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Doing Despite Disliking: Self-regulatory Strategies in Everyday Aversive Activities

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Abstract: We investigated the self-regulatory strategies people spontaneously use in their everyday lives to regulate their persistence during aversive activities. In pilot studies (pooled N = 794), we identified self-regulatory strategies from self-reports and generated hypotheses about individual differences in trait self-control predicting their use. Next, deploying ambulatory assessment (N = 264, 1940 reports of aversive/challenging activities), we investigated predictors of the strategies' self-reported use and effectiveness (trait self-control and demand types). The popularity of strategies varied across demands. In addition, people higher in trait self-control were more likely to focus on the positive consequences of a given activity, set goals, and use emotion regulation. Focusing on positive consequences, focusing on negative consequences (of not performing the activity), thinking of the near finish, and emotion regulation increased perceived self-regulatory success across demands, whereas distracting oneself from the aversive activity decreased it. None of these strategies, however, accounted for the beneficial effects of trait self-control on perceived self-regulatory success. Hence, trait self-control and strategy use appear to represent separate routes to good self-regulation. By considering trait- and process-approaches these findings promote a more comprehensive understanding of self-regulatory success and failure during people's daily attempts to regulate their persistence. © 2018 European Association of Personality Psychology

Key words: self-regulation; self-control; strategies; persistence; goal pursuit

In our daily lives, we sometimes need to engage in activities that we do not enjoy, often for the sake of a personal goal. Students, for example, may sometimes need to read textbooks they find profoundly boring, and athletes may need to practice their sports at painfully high intensities to increase their performance. Moreover, many occupations involve tasks that are perceived as monotonous (e.g. assembly line work) or require workers to cope with emotional stressors (e.g. in emergency management or intensive care units). When an activity is boring, difficult, or requires physical or mental effort, persistence in it requires self-regulation (or self-control),[1] that is, processes by which individuals can alter their cognitive, emotional, or behavioural responses in the service of their long-term goals (Baumeister, Vohs, & Tice, 2007).

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[1]To reflect the broad range of possible strategies that people may use to help themselves persist during unpleasant and challenging activities, we will from now on use the term 'self-regulation' instead of 'self-control' whenever we refer to processes (but will stick to 'trait self-control' for the individual difference construct). In the literature, 'self-control' is often used in a more restricted sense as referring to the effortful suppression of impulses. While people may suppress the impulse to quit and thereby capitalize on their self-control, they may also use other self-regulatory strategies to help themselves persist, for example, by making activities more fun. As we wish to include all kinds of strategies in our analysis, we will use the broader term 'self-regulation' throughout the article, except when we refer to trait self-control.

To date, relatively little is known about how people try to promote their own persistence in such everyday activities. Which self-regulatory strategies do they spontaneously use? And how much do these strategies actually help them to persist? In the present research, we attempted to answer these questions while placing them into the larger context of individual differences in trait self-control. More specifically, we investigated (i) the self-regulatory strategies people use spontaneously in their everyday lives, for different activities and when confronted with various demands, (ii) the reported effectiveness of these strategies as a function of demand types, (iii) the extent to which individual differences in trait self-control predict the use of self-regulatory strategies, and (iv) whether, in turn, the use of these self-regulatory strategies can explain why people, who are high in trait self-control, report being more successful in regulating their persistence in a given moment.

SELF-REGULATORY STRATEGIES

We understand self-regulatory strategies as the means through which individuals, in order to help themselves achieve their goals, actively alter their cognitive, motivational, affective, or behavioural reactions to a self-regulatory challenge. The goals may be long-term (e.g. losing 15 kilos) or short-term task goals (working off 300 calories on a treadmill). The challenges may be initiation-related (getting up from one's couch to go to the gym even if it is aversive), inhibition-related (not eating delicious chocolate cake), or persistence-related (staying on

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the treadmill even if it is aversive) (see Hoyle & Davisson, 2016, for an introduction into the distinction of the three types of challenges). In the current research, we focus on the latter type of self-regulatory challenge, when the challenge lies in staying persistent in an aversive activity.

The strategies that people may use can capitalise on cognitive, motivational, affective, or behavioural processes. For example, a runner on a treadmill may use a cognitive strategy by imagining that she is not in a bland gym environment but running in a race against the other people working out next to her. Using a motivational strategy, the runner may monitor her own progress with regard to her training goals by checking the distance she has already tackled. Using an affective strategy, the runner may try to improve her mood by thinking happy thoughts when the workout gets really hard and painful. Finally, using a behavioural strategy, the runner may decide to leave the gym and instead run in the more pleasurable environment of a nearby forest. Note that these categories are intertwined. For example, the *cognitive* strategy of monitoring one's progress may be effective through its effects on *motivation* which themselves may have been set off by the *affective* consequences of perceiving one's progress as too slow (Carver & Scheier, 1990).

Prior research has usually taken a relatively narrow focus on self-regulation strategies: a lot of work has focused on the effects of single strategies like implementation intentions (Gollwitzer, 1999), self-reinforcement (Bandura, 1976), goal setting (Locke & Latham, 2002, 2006), or monitoring one's goal progress (for a review, see Harkin et al., 2016), and either instructed participants to apply the strategy (e.g. Duckworth, White, Matteucci, Shearer, & Gross, 2016; Gollwitzer & Brandstätter, 1997) or assessed its spontaneous deployment by the participant (e.g. Brickell & Chatzisarantis, 2007). Other work has not necessarily focused on a single strategy but on a specific context in which self-regulatory demands arise, like coping with boredom (Nett, Goetz, & Hall, 2011; Sansone, Weir, Harpster, & Morgan, 1992), self-regulated learning (e.g. Boekaerts, 1997; Dörrenbächer & Perels, 2016; Pintrich & De Groot, 1990; Zimmerman, 1990), academic writing (e.g. Zimmerman & Risemberg, 1997), sports training (e.g. Green-Demers, Pelletier, Stewart, & Gushue, 1998), or musical instrument practice (e.g. Nielsen, 2004). In the current work, we restrict our focus neither to single strategies nor to specific self-regulatory demands. Rather, we investigate a wide range of strategies for a wide range of self-regulatory demands, including mentally effortful, physically effortful, boring, and emotionally challenging tasks. To our knowledge, this is the first work to investigate the frequency of the spontaneous use of a large number of self-regulatory strategies in everyday (aversive or challenging) activities.

Despite the diversity of cognitive, motivational, affective, and behavioural processes involved in self-regulation, all (consciously used) self-regulatory strategies have in common that their use is, among other influences, probably a result of the person's metacognitive judgement that the activity at hand is aversive or challenging but that one should persist in it and that deploying a strategy may make persistence more likely (Mischel & Mischel, 1983; Schunk & Zimmerman, 1994). Which specific strategies are deployed then probably reflects the person's beliefs about what constitutes an effective strategy in a given situation (Courneya & McAuley, 1991; Kennedy & Miller, 1976; Palmer & Goetz, 1988). These beliefs probably result from past experiences and may, hence, represent helpful metacognitive knowledge (Mischel, 1981). They may, however, like all subjective beliefs, be misguided (e.g. Boggiano, Barrett, Weiher, McClelland, & Lusk, 1987; Yeager & Dweck, 2012). Accordingly, we expect that, overall, not all the strategies that individuals report using will actually promote persistence. It is probable, however, that individuals who are high in trait self-control tend to use those strategies that actually increase their persistence in a given activity.

Strategies in the light of the process model of self-regulation

Strategies can not only capitalise on a variety of cognitive, motivational, affective, and behavioural processes but they can also be deployed at various points in time. This is a central assumption of Gross' modal model of emotion regulation (Gross, 1998a, 1998b), which was recently adapted to self-regulation as the *process model of self-regulation* (Duckworth, Gendler, & Gross, 2016; Duckworth, White, et al., 2016). Based on the process model of self-regulation, strategies can be organised along a regulatory sequence or cycle: it begins with the psychologically relevant situation, here: the activity for which persistence may have to be regulated. When pursuing a goal, individuals may, for example, deploy strategies related to *situation selection* by choosing a goal-related activity that they consider pleasant rather than one that they consider unpleasant and for which they would have to regulate their persistence (Woolley & Fishbach, 2015). This could imply, for example, choosing running over the personally more dreadful rowing. Once selected, the activity or the situation in which it is performed may be modified to regulate persistence (*situation modification*). A person may, for example, add a second, more pleasant activity to accompany the unpleasant target activity, for example, by listening to music while running on the treadmill (e.g. Butler, 1998). Next in the sequence is the *deployment of attention* in the service of persistence regulation. Here, individuals may, for example, distract themselves from the unpleasant activity, for example, by thinking about what to cook for dinner instead of focusing on their strained muscles. *Cognitive change* then refers to regulations of one's thoughts about and appraisals of the activity. For example, a person may try to think of the activity in light of its positive consequences as opposed to the effort it involves. Finally, *response modulation* involves altering one's response to the unpleasant situation, typically, by suppressing the impulse to quit and 'just doing it'.

Strategy use as a process through which trait self-control 'gets outside the skin?'

Trait theories assume that people differ reliably from one another. Personality traits describe these individual differences in terms of characteristic thoughts, feelings, and behaviours

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(Funder, 2001). Individual differences in self-regulatory ability can be captured by assessing a person's self-control, his or her 'control over thoughts, emotional control, impulse control, performance regulation, and habit breaking' (Tangney, Baumeister, & Boone, 2004, p. 282). Self-control is also a facet of conscientiousness (e.g. Goldberg, 1999), the Big Five personality trait that is the 'most clearly relevant for self-regulation' (Hoyle, 2006, p. 1510). Like conscientiousness (see, e.g. Barrick & Mount, 1991; Donnellan, Conger, & Bryant, 2004; Ozer & Benet-Martinez, 2006; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007), trait self-control is predictive of numerous real-life outcomes like better school performance, healthier behaviour, and better socio-emotional adjustment (De Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Tangney et al., 2004). While it is among the most extensively studied traits to indicate individual differences in self-regulation or self-control and its beneficial consequences are well-known, little is known about how these individual differences 'get outside the skin' (Hampson, 2012). Recent evidence suggest that self-control relates to a broad range of behaviours and processes beyond the effortful inhibition of undesired responses: for example, it has been associated with the proactive avoidance of temptation (Ent, Baumeister, & Tice, 2015), the establishment of beneficial habits (Adriaanse, Kroese, Gillebaart, & De Ridder, 2014; Galla & Duckworth, 2015), the experience of one's daily activities as more autonomously regulated (e.g. more fun and interesting; Converse, Juarez, & Hennecke, 2018), and a weakened desire for temptations that conflict with a current goal (Hofmann, Baumeister, Förster, & Vohs, 2012). We locate our approach within this broad view of trait self-control as reflecting a group of processes that determine how people pursue goals in different situations (Fleeson & Jayawickreme, 2015; McCabe & Fleeson, 2016). Strategy use may represent another process through which individuals high in trait self-control achieve their goals. According to this view, trait self-control represents a density distribution of momentary self-control enactment over time (Fleeson, 2001), which is aided by the use of strategies.

THE PRESENT RESEARCH

In the present research, we investigated the following research questions: (i) what are the self-regulatory strategies people spontaneously use in their everyday lives, when confronted with various demands (physical effort, mental effort, emotional challenge, boredom)? (ii) As how effective do people experience these strategies in daily life and does their perceived effectiveness vary as a function of demand types? (iii) Do individual differences in trait self-control predict the use of self-regulatory strategies? Do individuals high in trait self-control use strategies that appear as helpful to their self-regulation more often and strategies that appear as harmful to their self-regulation less often than individuals low in trait self-control? And (iv) does their use of certain strategies, in turn, explain why individuals who are high in trait self-control report being more successful in self-regulating their persistence in a given moment?

