2007; Bandura 1991; e.g. Cole et al. 2004; Derryberry/Rothbart 1997; Blair/Ursache 2010). Specifically, emotions are critical in appraising a situation with regard to personal relevance and the valence of the situation (i.e. interpret an event as threat or challenge). Individuals may anticipate possible consequences of achieving a goal thereby pre-feeling emotions such as pride or shame. In this way, emotions may influence individual' decisions to select and pursue a goal (Bandura 1991). Emotions may also signal discrepancies between current state and goal or deviations from the expected course of goal pursuit and are thus important for initiating necessary adaptations (Carver/Scheier 1998; Botvinick 2001; Higgins 1987). Activities during goal pursuit may elicit positive emotions and this may keep efforts of goal pursuit ongoing by maintaining motivation (Ryan/Deci 2001; Bandura 1993). Successful or failed goal attainment may also result in emotions that feed back to subsequent attempts of goal setting, striving, and control beliefs (also called affective self-evaluation or self-satisfaction: Bandura 1991). Further, anticipated or currently experienced emotions may influence information processing (e.g. focusing on rosy future when being in a good mood: Gilbert/Wilson 2007) as well as behavioral prepotencies (e.g. avoiding a park because of anticipated fears of dogs). Hence, emotions may successfully modulate target processes from a short-term perspective, but in the long-run they may disrupt psychological or physical integrity (e.g. avoidance may increase fear). In emotion regulation literature, even maladaptive strategies are considered as self-regulatory mechanism as long as they are effective in modulating predefined target processes. All other domains of psychology focus on self-regulatory means that support adaptive modulation from an external perspective in that they contribute to accomplishing the task accurately or achieving the goal efficiently. For these accounts, self-regulatory mechanisms do not subsume maladaptive modulation by emotions.

5.6 Summary

Self-regulation can be defined in terms of the mechanisms that allow for goal-directed behavior. The nature of the suggested self-regulatory mechanisms greatly varies between disciplines of psychology. Cognitive psychology typically focuses on basic cognitive processes such as executive functions and cognitive control. In contrast, literature in clinical psychology, general, and social psychology typically refers to more complex strategies that may be cognitive, motivation, emotional, or behavioral in nature (e.g. attention and encoding control, motivation control, mental contrasting, implementation intention) and aim to achieve self-control, emotion regulation, coping and stress regulation (Gross/Thompson 2007). Whereas in cognitive psychology most self-regulatory

facets are measured in terms of a quantity (see Braver 2012 for an exception), research on emotion regulation and related fields focus on the quality of strategies that individuals use. Another cross-discipline difference is that cognitive psychology mainly addresses cognitive means that are conscious, non-automatic and traditionally describes self-regulation as a one-way route from cognitions to emotional, motivational, cognitive, behavioral, and physiological target processes. In contrast, clinical psychology and research in social, personality, and biological psychology consider the whole range of emotional, motivational, cognitive, behavioral, and physiological mechanisms and describe bidirectional links among them in that processes at all levels may take the role as mechanism and target process. From this perspective, self-regulatory mechanisms can also operate in a non-conscious and automatic way, so that the individual may not be aware of using a strategy and may not be aware of the effects that this strategy generally has or generates within the specific situation.

6 Conclusion

Psychological literature provides a high number of different conceptualizations of self-regulation. These perspectives converge in the general assumption that self-regulation embodies goal-directed behavior. Beyond, these different views seem to be almost incompatible when trying to merge them into one definition of self-regulation. As some other researchers have done before, I argue for appreciating this conceptual diversity in viewing self-regulation as a multifaceted concept. Following this diversity approach, the present paper aimed at systematizing differences and commonalities between self-regulatory facets along four key aspects. Throughout the paper, I first considered the role and the nature of goals within the respective theories. Second, I examined whether models assumed a process-like character of self-regulation and whether they focused on specific phases. Third, I described which obstacles and which target processes different models consider and on what levels they analyze them. Fourth, I presented what mechanisms these models propose for the modulation of target processes and on what levels these mechanisms are evaluated.

From my perspective, this approach provides several advantages. With regard to past research, the diversity approach may serve to classify already existing accounts of self-regulation. This may help to facilitate a dialogue across fields of psychology through enhancing researchers' awareness for connotations in the use of different termini. For example, the term 'cognitive control' usually refers to cognitive top-down processes that serve to modulate 'cognitive' target processes during problem solving. However, cognitive top-down processes also play a role in the modulation of emotional experience, which is usually referred to as 'emotion regulation'. This critical overlap becomes obvious in employing the suggested diversity approach and thus may allow for the combination of two conceptual standpoints that have been discussed in relative isolation so far. The proposed diversity approach may also bring progress to some ongoing conceptual debates, for example regarding the question where automatic processes may be involved in self-regulation (in goal formation, as target process, as mechanism). A more systematic description of self-regulatory facets on a conceptual level may also provide a useful tool to classify the large pool of methods for the assessment of self-regulation. These methods may address different goals, may consider different process phases, may analyze different obstacles and means, or may address the same objective at a different

level. Conceptual clarity along the four key aspects may also shed new light on alternative explanations for some empirical discrepancies in self-regulation research and uncover new relations between so far unrelated findings (e.g. considering the role of goal detection in the explanation of previous age-related differences in executive functions; considering the divergence between cue-directed compared to self-initiated executive function in developmental research).

With regard to future directions, analyzing self-regulatory facets along the four key aspects may inspire the conceptual and empirical consideration of self-regulatory facets from other domains. For example, goal formation may be an interesting topic for future research on self-regulation in cognitive developmental psychology. New studies on metacognitive parameter controlling the balance between control and desire may be interesting for clinical psychology. Temporal dynamics and self-regulatory strategies such as implementation and mental contrasting may be a promising, new avenue for childhood research on executive functions. Last, but not least, the diversity approach may also foster the creation of novel facets of self-regulation and stimulate the design of new self-regulation measures, respectively, through the systematic variations in one of the four aspects and analysis levels (e.g. motivational, cognitive, affective, physiological, motor behavior). For example, analyzing physiological mechanism in the regulation of cognition may provide a new embodied approach.

The present paper focused on goals, process phases, obstacles, and mechanisms as key aspects for systematically comparing self-regulatory facets. This list may not be exhaustive at all and awaits suggestions for other critical dimensions in upcoming conceptual discussions on self-regulation. Similarly, this overview addressed only some of the manifold concepts of self-regulation. Further conceptual analyses may extend this approach to a more comprehensive review of self-regulation theories. Despite these limitations, I hope that I was able to convey possible advantages of the diversity approach for conceptual, empirical, and methodological discussions on what self-regulation is.

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