In preparation of our confirmatory Main Study, we first ran three exploratory pilot studies (Pilot Studies 1, 2a, and 2b). The goal of Pilot Study 1 was to develop, in a bottom-up fashion, a list of self-regulatory strategies that people report using in their everyday lives to help themselves persist in unpleasant or challenging activities. Pilot Studies 2a and 2b then explored associations between trait self-control and these strategies. We then attempted to replicate associations between trait self-control and the strategies in the Main Study, given they were already present in Studies 2a and 2b. Additionally, the Main Study served to test whether strategy use predicted self-regulatory success. It also allowed us to explore a number of interesting questions about the role of demands in determining strategy use and the association of strategy use and successful persistence. It furthermore tested the conceptual process model that individuals with high levels of trait self-control are more successful in regulating persistence in their goal pursuit, *because* they use more helpful and less harmful self-regulatory strategies. By testing this model, we also respond to a call for personality science to be less descriptive and more explanatory (Cramer et al., 2012; Fleeson & Jayawickreme, 2015; Hampson, 2012) and to focus not only on the 'what' of personality but also on the 'how' (Revelle, 1995).

To investigate how people deal with self-regulatory challenges in their daily goal pursuits, the Main Study deployed the method of ecological momentary assessment. This method allows researchers to understand people's thoughts, feelings, and behaviours in their everyday lives by surveying them multiple times throughout a day over the course of several days (Csikszentmihalyi & Larson, 1987). Recently, self-regulation researchers have become interested in studying self-regulation through the use of this method (Friese & Hofmann, 2016; Hofmann et al., 2012; Milyavskaya & Inzlicht, 2017; Milyavskaya, Inzlicht, Hope, & Koestner, 2015). So far, however, this research has focused exclusively on self-regulatory conflicts that involve desires and temptations, while neglecting the kind of self-regulatory conflicts that are in the focus of the current work, namely, when individuals try to persist in an aversive or challenging activity.

We determined our sample sizes before running our studies, and we did not augment our samples after data analysis. We furthermore report all manipulations and, in the unabridged materials that are publicly available on the Open Science Framework (https://osf.io/vkd26/), all measures. Reproducible analysis scripts can also be found under this link. Unfortunately, we are unable to make the data public, as our informed consents at the time of data collection did not inform participants about this possibility. The data are available upon request. Hypotheses were not preregistered.

PILOT STUDY 1

To obtain a list of possible self-regulatory strategies used in everyday life in a bottom-up way, we asked participants to list strategies that they use to 'keep themselves going' when they experienced a goal-directed activity as unpleasant or challenging. After coding participants' responses, we

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checked, complementing the bottom-up approach with a top-down approach, whether the list of strategies we derived matched the strategies discussed most prominently in the self-regulation literature. This was the case (see Table 1 for an overview of strategies and their descriptions and Table S1 for more information, including exemplary references).

Table 1. Strategy descriptions and strategy use items from Pilot Study 2a

Strategy	Description	English item from Pilot Study 2a
Situation modification strategies		
1) Changing the activity itself	Changing the nature of the activity itself or of how it is performed (without adding an incentive from the outside)	*I change the activity itself* (*e.g. run more slowly on the treadmill*, *take notes during studying*).
2) Changing the environment	Changing the environment in which the activity is performed (unspecified whether this results in a fresh start, task enrichment, distraction of attention, or removal of distractions)	*I change the environment where I perform the activity* (*e.g. work from a coffee shop*, *take a new route when running*).
3) Reducing distractions	Reducing or removing distractors or temptations from one's environment	*I reduce or remove distractions and temptations*.
4) Seeking social support	Using the support of others	*I draw on the social support of others*.
5) Taking a substance	Taking substances, drugs, medication	*I take a substance or drug* (*e.g. coffee or energy drinks*).
6) Task enrichment	Adding some kind of (positive) stimulus input outside of the activity (e.g. music, TV, phone talk, food, and drink) without changing the activity itself	*I add something positive to the activity to make it more pleasant* (*e.g. listen to music*, *watch TV while doing it*).
Attentional deployment strategies		
7) Adopting a process focus	Focusing one's attention on how the activity is performed	*I focus my attention on the activity itself and on the way I am performing it*.
8) Distracting oneself from the activity	Focusing one's attention on something else outside of the activity (without changing the activity itself or enriching the task by adding an outside incentive)	*I distract my attention by focusing on something else outside of the activity*.
Cognitive change strategies		
9) Anticipating self-reward	Adding a reward that is external to the activity or its goal	*I later reward myself for performing the activity*.
10) Focusing on negative consequences	Thinking of negative consequences from non-pursuit of the activity, the prevention/avoidance goals that motivated the activity: responses usually include negation (not being healthy), reference to negative outcome or reference to avoidance or prevention	*I think of the negative consequences that occur if I do not perform the activity*.
11) Focusing on positive consequences	Thinking of positive consequences from pursuit of the activity, the promotion/approach goals that motivated the activity: responses usually include reference to a desirable outcome	*I remind myself why I perform the activity and think of its positive consequences*.
12) Goal setting	Committing to (sub)goals	*I define a specific goal or set subgoals for myself*.
13) Monitoring one's goal progress	Checking one's progress	*I check my goal progress*.
14) Planning/scheduling	Making a schedule or plan (may include the setting of subgoals, but only when timing is also set)	*I make a plan or set a specific time for engaging in the activity*.
15) Reappraisal	Thinking differently of the activity or changing its meaning (without changing the activity itself)	*I think differently about the activity or change its meaning* (*e.g. imagine running in a race*).
16) Self-talk	Motivating self-talk	*I talk to myself to motivate me*.
17) Thinking of the near finish	Thinking about (nearby) task completion (not about the long-term goals)	*I remind myself that soon I will be done with the activity*.
Response modulation strategy		
18) Suppressing the impulse to quit	Inhibiting the impulse to quit	*I suppress the impulse to quit*.
Not further specified strategy		
19) Emotion regulation (not further specified)	Regulating one's feelings (unspecified how this is done)	*I change how I feel* (*e.g. try to stay in a good mood*).

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Method

Sample

We had no prior expectations about what would represent a large enough sample size. We expected that when advertising 330 hits on Mturk, we would get at least 100 participants with useful responses in each of three scenarios described below. We therefore opened up the study for 330 hits on Mturk. Mturk returned 335 participants, six of which did not provide any strategies and were therefore excluded. That left us with a final sample of $N = 329$ participants (327 provided their age, 19–69 years, $M = 35.7$ years, $SD = 10.9$; 329 provided their gender, 44.1% female). Mturk workers earned $0.50 for their participation. All data were collected on 15 October 2015.

Procedure

In order to capture the full range of self-regulatory strategies, we decided to present each participant with one of three different scenarios, one implying a mentally challenging task ('exam' scenario), one implying a physically challenging task ('treadmill' scenario), and a third idiosyncratic variant ('idiosyncratic' scenario). The survey tool randomly assigned participants the different survey versions (see Supporting Information). We decided to confront each participant with only one type of scenario because we were worried that otherwise many participants could just name very similar strategies for each of the three scenarios to reduce the burden of consulting their own memory when having to consider different types of demands anyway. The 'exam' scenario required participants to imagine themselves preparing for a difficult exam with boring materials. The 'treadmill' scenario required participants to imagine themselves vigorously exercising on a treadmill. The 'idiosyncratic' scenario required participants to name a rather frequent activity in their lives that they needed to perform to achieve a goal they considered important and that they did not enjoy at all. In all three scenarios, our target questions asked participants to write down strategies that they use to keep themselves going with these activities even if they are not enjoyable. We furthermore instructed participants that these strategies could include changing what they think about, attending to certain aspects of the situation, ignoring other aspects, changing what they feel, or changing what they do or how they do it. We did so to make sure that their responses would cover the regulatory processes proposed in the Duckworth, Gendler, and Gross (2016) process model of self-regulation, which includes strategies of situation modification ('changing what they do or how they do it'), strategies of attentional deployment ('attending to certain aspects of the situation, ignoring other aspects'), strategies of cognitive change ('changing what they think about'), and strategies of response modulation (also 'changing what they do', although response modulation really includes 'just doing it', and hence not really using a specific strategy except for the use of one's willpower, Duckworth, White, et al., 2016). Note that while Duckworth's model also includes strategies of situation selection, we deemed those to not be relevant, because the situation in which persistence needed regulation had already been selected.

We then provided five empty entry boxes to which up to five more boxes were added one by one, if needed. With the goal to potentially explore participants' responses later, we afterwards asked a couple of additional questions depending on the scenarios (e.g. a question about how unpleasant they experienced preparing for exams in the past). These questions are not relevant to the current research agenda. Sociodemographic questions were the last procedural step.

Results and discussion

Participants reported between 0 and 10 different self-regulatory strategies ($M = 5.8$, $SD = 2.8$), providing us with a total number of 1942 strategies. To combine these strategies into categories, we used a multiple-step coding approach. In the first step, the first author randomly pulled 100 strategies from participants' responses across conditions in order to identify descriptive categories that most accurately and most parsimoniously corresponded to this subsample of strategies and that corresponded to strategies known from the self-regulation literature. She identified 25 distinct categories (including the categories 'no strategy/nonsense response' and 'other strategy'). Next, a research assistant with a bachelor's degree in psychology used these 25 categories to code the same 100 strategies. There were 33 disagreements between the first author and the research assistant. Within the 67 agreements, four responses were unanimously identified as not meaningful. To increase future agreements, the coding system was improved, specifically by adding, for each strategy, a list of potentially similar but distinct other strategies from which coders should explicitly distinguish any strategy in question (see Table S1). The first author and two research assistants (both with bachelor's degree in psychology) then independently coded a new random sample of 100 strategies. Agreement between these three coders ranged between 54% and 71%. After some additional clarifications within the coding system, another third random sample of 100 strategies was selected and independently coded by the two research assistants. Their agreement rate was 65%, which corresponds to a Cohen's kappa of .62, a score that is considered as 'fair to good agreement beyond chance' (Fleiss, Levin, & Paik, 1981, p. 604). Most importantly, none of the 300 coded strategies fell into the auxiliary category of 'other strategy', suggesting that the coding system was reliable and exhaustive. We therefore decided that we had attained our goal of extracting a comprehensive list of the kinds of strategies people use in their everyday lives.

Without the categories 'no strategy/nonsense response' and 'other strategy', the coding system contained 23 distinct strategies. These were, except for one, transformed into questionnaire items for subsequent studies. One strategy, *focusing on consequences*, was not transformed into its own item, as the two strategies *focusing on positive consequences* (of the activity) and *focusing on negative consequences* (of not performing the activity) already covered all possible thoughts of consequences, leaving us with 22 strategies. Of these 22 strategies, three did not refer to how people deal with wanting to persist with an unpleasant activity in the moment, namely, *taking a break*, *avoiding unpleasant activities*

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altogether, and *improving one's self-regulation* outside of the activity (e.g. through reading self-help books). Accordingly, we do not consider these strategies further.

The 19 final strategies and the descriptions that allowed for their reliable assignment to categories are displayed in Table 1. Table S1 furthermore displays a (non-exhaustive) list of exemplary references to previous work that has already studied these or similar strategies. It is apparent that most of the strategies named by participants have already been discussed (albeit not together) in the basic or applied self-regulation literature. Most strategies could furthermore be organised along the sequential process model of self-regulation (see Figure 1, Gross, 1998a, 1998b; Duckworth, Gendler, & Gross, 2016). *Changing the activity itself*, *changing the environment*, *reducing distractions*, *seeking social support*, *taking a substance* (e.g. coffee or an energy drink), and *task enrichment* (which implies adding something pleasant to the activity, like listening to music while exercising) can all be considered strategies of situation modification. They leave the target activity relatively intact but try to make persistence in it more likely by changing something about the conditions under which it is performed. *Distracting oneself from the activity* and *adopting a process focus*, which implies paying attention to the way one performs the activity, can be considered strategies of attentional deployment. These strategies include directing the focus of attention to features of the activity or outside of the activity to facilitate persistence. Cognitive change strategies, that is, strategies that help oneself to think differently about the activity included *anticipating self-reward*, *focusing on negative consequences* (of not performing the activity), *focusing on positive consequences* (of performing the activity), *goal setting*, *monitoring one's goal progress*, *planning/scheduling*, *reappraisal*, *self-talk*, and *thinking of the near finish*. Finally, one strategy clearly referred to response modulation, which entails voluntarily *suppressing the impulse to quit*.

In addition, one strategy was described that was not easily assigned to any of the four classes of strategies provided by the model. Some participants referred to *emotion regulation* without further specifying it (e.g. by describing that they were trying to stay in a good mood but not how). As emotion regulation can, as proposed in Gross' model (e.g. Gross, 1998a, 1998b), be attempted along the entire sequence of situation selection, situation modification, attentional deployment, cognitive change, and response modulation, we could not assign it to any of these categories alone.

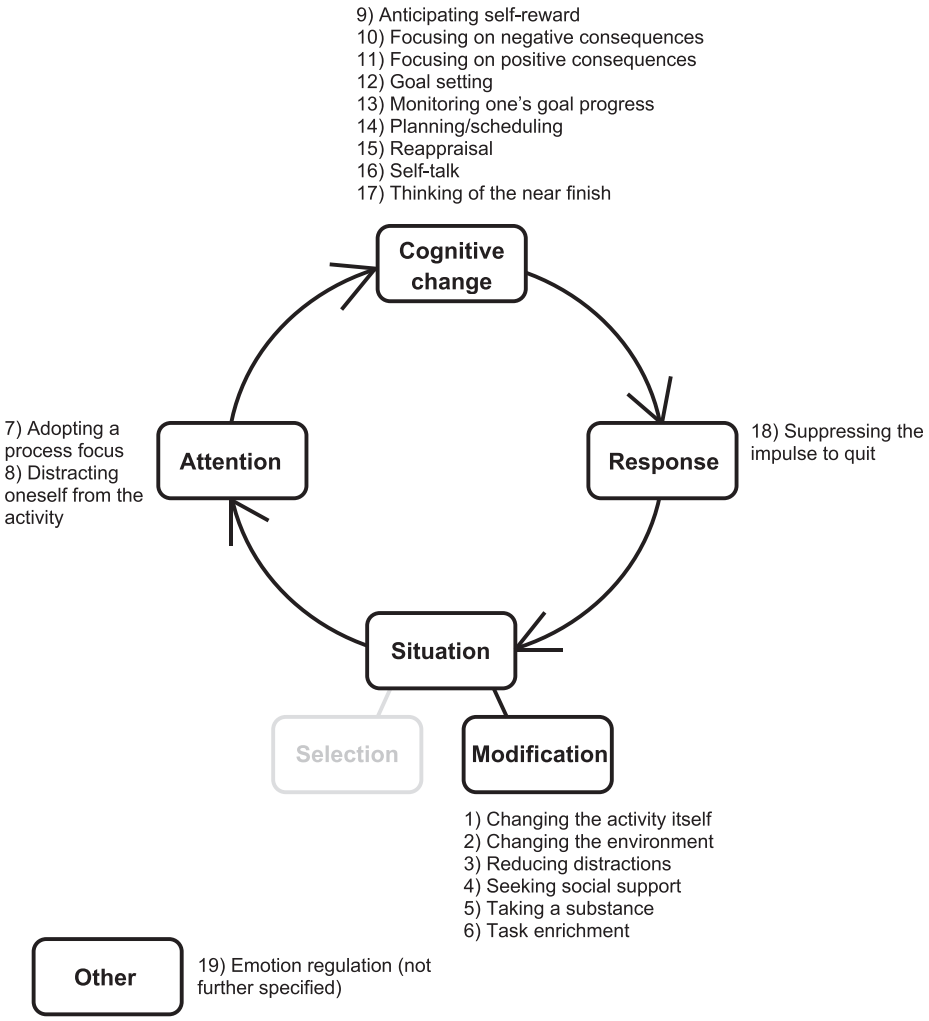

Figure 1. Assignment of strategies to categories of self-regulatory strategies in the Duckworth, Gendler, & Gross (2016) and Duckworth, White et al. (2016) process model of self-regulation.

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It is important to note that we cannot guarantee having exhausted the full spectrum of all possible self-regulatory strategies in daily life. While we tried to elicit strategies for different kinds of activities and were successful in creating an exhaustive coding scheme, it is possible that some people may sometimes use other strategies that we have not yet covered. It is unlikely, however, that we missed other *frequently* used strategies with our approach. We will revisit this issue in the Main Study, where participants were able to report any other strategy that they may have used that was not on the list. If this were to be the case frequently, it would be necessary to revise our list of frequently used self-regulatory strategies.

After having obtained the list of self-regulatory strategies in this first Pilot Study, we wanted to test whether individual differences in trait self-control could predict the frequency of their usage in everyday life. For this reason and to decrease the number of hypotheses to be tested in the Main Study, we ran two more pilot studies (2a and 2b) to explore associations between trait self-control and strategy use. We expected that some of the strategies would show positive correlations with trait self-control, as their effectiveness is well-supported by prior research (e.g. *goal setting*, Locke & Latham, 2002, 2006; or *monitoring one's goal progress*, Harkin et al., 2016), and it is likely that individuals with high levels of self-control also use successful strategies. For some strategies, it was difficult to derive clear hypotheses. Take, for example, the strategy of *focusing on the positive consequences* of the activity*:* On the one hand, it has been shown that a focus on the desired outcomes or consequences of goal pursuit can be detrimental to persistence and success in goal pursuit (Fishbach & Choi, 2012; Freund & Hennecke, 2012, 2015). This makes it less likely that the strategy of *focusing on the positive consequences* of the activity is used by individuals with high self-control. On the other hand, goal activation (Fishbach, Friedman, & Kruglanski, 2003; Shah & Kruglanski, 2003) and motivation control (Kuhl, 1984) have both been discussed as potentially helpful in enabling persistence, and a promotion focus has been linked to a higher trait self-control (Cheung, Gillebaart, Kroese, & De Ridder, 2014). These findings, in turn, make it more likely that the strategy is used more by individuals with higher trait self-control. As we could not always derive clear hypotheses, we therefore decided to take a data-driven approach to hypothesis generation in the upcoming two pilot studies.

PILOT STUDIES 2a AND 2b

As described earlier, we were interested in whether individual differences in self-control were correlated with the extent to which participants used self-regulatory strategies. To obtain correlations of trait self-control with strategy use, we asked participants to indicate how frequently, in the past, they had used the 19 strategies obtained in Pilot Study 1. For internal replication, we ran the same study with two samples, one English-speaking sample that we recruited through Mturk (Pilot Study 2a) and one German-speaking sample (Pilot Study 2b).

Method

Sample A

To attain precise correlation estimates, we posted 250 hits for workers from Canada and the USA on Mturk (Schönbrodt & Perugini, 2013). Deleting responses from participants, who had not provided their IDs or had incorrectly responded to an instructed response item ['To help us monitor our data quality, please choose the response option in the middle (neither agree nor disagree).'], left us with a sample of $N = 245$ participants (19–74 years, $M = 36.4$ years, $SD = 12.1$, 42.4% female, 55.5% male, 0.4% other, 1.6% did not indicate their gender). Participants received $4.00 as compensation. All data were collected on 19 April 2016.

Sample B

Again, to attain precise correlation estimates (Schönbrodt & Perugini, 2013), our goal was to recruit 250 German-speaking participants. However, we quit data collection after 2 months, when no more new responses rolled in. Participants were psychology students and individuals, who had participated in previous studies of our lab. For compensation, psychology students received course credit; other participants took part in a raffle to win a book voucher ($10). Additionally, we donated, for each participant, $2 to a charity organisation. Deleting responses from participants, who had failed to correctly respond to an instructed response item, left us with a sample of $N = 220$ participants (18–74 years, $M = 30.2$ years, $SD = 11.6$; 73.2% female, 23.2% male, 3.6% did not indicate their gender). All data were collected between 15 January and 16 March 2016.

Measures

Descriptive information for all variables is displayed in Table 2.

Frequency of use of self-regulatory strategies. For each of the 19 self-regulatory strategies identified in Pilot Study 1, we created English and German items and asked participants to indicate on a scale from 1 (*never*) to 5 (*all the time*), how often they had used the strategy in the past (see Table 1 for the English items). Both the English and the German items were developed in parallel at the same time when preparing Pilot Studies 2a and 2b. The team of the three authors of this manuscript, who are all fluent in both languages, formulated the items together and made sure that wordings in the two languages matched well with each other. The instructions introducing these items were as follows: 'Sometimes, in order to attain a goal or avoid unpleasant consequences, we have to engage in activities that we experience as highly unpleasant, challenging, or boring. In such situations, we have to keep ourselves from stopping even though we feel like it. Some people, for example, find certain work tasks or exercising unpleasant, but nevertheless keep going. Please think of yourself in similar situations. Below you find a list of 22 strategies that people can use in order to keep going with an activity even when it is unpleasant. Please let us know how often you use such strategies and how effective you think these strategies are for you personally'. Note that we still asked

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Table 2. Descriptive statistics and correlations of self-regulatory strategy use with trait self-control (TSC) (Pilot Studies 2a and 2b)

	Sample 2a					Sample 2b				
Variable	*M*	*SD*	*r* with TSC	95% CI	*p*	*M*	*SD*	*r* with TSC	95% CI	*p*
Trait self-control	4.47	1.18	—			4.12	0.92	—		
Situation modification strategies										
1) Changing the activity itself	2.93	0.95	.06	[−0.07, 0.18]	.380	2.78	0.94	−.02	[−0.15, 0.11]	.831
2) Changing the environment	2.80	1.09	**.16**	[0.04, 0.28]	.013	2.92	1.09	.11	[−0.02, 0.24]	.092
3) Reducing distractions	3.00	1.11	**.31**	[0.19, 0.42]	<.001	3.01	1.03	**.24**	[0.11, 0.36]	<.001
4) Seeking social support	2.45	1.17	**.13**	[0.01, 0.25]	.045	2.71	0.97	.00	[−0.13, 0.13]	.949
5) Taking a substance	2.44	1.24	**−.23**	[−0.35, −0.11]	<.001	2.34	1.18	−.11	[−0.24, 0.02]	.118
6) Task enrichment	3.58	1.02	**−.22**	[−0.34, −0.10]	.001	3.37	1.03	−.13	[−0.26, 0.00]	.060
Attentional deployment strategies										
7) Adopting a process focus	3.40	0.98	**.25**	[0.13, 0.36]	<.001	2.93	1.03	**.28**	[0.15, 0.40]	<.001
8) Distracting oneself from the activity	2.91	1.10	**−.26**	[−0.37, −0.14]	<.001	2.85	0.99	**−.25**	[−0.37, −0.12]	<.001
Cognitive change strategies										
9) Anticipating self-reward	3.41	1.12	.07	[−0.06, 0.19]	.284	3.52	1.02	−.04	[−0.17, 0.09]	.519
10) Focusing on negative consequences	3.32	1.24	**−.14**	[−0.26, −0.02]	.027	3.23	1.14	**−.18**	[−0.31, −0.05]	.007
11) Focusing on positive consequences	3.79	0.97	**.21**	[0.09, 0.33]	.001	3.83	0.93	**.20**	[0.07, 0.32]	<.001
12) Goal setting	3.60	1.06	**.26**	[0.14, 0.37]	<.001	3.42	1.10	**.38**	[0.26, 0.49]	<.001
13) Monitoring one's goal progress	3.60	0.98	.09	[−0.09, 0.21]	.150	3.33	0.99	**.25**	[0.12, 0.37]	<.001
14) Planning/scheduling	3.40	1.04	**.14**	[0.02, 0.26]	.031	3.42	1.07	**.30**	[0.18, 0.42]	<.001
15) Reappraisal	2.70	1.12	**.17**	[0.05, 0.29]	.010	2.29	0.95	**.17**	[0.04, 0.30]	<.013
16) Self-talk	3.00	1.19	.08	[−0.05, 0.20]	.197	2.84	1.21	.03	[−0.10, 0.16]	.640
17) Thinking of near finish	3.58	0.95	−.08	[−0.20, 0.05]	.193	3.52	0.90	−.08	[−0.21, 0.05]	.244
Response modulation strategy										
18) Suppressing the impulse to quit	3.38	1.05	.10	[−0.03, 0.22]	.127	3.15	0.93	.07	[−0.06, 0.20]	.272
Not further specified strategy										
19) Emotion regulation (not further specified)	3.15	1.02	**.29**	[0.17, 0.40]	<.001	3.03	1.05	**.16**	[0.03, 0.29]	.016

Note: *N*s range from 243 to 245 in Sample 2a and from 216 to 220 in Sample 2b. Significant correlation coefficients are written in bold. CI, confidence interval.

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about 22 strategies but exclude the three strategies that did not refer to how people deal with wanting to persist with an unpleasant activity in the moment, namely, *taking a break*, *avoiding unpleasant activities altogether*, and *improving one's self-regulation* outside of the activity (e.g. through reading self-help books) in our analyses. We also measured subjective effectiveness of the strategies, but because it was not the focus of this investigation, we do not report results here.

Trait self-control. In sample A, we measured trait self-control with the 13-item short version of the trait self-control scale (Tangney et al., 2004; α = .85). A sample item is 'I am able to work effectively towards long-term goals'. In sample B, we administered the German translation by Bertrams and Dickhäuser (2009) (α = .78).

Results and discussion

Popularity of different self-regulatory strategies

Overall, average frequencies were very similar in the two samples, as indicated by a very high correlation of the average frequencies from both samples of $r(19) = .90$, 95% confidence interval (CI) [0.76, 0.96], $p < .001$. In sample A, participants reported that when being faced with an unpleasant or challenging task, they would most frequently *focus on positive consequences*, *set goals*, *monitor their goal progress*, *think of the near finish*, and *use task enrichment* to increase their persistence. In sample B, the strategy *rewarding oneself* was additionally among the five most popular strategies, whereas *monitoring one's goal progress* was somewhat less popular than in sample A.[2]

Trait self-control and strategy use

Next, we looked at whether a person's trait self-control predicted how frequently that person uses a certain self-regulatory strategy. To be conservative in determining the strategies that were consistently related to trait self-control, we decided to only interpret correlations for strategies that correlated significantly with trait self-control in both samples.

According to this criterion, seven strategies were positively and two strategies were negatively associated with trait self-control (see Table 2): people higher in trait self-control reported to more often *reduce distractions*, *adopt a process focus*, *focus on the positive consequences* of the activity, *set goals*, *plan/schedule*, *reappraise the current activity*, and *regulate their emotions*. They reported to less often *distract themselves from the activity* and *focus on the negative consequences* of not performing the activity.

With regard to the strategies that were *positively* associated with trait self-control, *reducing distractions* has already been deemed a very effective situation modification strategy (Duckworth, White, et al., 2016; Kuhl, 1984) while as of yet little was known about the extent to which individuals spontaneously deploy this strategy in their everyday lives (but see Wertenbroch, 1998).

As discussed before, for the strategy of *focusing on the positive consequences* of the current activity, the literature makes conflicting predictions. On the one hand, it is reflective of goal activation (Fishbach et al., 2003; Shah & Kruglanski, 2003) and motivation control (Kuhl, 1984), which should have positive self-regulatory consequences. In addition, with its focus on *positive* outcomes of goal attainment (as opposed to negative outcomes of non-attainment), it indicates approach-motivated goal pursuit, which tends to be more productive than avoidance-motivated goal pursuit (e.g. Elliot, McGregor, & Gable, 1999). On the other hand, a strong outcome focus has been found to have negative implications for persistence and goal attainment (Fishbach & Choi, 2012; Freund & Hennecke, 2012, 2015). Adopting a *process focu*s, however, had positive implications for persistence and goal attainment in these studies (Freund & Hennecke, 2012, 2015), a finding that is in line with the positive associations we found with self-regulatory traits in the current study. We will return to the question of whether and under which conditions focusing on the positive consequences of a goal helps or hurts self-regulation in the general discussion, after having established the strategies' effects in the Main Study.

Many previous studies have demonstrated the positive self-regulatory consequences of *setting goals* and *planning/scheduling* (e.g. Gollwitzer & Sheeran, 2006; Locke & Latham, 2002). In an attempt to regulate their emotions during an unpleasant activity, people may focus on upregulating their positive affect or on downregulating their negative affect (Gross, 1998a, 1998b). The ability to regulate emotions is generally helpful for goal attainment (Hofmann, Friese, & Roefs, 2009), and the strategy of *reappraisal* has been discussed as being especially helpful for self-regulation (e.g. Duckworth, Gendler, & Gross, 2014; Fujita, 2011; Mischel & Baker, 1975). Accordingly, the positive associations of the two strategies *emotion regulation* (*not further specified*) and *reappraisal* with trait self-control are in line with prior work attesting to their effectiveness.

The fact that *distracting oneself from the activity* correlated negatively with trait self-control is noteworthy, as it was identified as a good strategy for coping with temptations in Mischel's work (Mischel, Ebbesen, & Raskoff Zeiss, 1972; Peake, Hebl, & Mischel, 2002; see also Duckworth et al., 2014). However, in the present study, we asked about a different kind of self-regulation, namely, persistence, and here, distraction is aimed away from the unpleasant or challenging task. This may, in fact, draw attention to alternative activities outside of the focal unpleasant one and thereby reduce persistence.

[2]Note that our coding system was designed in a way that would reduce conceptual overlap between strategies to a minimum and to make it easy to assign each coded strategy to one category only. Therefore, theoretical independence of the 19 strategies is highly likely. To nevertheless address empirically whether it would be possible to identify naturally occurring groupings of strategies into higher order factors, we submitted the strategies to factor analyses. The results of these exploratory factor analyses support our previous assumption of relative independence, because the groupings that emerged were not theoretically meaningful and difficult to interpret. More details on these factor analyses can be found in Supporting Information. Note that low correlations between strategies within a 'type' from the Duckworth et al. (2016a) process model may occur if, for example, people do not tend to use multiple strategies from one type but rather prefer to diversify across types (e.g. use a situation modification strategy along with an additional reappraisal strategy).

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Finally, *focusing on the negative consequences* of not performing the activity also correlated negatively with trait self-control. This suggests that high self-control goes hand in hand with an approach focus during the regulation of persistence but not an avoidance focus. This would be in line with prior research on avoidance motivation which has been shown to indeed be harmful to goal attainment (e.g. Elliot et al., 1999). It may be the case that negative cognitions that focus on threatening future prospects may disrupt current pursuits, for example, because they make the person prioritise the regulation of negative feelings over task completion. Individuals who do not adopt such a focus may, in turn, be more successful at self-control.

MAIN STUDY

While the previous studies were primarily exploratory in nature and served for generating our hypotheses, we next turned to a large-scale ambulatory assessment study for testing these hypotheses in the context of people's everyday activities. First, we aimed at confirming through replication that people who score high (vs low) on the trait self-control more frequently *reduce distractions*, *adopt a process focus*, *focus on the positive consequences* of the activity, *set goals*, *plan/schedule*, *reappraise* the *activity*, and *regulate their emotions* (with no specification how) and that they less frequently *distract themselves* from the activity and *focus on the negative consequences* of not performing it.

Second, we aimed at testing whether strategy use was predicted by trait self-control. We also explored various types of demands as additional predictors of strategy use. Third, we aimed at testing whether using the strategies that were used more by people high in trait self-control were indeed more helpful for self-regulation, whereas the strategies that they used less were indeed more harmful for self-regulation, independent of specific demands. Finally, we aimed at testing whether strategy use could account for the supposedly positive effects of trait self-control on the regulation of persistence during aversive activities.

By deploying ambulatory assessment, we aimed at getting ecologically valid and relatively memory-bias free (Scollon, Prieto, & Diener, 2009) information about (i) the frequencies, by which people face the self-regulatory demand of having to persist in an unpleasant or challenging task, (ii) the frequencies by which they use each self-regulatory strategy to deal with such situations, and how these frequencies are contingent on demand types, and (iii) the success of these regulatory efforts across a wide range of demands. Additionally, ambulatory assessment with its multiple measurement occasions for each participant allowed us to disaggregate between-person effects from within-person effects of strategy use (Curran & Bauer, 2011; Hoffman & Stawski, 2009).

Method

Participants

Given the novelty of our research question and the difficulties involved in calculating sample sizes for studies with many repeated measures (e.g. Kreft & De Leeuw, 1998; Scherbaum & Ferreter, 2009), we based our recruitment goal on sample sizes in studies with similar designs and research questions (Friese & Hofmann, 2016; Hofmann et al., 2012; Milyavskaya et al., 2015; Milyavskaya & Inzlicht, 2017).[3] In these studies, final sample sizes varied between *N*s of 101 and 205. We aimed at recruiting 200 participants with a minimum response rate of 70%, so we over-recruited an original sample of 233 participants. In order to be enrolled in the study, participants had to own a smartphone with data service.

Due to technical problems, a number of participants did not receive the full number of signals, so, including other dropouts, 75 of these 233 (32.2%) had a response rate below 70%. Before having looked at the data, we therefore decided to augment the sample with a second wave of about 50 participants in the same semester. Data collection of both waves took four weeks in total, so we do not expect seasonal differences in any relevant variables between waves. Altogether, the sample of these two waves was composed of $N = 287$ participants. Ultimately, due to technical problems or early dropout, 11 of these did not receive/respond to any signals and were therefore excluded from analyses. Another 12 participants did not report any episode where they had engaged in a somewhat unpleasant activity. Everyone who reported at least one episode where they had engaged in a somewhat unpleasant activity remained in the sample, leaving us with a final sample of 264 participants (85% female, 15% male). Participants were between 18 and 54 years old ($M = 23.0$, $SD = 4.3$). The majority held a high school (74%) or university degree (23%) and was enrolled in psychology (70%). Fifty-three per cent of participants were single, 44% in a relationship, 3% married, and 2% had children. Forty-one per cent reported being employed with an average work load of 30% (~12.6 hours per week, $SD = 20\%$). On a scale from 0 (*very bad*) to 10 (*very good*), the sample reported a high average language proficiency of $M = 9.4$ ($SD = 0.8$). Fifty-one per cent participated in exchange for course credit and 49% participated in exchange for financial reimbursement (up to $70, contingent on completion). All data were collected between 10 November and 10 December 2016.

Procedure

Persons interested in participating were asked to go to a website that contained extensive information about the study procedure, data confidentiality, and compensation. By leaving their personal information on that website, they also provided informed consent to study participation. In the first e-mail after enrolment, participants received more detailed instructions on the study procedure, as well as web links to the two baseline surveys. Participants were asked to fill in these surveys within two days after receiving the e-mail. Within these two days, we registered them for the study on

[3]In hindsight, we are aware that determining a study's sample size based on the sample sizes of previously published studies is problematic, given that, due to publication bias, consulting only published research may involve an overestimation of the true effect sizes.

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SurveySignal®, a web-based survey distribution and management provider (Hofmann & Patel, 2015). Participants received, within one or two days, a validation text message, which also served to link their cellphone to a personal ID. On each of seven consecutive days, seven signals were distributed throughout a time window of 14 hours. Participants could, at the beginning of the study, decide whether they wanted to begin receiving the signals at 7 am (24%), 8 am (33%), 9 am (29%), or 10 am (14%). Consecutive signals were programmed to always be at least one hour apart and the link to the survey expired within one hour if a participant did not respond to it. If after seven days participants had a response rate below 80%, data collection was extended by one additional day (in 21% of cases). At the end of the study, the sample had an average response rate of 74% (*SD* = 27%; *Mdn* = 86%), and everyone in the sample had responded to at least two signals (*M* = 37.2, *SD* = 13.0, *Mdn* = 43.0). The average response latency was *M* = 10.9 minutes (*SD* = 14.5).

Baseline

Trait self-control. As in Pilot Study 2b, we measured trait self-control with the 13 items from the Bertrams and Dickhäuser (2009) German translation of the Tangney et al. (2004) Short Trait Self-Control Scale (scales from 1 = *does not apply at all* to 7 = *fully applies*; *M* = 4.13, *SD* = 0.94, actual range from 2.00 to 6.46, α = .88).

Ambulatory assessment

Every signal led participants to the same survey that consisted of two parts: the first part will be described here; the second part is not relevant to the current investigation.

Activities with a self-regulatory challenge and demand types. At each measurement occasion, participants were asked whether, within the past hour, they had engaged in any activity that they experienced as unpleasant, challenging, or boring (response format: *yes, I have/no, I have not*). If participants had confirmed their engagement in such an activity, they were asked to assign it to one out of 23 activity type categories (e.g. *participation in a study-related activity*, e.g. *lecture or seminar*; *self-instructed studying*; *work*; *meeting friends or acquaintances*; *housework*) or, if it did not correspond to any of these categories, to describe the activity in their own words. Response categories were based on categories by Kahneman, Krueger, Schkade, Schwarz, and Stone (2004) and pretested with a different sample.

Next, participants were asked how unpleasant this activity had been for them overall on a scale from 1 (*not unpleasant at all*) to 7 (*very unpleasant*). We furthermore asked them to describe the activity's demands in more detail by indicating on seven items with scales ranging from 1 (*not at all true*) to 7 (*very true*), whether it was physically effortful (*M* = 2.22, *SD* = 1.81); mentally effortful (*M* = 4.95, *SD* = 1.85); too easy/monotonous (*M* = 3.55, *SD* = 2.00); meaningless/superfluous (*M* = 2.89, *SD* = 1.85); caused anger, sadness, disgust, or anxiety (*M* = 2.63, *SD* = 2.00); was boring (*M* = 4.14, *SD* = 2.10); or frustrating (*M* = 3.67, *SD* = 1.99). These demand types were also pretested with a different sample to ensure that they covered most of the demands participants actually experience.[4] Participants could also provide a free response to describe the reason why the activity was unpleasant (e.g. 'took too much time', 'I was too tired', 'it hurt').

Self-regulatory strategies. Next, participants were asked to pick all strategies that they had used 'to perform the activity, even though it was unpleasant' from the list of the 19 strategies (e.g. 'I reduced or removed distractions and temptations'). If participants had used a different strategy that was not part of the list, they could provide their own response to the question as well if they had used a different strategy (e.g. 'I bought and ate some chocolate', 'I looked for a solution'). Participants could pick more than one strategy at a time. In fact, they reported having used between 0 and 13 strategies (*M* = 2.27, *SD* = 1.82).

Perceived self-regulatory success. Finally, we asked participants about how satisfied they were with how long they had persisted in the activity on a scale from 1 (*not satisfied at all*) to 7 (*absolutely satisfied*) (*M* = 5.15, *SD* = 1.59). We decided to frame our question like this to capture, in one item, participants' experience of potential discrepancies (or the lack thereof) between their desired and their actual persistence, which we consider a good proxy for their momentary self-regulatory success (see Carver & Scheier, 1990; Higgins, 1987; Michalos, 1985). Afterwards, the second part of the ambulatory assessment survey followed (see OSF-page).

Data structure and analysis

We collected data at two levels of measurement: an observation-level or Level 1 (measurement occasions), at which the ambulatory assessment data were located, and a person-level or Level 2, at which individual characteristics from the baseline measures, here: trait self-control, were located. Because observations were nested within persons, hypothesis tests were conducted using the 'lme4' package

[4]Demand types were chosen based on a pretest prior to the main study. We asked *N* = 425 students during a psychology lecture to fill in a brief survey that asked them first whether they had engaged in some unpleasant activity the day before. If so, we also asked them to indicate the extent to which the activity was physically effortful, mentally effortful, too easy/monotonous, meaningless/superfluous, caused anger/sadness/disgust or anxiety, or was boring. To investigate whether these demand types were exhaustive, we also asked participants to provide us with an explanation if the activity was unpleasant for a different reason. Only 18 out of the 256 (7%) respondents who reported having engaged in an unpleasant activity the day before provided us with descriptions of such demands. These were in particular: 'complicated', 'my friends did not show up for the scheduled appointment, so I had to argue with them', 'I was sick and therefore showering is not that pleasant!', 'effortful', 'getting up early after going out', 'tired', 'overcoming', 'boring and effortful', 'time could have been used more meaningfully', 'no motivation', 'boring', 'bad weather ➔ difficult external influences', 'unnecessary', 'because the system prevents a simple solution ➔ didn't know what's going on', 'hangover', 'stress', 'boring, tiring', 'no motivation, didn't feel like it'. Many of these additional demands appeared only once or twice, were in fact covered by our items (caused anger, mental effort, meaningless/superfluous, boring), or just provided descriptions that motivation was lacking but no indication of the specific demand. We therefore only included the additional item 'frustrating' in the item pool of the main study as this appeared to be an additional demand type we had not yet covered. Note that in the main study with 1940 instances at which participants reported a recent unpleasant activity, only at 63 instances they reported a different demand in their open response (3%), some of which were again, in fact, redundant with the demand items. Hence, we believe that our item pool was relatively exhaustive.

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for multilevel modelling (Bates, Maechler, Bolker, & Walker, 2015) in R (R Core Team, 2016) or, for the multilevel mediation models, using the software Mplus 7.31 (Muthén & Muthén, 1998–2015). Note that for each strategy, its use at any given occasion was assessed as a binary variable (0 = strategy was not used, 1 = strategy was used). Therefore, in the analyses predicting strategy use (except for the multilevel mediation models, see below), we applied logistic multilevel regression analyses provided by the 'glmer' function.

To predict strategy use from people's trait self-control, we followed a stepwise approach that allowed us to be conservative in our interpretations and to restrict the number of models to a minimum while also having enough power to detect associations. We only ran models for strategies (i) for which we had found consistent correlations with trait self-control in Pilot Studies 2a and 2b and (ii) that had been used in at least 10% of all occasions in which participants had engaged in an unpleasant activity. The following strategies fulfilled both criteria: *distracting oneself from the activity*, *focusing on negative consequences*, *focusing on positive consequences*, *goal setting*, and *emotion regulation* (*not further specified*). Accordingly, we aimed at replicating that, when regulating their persistence, people with higher trait self-control are more likely to *focus on the positive consequences*, *set goals*, and show *emotion regulation* (*not further specified*) and less likely to *distract themselves from the activity* and *focus on the negative consequences* (of not performing it) than people with lower trait self-control.

To test whether strategy use mediated the effects of trait self-control on self-regulatory success, we ran mediation models in Mplus that applied the robust weighted least squared estimator to predict strategy use, which was a binary variable for each strategy (referred to as WLSMV in Mplus; Muthén & Muthén, 1998–2015).

As advised (Enders & Tofighi, 2007), the person-level (or Level 2) predictor trait self-control was grand-mean centred prior to analyses. Accordingly, intercepts can be interpreted as outcome scores for a person with an average level of trait self-control. All predictors on the level of measurement occasions (Level l) were group-mean centred (here: within participants) prior to analyses.

Results and discussion

Descriptive findings

Participants reported having engaged in an activity that was unpleasant or otherwise challenging to their self-regulation at 18.7% (1940 in total) of all responded-to signals. The most frequently mentioned activity was 'self-study' with 39%, followed by 'lecture/seminar' with 26.6%, 'commuting' with 11.5%, 'work' with 8.7%, 'other activities' with 7.8%, 'social contact per phone, internet, or through social networks' with 6%, and 'housework' with 5.5%. All other types of activities were mentioned at less than 5% of occasions. Note that in general, multiple mentions were allowed, and participants could, for example, report that they were both eating and commuting.

We also explored the general unpleasantness as well as the specific demands posed by the unpleasant activities based on the items that measured whether they were physically effortful; mentally effortful; too easy/monotonous; meaningless/superfluous; caused anger, sadness, disgust or anxiety; was boring; or frustrating. Based on high inter-item correlations (see Table S2), we built aggregate scores for boredom (average of 'too easy/monotonous', 'meaningless/superfluous', and 'boring', *r*s between these three items ranged from .40 to .69, all ps $< .001$, $\alpha = .77$) and for emotional challenge (average of 'caused anger, sadness, disgust or anxiety' and 'frustrating', $r = .87$, $p < .001$). The overall level of unpleasantness across activities was, as intended, rather high [$M = 4.12$, $SD = 1.46$, intraclass correlation coefficient (ICC) = 0.20]. Across reported self-regulatory conflicts, participants most strongly experienced mental effort ($M = 4.95$, $SD = 1.85$, ICC = 0.23), followed by boredom ($M = 3.52$, $SD = 1.64$, ICC = 0.27), emotional challenges ($M = 3.15$, $SD = 1.74$, ICC = 0.34), and lastly, physical effort ($M = 2.22$, $SD = 3.28$, ICC = 0.19). As can be seen in Figure 2, there was a great amount of variety in these experiences across activities. The greatest unpleasantness was reported for 'other activities' (e.g. 'standing in line', 'correcting a friend's thesis', 'job interview', 'participating in a research study'), followed by 'housework'. The greatest physical effort and boredom was experienced during 'housework', the greatest mental effort during 'self-study', and the greatest emotional challenge during 'social contact per phone etc.'

We checked whether trait self-control predicted how frequently participants reported having executed an unpleasant or challenging activity. This was not the case. We also checked whether trait self-control predicted the degree of overall unpleasantness ($M = 4.13$, $SD = 1.46$). There was a tendency for participants with high trait self-control to experience activities as less unpleasant [$B = -0.15$, 95% CI (-0.26, -0.03), $p = .011$] and, more specifically, as less emotionally challenging [$B = -0.29$, 95% CI (-0.44, -0.13), $p < .001$] and less boring [$B = -0.25$, 95% CI (-0.39, -0.12), $p < .001$].

Overall popularity of different self-regulatory strategies.

How frequently do people use the 19 strategies in their daily lives? As in the Pilot Studies 2a and 2b, participants most frequently reported having *focused on positive consequences* (used during $n = 695$, that is, in 36% of all unpleasant activities). *Thinking of the near finish* was the second most popular strategy ($n = 535$), followed by *task enrichment* ($n = 400$), *focusing on negative consequences* ($n = 325$), *suppressing the impulse to quit* ($n = 291$), *emotion regulation* (*not further specified*) ($n = 290$), *distracting oneself from the activity* ($n = 261$), *monitoring one's goal progress* ($n = 233$), and *goal setting* ($n = 194$) (see Figure 3 for proportions). All other strategies were used in less than 10% of all measurement occasions. Generally, the relative frequencies by which strategies were used in the Main Study correlated highly with the average frequencies of strategy use from Study 2a [$r(19) = .61$, 95% CI (0.22, 0.83), $p = .005$] and Study 2b [$r(19) = .65$, 95% CI (0.28, 0.85), $p = .003$].

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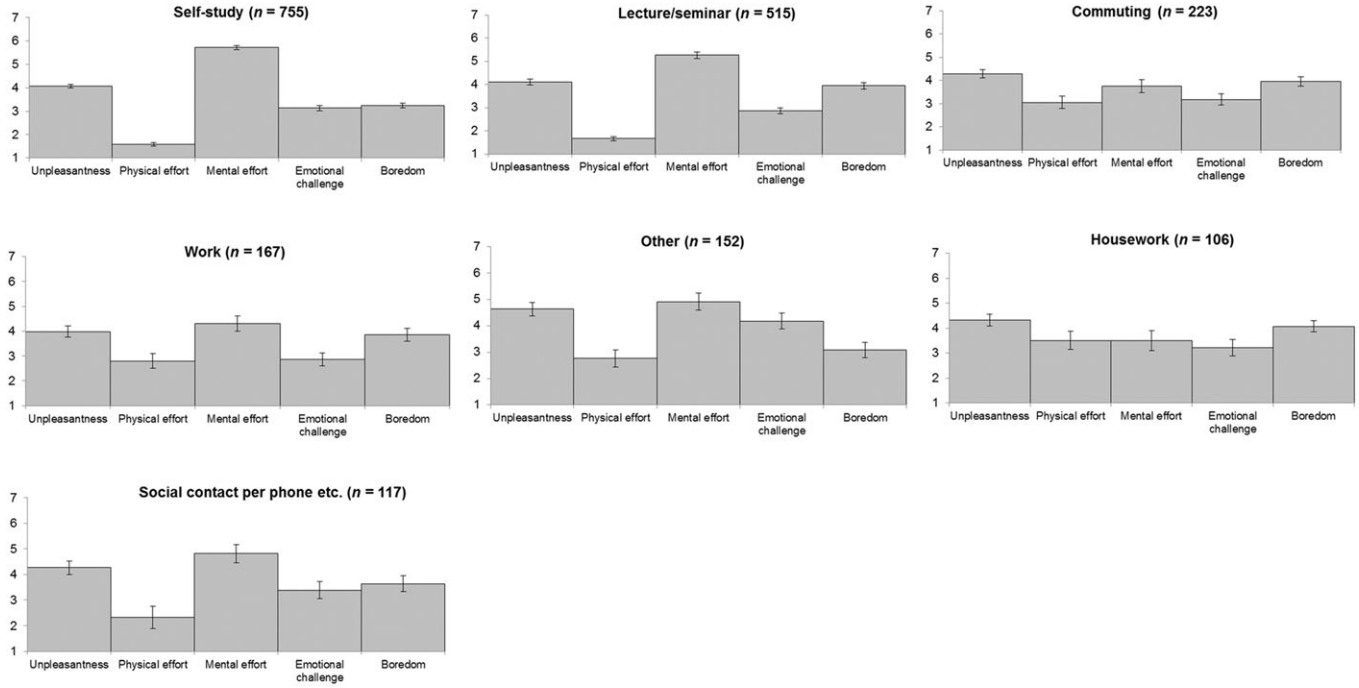

Figure 2. Means and 95% CIs describing activity demands for activities that were reported in more than 10% of occasions (Main Study).

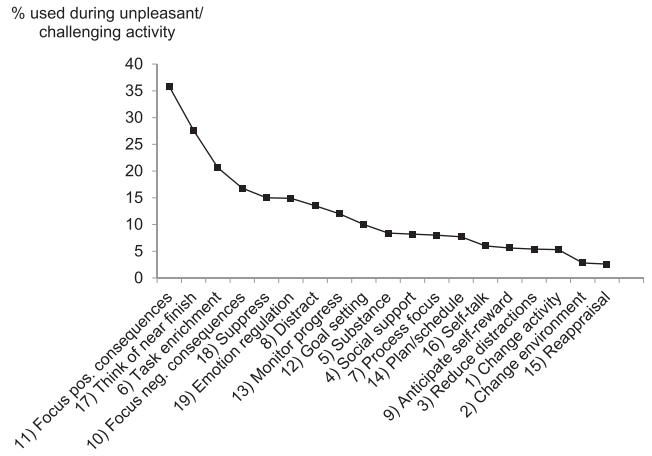

Figure 3. Proportions by which the 19 self-regulatory strategies were used when participants experienced an activity as unpleasant or challenging. There is missing data on strategy use for 9 out of 1940 occasions in which participants reported having performed an unpleasant or challenging activity, so 100% equal 1931 occasions (Main Study). As participants could name more than one strategy at any given occasion, the sum of the relative frequencies exceeds 100%.

Note that in only 2.2% of all measurements at which participants had reported strategy use, they indicated a strategy that was not on our list. This confirms that our list of 19 strategies covered the most frequently used self-regulatory strategies of daily life.

Popularity of strategy use by demand type. Next, we explored which strategies were used as a function of the types of demands that participants had experienced. We ran a series of multilevel regression analyses (random intercept models only, as models with random slopes did not converge) predicting the use of each strategy by the reported intensity of the four types of demands (physical effort, mental effort, emotional challenge, and boredom; see Table 3). Note that whether *p*-values from exploratory analyses like these can be interpreted is currently being discussed (Nosek, Ebersole, DeHaven, & Mellor, 2017; Nosek & Lakens, 2014; Forstmeier, Wagenmakers, & Parker, 2016; see also Dahl, Grotle, Benth, & Natvig, 2008; De Groot, 2014). However, as *p*-values are good predictors of replication success (Open Science Collaboration, 2015) and recent theorising attests to their validity even in exploratory analyses (Rubin, 2017), we will use them as guides to highlight certain trends in the data.

The use of all strategies was predicted by demands, indicating that strategy popularity varies as a function of the way an activity is experienced (see Table 3). It was not the case that all types of demands just increased the likelihood that a strategy would be used. Rather, some types of demands actually decreased the likelihood that a given strategy would be used, presumably because these strategies were not perceived as effective or could not be used (e.g. due to the cognitive load already involved in the activity). Let us elaborate on a couple of interesting trends in the data. With higher levels of mental effort, participants were less likely to use *task enrichment* or to *distract themselves from their activity*. This suggests that when mental effort and, hence, cognitive load is high already, people do not look for additional stimulation. Boredom, in turn, positively predicted *task enrichment* and *distraction*, presumably because people were looking for additional stimulation (Hebb & Thompson, 1954). Mental effort and boredom also appear different in the sense that mental effort evoked classical goal-related strategies of self-regulation like *goal setting* and *monitoring*, whereas boredom was even negatively related to *goal setting*. Physical effort predicted the lowest number of strategies,

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Table 3. Results from multilevel regression models of self-regulatory strategies on activity demands (ICCs for strategies are calculated based on models without predictors)

	6) Task enrichment			8) Distracting oneself from the activity			10) Focusing on negative consequences			11) Focusing on positive consequences			12) Goal setting		
Predictor	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p
Intercept	−1.75	[−2.00, −1.53]	<.001	−2.24	[−2.49, −2.02]	<.001	−2.07	[−2.34, −1.83]	<.001	−0.63	[−0.80, −0.47]	<.001	−2.66	[−2.97, −2.40]	<.001
Physical effort	**0.17**	[0.08, 0.25]	<.001	0.01	[−0.10, 0.11]	.883	**−0.11**	[−0.21, −0.01]	.025	**0.10**	[0.02, 0.17]	.008	0.00	[−0.12, 0.11]	.954
Mental effort	**−0.13**	[−0.21, −0.04]	.004	**−0.11**	[−0.21, −0.01]	.038	**0.12**	[0.02, 0.23]	.020	0.05	[−0.02, 0.13]	.166	**0.17**	[0.04, 0.30]	.012
Emotional challenge	**−0.14**	[−0.23, −0.04]	.007	0.07	[−0.04, 0.19]	.190	0.07	[−0.03, 0.18]	.160	**−0.15**	[−0.24, −0.07]	<.001	**−0.14**	[−0.27, −0.02]	.030
Boredom	**0.14**	[0.04, 0.24]	.007	**0.47**	[0.35, 0.59]	<.001	−0.06	[−0.17, 0.05]	.294	**−0.12**	[−0.21, −0.04]	.004	**−0.18**	[−0.32, −0.04]	.012
ICC	0.26			0.17			0.30			0.20			0.22		

Note: Predictors were group-mean centred. Significant B_{logs} are written in bold (except for significant intercepts). CI, confidence interval; ICC, intraclass correlation coefficient.

Table 3. (Continued)

	13) Monitoring one's goal progress			17) Thinking of the near finish			18) Suppressing the desire to quit			19) Emotion regulation (not further specified)		
Predictor	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p
Intercept	−2.48	[−2.78, −2.23]	<.001	−1.07	[−1.25, −0.91]	<.001	−2.20	[−2.47, −1.95]	<.001	−2.30	[−2.61, −2.04]	<.001
Physical effort	0.01	[−0.09, 0.11]	.808	0.04	[−0.04, 0.11]	.320	0.05	[−0.05, 0.14]	.342	0.01	[−0.09, 0.11]	.866
Mental effort	**0.16**	[0.04, 0.27]	.008	**0.09**	[0.01, 0.17]	.034	**0.13**	[0.03, 0.24]	.014	0.03	[−0.08, 0.14]	.586
Emotional challenge	**−0.22**	[−0.34, −0.10]	<.001	**−0.10**	[−0.18, −0.01]	.027	0.10	[−0.01, 0.20]	.066	−0.01	[−0.12, 0.10]	.898
Boredom	**−0.13**	[−0.26, −0.01]	.041	**0.17**	[0.08, 0.26]	<.001	0.08	[−0.03, 0.19]	.158	**−0.28**	[−0.40, −0.16]	<.001
ICC	0.25			0.18			0.30			0.34		

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namely, *task enrichment*, *focusing on the positive consequences* (both positively), and *focusing on negative consequences* (negatively). Finally, emotional demands did not increase the likelihood of use for any strategies but only made *task enrichment*, *focusing on the positive consequences*, *goal setting*, *monitoring one's progress*, and *thinking of the near finish* less likely.

Trait self-control and strategies

Does a person's level of trait self-control predict how frequently that person uses a certain self-regulatory strategy? As described above, we only ran models for strategies for which we had, in Studies 2a and 2b, found consistent correlations with trait self-control and that participants had used in at least 10% of all occasions (see Figure 3) in which they had performed an unpleasant/challenging activity in the current study. Replicating the results from the two pilot studies, participants with higher trait self-control more frequently *focused on positive consequences*, *set goals*, and *regulated their emotions*. For easier interpretation of the log-odds displayed in Table 4, Figure 4 shows the predicted strategy use for people with an average level of trait self-control and with levels that are 1 *SD* above or below the average.

Perceived self-regulatory success as a function of specific strategies

Next, we tested whether the 10 self-regulatory strategies that were used in more than 10% of occasions in which participants had engaged in an unpleasant or challenging activity, were, according to participants' self-reports, helpful in increasing participants' success in regulating their persistence. As previously reported, strategy use was somewhat contingent of the kinds of demands participants had reported. Therefore, to de-confound the effects of strategy use and activity type/demands on subjective self-regulatory success, we simultaneously estimated the effects of demand types in a series of hierarchical linear models. We furthermore added interaction terms to these analyses to explore whether perceived strategy effectiveness varied as a function of demand types. All models (one for each strategy, all other predictors were entered simultaneously) included random effects for the intercept only, as models also including random slopes did not converge. We predicted that the three strategies that were more frequently used by individuals with high levels of trait self-control [*focusing on positive consequences*, *setting goals*, *emotion regulation* (*not further specified*)] should also, across demands, be positively related to perceived self-regulatory success. Due to the large number of results, we have moved the respective tables to Tables S3 to S11 and report, in text, regression coefficients for significant associations only.

Across these models, there were consistent main effects of demands: whereas physical effort positively predicted perceived self-regulatory success (effects ranging from $B = 0.11$ to $B = 0.18$, all ps $< .001$ across models), emotional challenges (effects ranging from $B = -0.27$ to $B = -0.31$ across models, all ps $< .001$), and boredom negatively predicted it (effects ranging $B = -0.12$ to $B = -0.20$ from to across models, all ps $< .001$). There were no effects of mental effort

Table 4. Results from multilevel regression models of self-regulatory strategy use on trait self-control (Main Study)

	8) Distracting oneself from the activity			10) Focusing on negative consequences			11) Focusing on positive consequences			12) Goal setting			19) Emotion regulation (not further specified)		
Predictor	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p	B_{log}	95% CI	p
Intercept	−2.06	[−2.29, −1.86]	<.001	−2.03	[−2.30, −1.79]	<.001	−0.63	[−0.79, −0.47]	<.001	−2.60	[−2.89, −2.36]	<.001	−2.22	[−2.50, −1.97]	<.001
Trait self-control	−0.19	[−0.40, 0.01]	.066	−0.06	[−0.30, 0.17]	.604	**0.31**	[0.14, 0.49]	<.001	**0.45**	[0.21, 0.69]	<.001	**0.40**	[0.17, 0.65]	.001

Note. Predictors were grand-mean centred. Significant B_{log}s are written in bold (except for significant intercepts). CI, confidence interval.

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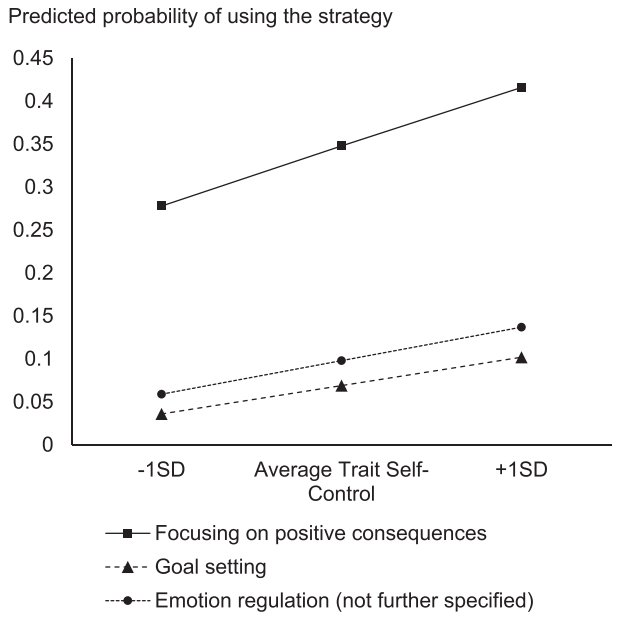

Figure 4. Predicted probabilities of using the strategies *11) Focusing on positive consequences*, *12) Goal setting*, and *19) Emotion regulation* (*not further specified*) as a function of trait self-control. Predicted log-odds from the logistic regression analyses were transformed into probabilities for ease of interpretation (Main Study).

on perceived success. It is possible that in our sample, which contained many students, there was a lot of pressure to even finish mentally effortful tasks, independent of how mentally effortful they were. The positive effect of physical effort on perceived self-regulatory success is surprising and interesting. It may be explained by people's impression that physical effort is, while unpleasant, an indicator that one is improving one's physical fitness ('no pain, no gain') and may, like a form of positive feedback, even promote satisfaction with one's persistence.

We furthermore found main effects on perceived self-regulatory success of five of the nine strategies. As predicted, two out of three strategies that were more frequently used by individuals with high levels of trait self-control, namely, *focusing on the positive consequences* [B = 0.44, 95% CI (0.31, 0.57), $p < .001$] and *emotion regulation* (*not further specified*) [B = 0.35, 95% CI (0.16, 0.54), $p < .001$], had positive effects on perceived self-regulatory success. The third strategy *goal setting* had no positive effect on perceived self-regulatory success. Additionally, the strategies *monitoring one's goal progress* [B = 0.26, 95% CI (0.05, 0.47), p = .014] and *thinking of the near finish* [B = 0.34, 95% CI (0.19, 0.48), $p < .001$] had positive effects on perceived self-regulatory success, even though they were not associated with trait self-control. Lastly, *distracting oneself from the activity* [B = −0.54, 95% CI (−0.75, −0.33), $p < .001$], a strategy also uncorrelated with trait self-control in the current study, had a negative effect on perceived self-regulatory success.

A few interaction effect with demands emerged in these analyses. To check the shapes of these interactions, we analysed the simple slopes (on http://www.quantpsy.org/interact/hlm2.htm) for situations in which the respective demands were low (1 SD below the mean) and high (1 SD above the mean). First, *task enrichment* interacted with boredom [B = 0.14, 95% CI (0.02, 0.27), p = .029]. The simple slope analyses revealed that if boredom was low, *task enrichment* had no effect on perceived self-regulatory success (simple intercept: B = 4.76, SE = 0.06, z = 73.71, $p < .001$; simple slope: B = 0.27, SE = 0.14, z = 1.90, p = .058). If, however, boredom was high, *task enrichment* increased perceived self-regulatory success (simple intercept: B = 4.11, SE = 0.08, z = 52.23, $p < .001$, simple slope: B = 0.73, SE = 0.34, z = 2.13, p = .033).

Second, both physical effort [B = 0.15, 95% CI (0.02, 0.28), p = .26] and emotional challenge [B = 0.14, 95% CI (0.09, 0.28), p = .038] interacted with *distracting oneself from the activity*. The simple slopes analyses revealed that if physical effort or emotional challenge was low, *distracting oneself from the activity* was harmful to perceived self-regulatory success (for physical effort, simple intercept: B = 5.29, SE = 0.06, z = 88.64, $p < .001$; simple slope: B = −0.48, SE = 0.11, z = −4.45, $p < .001$; for emotional challenge, simple intercept: B = 4.80, SE = 0.07, z = 68.60, $p < .001$, simple slope: B = −0.34, SE = 0.14, z = −2.52, p = .012). When physical effort or emotional challenge was high, *distraction* had no effect on perceived self-regulatory success (for physical effort, simple intercept: B = 5.68, SE = 0.07, z = 85.90, $p < .001$; simple slope: B = 0.06, SE = 0.29, z = 0.23, p = .821; for emotional challenge, simple intercept: B = 3.72, SE = 0.14, z = 26.49, $p < .001$; simple slope: B = 0.14, z = 0.43, p = .670).

Third, physical effort interacted with *focusing on the positive consequences* [B = −0.14, 95% CI (−0.23, −0.05), p = .002]. When physical effort was low, *focusing on positive consequences* had a positive effect on perceived self-regulatory success (simple intercept: B = 5.07, SE = 0.06, z = 78.55, $p < .001$; simple slope: B = 0.38, SE = 0.07, z = 5.33, $p < .001$). When physical effort was high, *focusing on the positive consequences* had no effect on perceived self-regulatory success (simple intercept: B = 5.73, SE = 0.14, z = 42.11, $p < .001$; simple slope: B = −0.12, SE = 0.19, z = 0.64, p = .520).

Finally, both physical effort [B = −0.15, 95% CI (−0.25, −0.06), p = .002] and emotional challenge [B = 0.12, 95% CI (0.01, 0.23), p = .030] interacted with *thinking of the near finish*. When physical effort was low, *thinking of the near finish* increased perceived self-regulatory success (simple intercept: B = 5.13, SE = 0.06, z = 81.93, $p < .001$; simple slope: B = 0.28, SE = 0.08, z = 3.67, $p < .001$). When physical effort was high, *thinking of the near finish* had no effect on perceived self-regulatory success (simple intercept: B = 5.70, SE = 0.12, z = 47.33, $p < .001$; simple slope: B = −0.26, SE = 0.21, z = −1.26, p = .207). *Thinking of the near finish* increased perceived self-regulatory success when emotional challenge was low (simple intercept: B = 4.62, SE = 0.07, z = 63.54, $p < .001$; simple slope: B = 0.51, SE = 0.11, z = 4.68, $p < .001$) and did so even more strongly when emotional challenge was high (simple intercept: B = 3.54, SE = 0.15, z = 23.51, $p < .001$; simple slope: B = 0.93, SE = 0.28, z = 3.30, p = .001).

In sum, not all helpful strategies were perceived as equally helpful under all circumstances. Two strategies had

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Table 5. Results from the multilevel mediation model predicting perceived self-regulatory success from trait self-control through self-regulatory strategy use (Main Study)

Path	*B*	95% CI	*p*
Between-person effects			
a1: Focusing on positive consequences predicted by trait self-control	**0.24**	[0.15, 0.34]	<.001
a2: Emotion regulation (not further specified) predicted by trait self-control	**0.29**	[0.17, 0.41]	<.001
b1: Subjective self-regulatory success predicted by focusing on positive consequences	0.13	[−0.11, 0.48]	.371
b2: Subjective self-regulatory success predicted by emotion regulation (not further specified)	−0.02	[−0.21, 0.16]	.843
c': Subjective self-regulatory success predicted by trait self-control	**0.35**	[0.21, 0.48]	<.001
Within-person effects			
b1w: Subjective self-regulatory success predicted by focusing on positive consequences	**0.34**	[0.27, 0.40]	<.001
b2w: Subjective self-regulatory success predicted by emotion regulation (not further specified)	**0.25**	[0.15, 0.35]	<.001
Indirect effects			
a1*b1	0.03	[−0.03, 0.09]	.373
a2*b2	−0.01	[−0.06, 0.05]	.842

Note. Trait self-control was grand-centred; *focusing on positive consequences* and *emotion regulation* (*not further specified*) were person-centred prior to this analysis. Significant coefficients are written in bold. ICC for focusing on positive consequences = 0.24, ICC for emotion regulation (not further specified) = 0.35, ICC for subjective self-regulatory success = 0.20. Residual variance for subjective self-regulatory success = 1.85 ($SE = 0.06$, $p < .001$). CI, confidence interval; ICC, intraclass correlation coefficient.

stronger positive effects if certain types of demands were higher (*task enrichment* if boredom was high, *thinking of the near finish* when emotional challenge was high). Two strategies had more positive effects when physical effort was low (*focusing on positive consequences* and *thinking of the near finish*). Finally, one strategy, *distracting oneself from the activity*, was experienced as especially *harmful* when physical effort or emotional challenge were low. Overall, however, there were few interactions of strategies and demand types on perceived self-regulatory success.

Mediation analyses: does strategy use mediate effects of trait self-control on self-perceived regulatory success?

Finally, we continued to test our conceptual mediation model according to which individuals with high trait self-control are more likely to report using *helpful* strategies when confronted with an activity that challenges their self-regulation and that this, in turn, accounts for their greater perceived momentary success in persisting during such an activity (see Table 5). We focused on the strategies that fulfilled the two necessary criteria for probing the mediation: first, they had to be predicted by trait self-control. Second, they had to be predictors of perceived self-regulatory success (effect of the mediator on the outcome). Two strategies fulfilled these two criteria, namely, *focusing on positive consequence* and *emotion regulation* (*not further specified*), and were therefore retained for the mediation models.

We also checked an additional precondition for the mediation models, namely, that trait self-control positively predicted perceived self-regulatory success. This was the case [$B = 0.34$, 95% CI (0.21, 0.48), $p < .001$]. We therefore continued to test a mediation model to see whether the two strategies *focusing on positive consequences* and *emotion regulation* (*not further specified*) as mediators would account for the positive effect of trait self-control on perceived self-regulatory success.

To test our multilevel mediation models with predictors on Level 2 and mediators and outcome on Level 1, we followed the Preacher, Zyphur, and Zhang (2010) recommendations (see model E in their appendix). According to these authors, ordinary multilevel models would bias the indirect effect because they do not distinguish the within-effects from the between-effects of the Level 1 mediator on the Level 1 outcome. Because the effect of our Level 2 predictor trait self-control is a between-persons effects, any mediation of the Level 2 predictors must also occur at the between-person level, and mediation effects on that level should be estimated without conflation from Level 1 effects. We therefore report coefficients from models that estimate separately the within and the between components of the b-paths. While only the between components are of interest for the mediation models, the within component tells us something about the underlying processes. A significant within-effect indicates that using a strategy in a given moment increases perceived self-regulatory success in that moment, irrespective of the Level 2 cluster, that is, whether that person tends to use strategies more or less often.

The results suggest that neither *focusing on the positive consequences* nor *emotion regulation* (*not further specified*) mediate the positive effects of trait self-control on perceived self-regulatory success in a given moment. In other words, the fact that individuals high in trait self-control more often focus of the positive consequences of unpleasant activities and regulate their emotions does not seem to explain their higher reported self-regulatory success in a given moment.

GENERAL DISCUSSION

Many goals require engagement in activities that feel unpleasant, effortful, challenging, or boring. During such activities, a person may experience an intrapsychic conflict between what he or she *should* be doing (persist) and what he or she *wants* to do (something else) (Bazerman, Tenbrunsel, & Wade-Benzoni, 1998; O'Connor et al., 2002). From an individual-difference perspective, the ability to resolve this conflict in the interest of one's goals is a

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relatively stable trait. Individual differences in trait self-control do indeed predict people's success in attaining desirable outcomes like successful work or school performance (e.g. De Ridder et al., 2012; Tangney et al., 2004). Our data furthermore attest to the trait's predictive power, as it shows that individuals with high levels of trait self-control are indeed more successful in staying persistent during unpleasant activities in daily life. What had remained overlooked so far is *how* people high and low in the trait go about regulating their persistence during unpleasant or challenging goal pursuit in their daily lives.

The list of strategies we generated in Pilot Study 1 illustrates the potential variety of processes that individuals may deploy to self-regulate their persistence. It describes self-regulatory strategies at a useful level of abstraction that was (i) prompted by participants own responses, (ii) appeared to provide a good balance between parsimony and differentiation during ambulatory assessment, and (iii) matched well with constructs from the existing self-regulation literature. It moreover also included one new, not previously investigated self-regulatory strategy that was quite popular among our participants: *thinking of the near finish*, which implies thinking that one will soon be done with the activity while performing it.

Our Main Study supported that, in the face of an unpleasant or challenging task, people high in trait self-control help themselves persist by deploying three self-regulatory strategies: they more frequently *focus on the positive consequences* of the activity, *set goals*, and *regulate their emotions*. The strategies *focusing on the positive consequences*, *regulating one's emotions*, *monitoring one's goal progress*, and *thinking of the near finish* were also reported as being effective in increasing participants' self-regulatory success in a given moment. In contrast, *distracting oneself from the activity* actually decreased subsequent perceived self-regulatory success in a given moment.

Finally, a multilevel mediation model revealed that the finding that individuals high in trait self-control more often focus on the positive consequences of unpleasant activities or regulate their emotions cannot explain their higher perceived self-regulatory success in a given moment. In sum, none of the self-regulatory strategies could explain the beneficial effect of trait self-control on self-regulation in a given moment.

Self-regulatory strategies and self-regulatory success

The reported popularity of the 19 strategies was quite similar across Pilot Studies 2a and 2b and the Main Study despite the different assessment methods. Overall, *focusing on the positive consequences* of the activity was clearly the most popular method: in the Main Study, participants reported using it in more than one third of occasions at which they had to persist in an unpleasant or challenging activity. This is highly interesting, as prior evidence of the strategy's instrumentality was rather mixed (see above). The character of the goal-relevant task might be an important moderator of the relationship between focusing on the positive consequences of goal attainment and persistence. Studies that found detrimental effects of focusing on positive consequences seem to have deployed somewhat less aversive tasks. For example, in the Fishbach and Choi (2012) four studies, irrespective of whether participants were instructed to focus on the outcomes or on the experience of an activity, experience ratings for the four goal-related activities of working out on a treadmill (Study 1, $M = 5.10$ and $M = 5.78$, on a scale from 1 to 7), doing origami (Study 2, $M = 4.54$ and $M = 5.38$, on a scale from 1 to 7), flossing (Study 3, $M = 5.96$ and $M = 7.15$ on a scale from 1 to 9), and practicing yoga (Study 4, $M = 7.39$ and $M = 8.13$ on a scale from 1 to 9) were all above the midpoints of the respective scales, indicating that these activities were somewhat pleasant. Freund and Hennecke (2012) investigated dieting that requires a multitude of activities that probably vary in their experience (e.g. from an enjoyable 'stroll at the local farmer's market to get fresh vegetables' to a less enjoyable 'cutting onions'). The conclusion that an outcome focus made the experience of these activities less positive and thereby reduced participants' persistence may therefore hold for relatively pleasant activities but not for the aversive activities we have investigated in the research at hand. In fact, for relatively enjoyable activities, an effect akin to the crowding-out or undermining of intrinsic motivation (Deci, 1971; Kruglanski, Friedman, & Zeevi, 1971; Lepper, Greene, & Nisbett, 1973) may be responsible for the negative impact of focusing on their external instrumentality. But just as there is no undermining of intrinsic motivation through extrinsic incentives for non-enjoyable activities (Calder & Staw, 1975), it may not undermine but rather increase a person's persistence in a non-enjoyable activity, if he or she thinks about its positive consequences. Clearly, more research is needed to investigate whether task experience is in fact a moderator in the relationship between the self-regulatory strategy of *focusing on positive consequences* and persistence.

Three other strategies had positive reported self-regulatory effects, namely, *monitoring one's goal progress*, *thinking of the near finish*, and *emotion regulation* (*not further specified*). With regard to the positive effects of *monitoring one's progress*, our results match well with theoretical considerations from control theory (e.g. Carver & Scheier, 1982; Powers, 1973) and empirical results that were recently summarised in a meta-analysis (Harkin et al., 2016). According to this meta-analysis, interventions that promote goal progress monitoring are effective at improving goal attainment.

Thinking of the near finish by reminding oneself that one will soon be done with the unpleasant activity emerged as another positive predictor of perceived self-regulatory success. While being a highly effective strategy in our data, we were unable to identify previous research that has explicitly focused on the strategy's application and adaptiveness. Generally, however, it has been shown that motivational strength and persistence increase with subjective proximity to a given goal (e.g. Förster, Higgins, & Idson, 1998; Hull, 1932; Kivetz, Urminsky, & Zheng, 2006). As a strategy, *thinking of the near finish* may involve self-talk that capitalises on this effect. Obviously, thinking that one is 'almost there' is a strategy of limited applicability as it

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probably supports persistence only when a goal-related activity is indeed almost completed. Supporting this notion, Koo and Fishbach (2012) have demonstrated that providing goal pursuers with information about how much more progress remains required before goal attainment increases motivation given that what is remaining is in fact smaller than the already accumulated goal progress.

As reviewed earlier, the ability to *regulate one's emotions* has emerged not only as an important contributor to daily well-being (Gross & John, 2003). Recently, it has also been shown that individuals also regulate their feelings to help themselves attain instrumental goals like 'getting work done' (English, Lee, John, & Gross, 2017) and that the ability to regulate one's feelings is indeed a predictor of desirable outcomes like a more self-regulated eating behaviour (Hofmann et al., 2009) or task performance at work (Carmeli & Josman, 2006).

Distracting oneself from the activity emerged as a *negative* predictor of perceived self-regulatory success. While distraction has frequently been promoted as a useful self-regulatory strategy when individuals face a temptation (Metcalfe & Mischel, 1999; Mischel et al., 1972), its detrimental effects in the current study support the notion that different forms of self-regulation (e.g. inhibition of desires vs persistence) may require different strategies. It is possible that when individuals try to increase their persistence by focusing on something else than the current activity, it may undermine persistence by diverting attention away from the focal goal and towards more desirable activities.

It was surprising to us to find no effects on perceived self-regulatory success for some strategies like *task enrichment* or *goal setting*. For example, the positive effects of *setting goals*, as they are, for example, advocated in goal setting theory, have been shown many times (Kyllo & Landers, 1995; Latham & Kinne, 1974; Latham & Marshall, 1982). One important aspect of goal setting theory is, however, that in order to be effective, goals have to be specific and reasonably difficult to achieve. It is possible that when spontaneously setting their own goals, participants in our study may not have been very effective in formulating them in a way that actually helped their persistence. For example, a goal like 'I'm going to do my best' should, according to goal setting theory (Locke & Latham, 2002, 2006), not be very helpful, as opposed to, for example, a goal like 'I'm going to continue studying until I have finished this chapter and I am able to give a quick summary of it'. It is also possible that participants set unrealistically ambitious goals and that, hence, with such high standards, they were in turn dissatisfied about their actual performance (Carver & Scheier, 1990). As we did not collect information on the goals that participants set for themselves, we can neither confirm nor disconfirm that this explanation is responsible for the lack of an effect, but it is a possibility.

Implications for self-regulation theories and research

One of the goals of the present research was to investigate whether strategy use is one of the processes through which trait self-control 'gets outside the skin' (p. 315, Hampson, 2012). What we found is that individuals with high trait self-control do indeed use three strategies more often than individuals with lower levels of these traits, namely, *focusing on the positive consequences*, *goal setting*, and *emotion regulation* (*not further specified*). However, none of these strategies accounted for the greater reported momentary self-regulatory success of people high in trait self-control. Accordingly, future research should continue to investigate the underlying explanatory mechanisms for self-regulatory ability for advancing a 'whole trait' view (Fleeson & Jayawickreme, 2015) of self-control. This view assumes that each trait has a *descriptive* side that can be understood as the distribution of states (or 'what one actually does', here: whether, over time, one is successfully in regulating one's behaviour) and an *explanatory* side that consists of social-cognitive mechanisms that produce these states in response to relevant situations (here: aversive activities). Our data do not support that the strategies which participants explicitly report represent such social-cognitive mechanism. It is possible that more automatic processes that individuals may not be able to explicitly report are better candidates for explaining individual differences in self-control (e.g. Fishbach et al., 2003). Generally, a recent process-oriented perspective on self-regulation has furthermore begun to identify other explanatory constructs that, beyond the effortful inhibition of impulses, promote successful self-regulation (e.g. Duckworth et al., 2016a; Fujita, 2011; Gillebaart, Schneider, & De Ridder, 2015). For example, individuals with high self-control appear to experience less or less severe self-control conflicts in the first place, possibly because they avoid tempting alternatives (Ent et al., 2015), experience their duties as more autonomously motivated (Converse et al., 2018), or have established habits that promote their goals (Galla & Duckworth, 2015).

Limitations and future directions

We set out to study which strategies people spontaneously use in their everyday lives whenever they have to regulate their persistence during unpleasant activities. For the future, it would be desirable to extend this research to other, more diverse populations. While Studies 2a and 2b taken together reflect some diversity (with an English-speaking Mturk sample and a German-speaking sample with a substantial proportion of non-students), our Main Study is ultimately a study with a relatively young and well-educated sample. This may not be a large concern for the generalizability of within-participant processes—individual differences in trait self-control, for example, could be equally predictive of strategy use across different populations—but our sample might face different self-regulatory challenges or prefer different self-regulatory strategies than other samples. Students, for example, are relatively autonomous when deciding when, where, and with whom to study and face a lot of mental (rather than, for example, physical) challenges. Further, they tend to pursue a relatively abstract but potentially intrinsically meaningful goal (e.g. becoming a psychologist). In contrast, blue-collar workers tend to be supervised more closely, are more likely to engage in a lot of monotonous or physically

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challenging work, and the most important positive consequence of their work may be a paycheck at the end of the month. It may be that the effectiveness of focusing on the positive consequences of an activity may be lower in such a case, where the consequence is highly extrinsic (Deci & Ryan, 1985; Kruglanski et al., 1971; Lepper et al., 1973). Finally, strategies may vary in their effectiveness between different populations, for example, depending on individuals' differing capacities to enact strategies effectively. Specifically, strategies that are very future-oriented (e.g. focusing on the positive consequences) that require a great deal of anticipation (e.g. focusing on the positive/negative consequences) or planning (e.g. planning/scheduling) or that are otherwise cognitively demanding may be usable and effective for some people but too taxing for others. The latter may instead prefer and be more successful with more *ad hoc* in-the-moment strategies (e.g. adding something positive to the activity). At this point, all of this is speculative and future research will have to address potential moderator variables.

While the current research has shown that a person's trait self-control predicts which strategies that person prefers using, it says nothing about *why* a person, in a given moment, prefers using one strategy over another. It is probably the case that people more often use the strategies that they believe to be effective. In fact, in our Pilot Studies 2a and 2b, we also measured participants' beliefs about the strategies' effectiveness. These were highly correlated with participants' reported frequencies of strategy use (with *r*s ranging from .42 to .79 across strategies). In the future, it would be interesting to investigate the role of subjective beliefs about strategy effectiveness in predicting strategy use more systematically. It is possible that individuals with high levels of trait self-control have more appropriate beliefs about what constitutes a suitable strategy in a given situation.

One aspect that we have not yet addressed and that may also have important implications for self-regulatory success is regulatory flexibility (Aldao, 2013; Bonanno & Burton, 2013). In the literature on emotion regulation, it has been proposed that because the effectiveness of a given strategy is contingent on the context in which it is used, flexibility in using different kinds of strategies is advantageous. According to Bonanno and Burton (2013), flexibility encompasses three sequential components, namely, (i) sensitivity to context, (ii) availability of a broad repertoire of strategies, and (iii) responsiveness to feedback. Transferred to self-regulation more broadly, the first component implies that a good self-regulator should be able to detect the demands of a given self-regulatory conflict and choose the appropriate strategy in response. This could imply using *task enrichment* if mental stimulation is too low, *reducing distractions* if there are too many, or *setting goals* or *planning/scheduling* if there is too little structure. The second component involves the necessity of actually having a sufficient number of self-regulatory strategies at one's disposal to flexibly switch between them if required. And the third component involves that one can respond to feedback in order to make adjustments, that is, adjust a strategy or select a new one, given that the current one does not really match the situational demands. Future research may address, whether individual differences in trait self-control can, to some extent, be explained by differences in self-regulatory flexibility. Note, however, that in the present research, we did not find many interaction effects to indicate that a given strategy's effectiveness varies much as a function of demands. This would also limit the advantages of regulatory flexibility. However, some of the strategies were rarely used in response to certain demands in our Main Study. Clearly, if a strategy is rarely used in combination with a certain demand, estimating its specific effectiveness for that activity or demand is quite unreliable. Here, experimental studies should augment our approach by systematically pairing strategies with different activities and demands. Moreover, our assessment of demands was clearly limited to a couple of items referring to mental effort, physical effort, boredom, and emotional challenges. A more fine-grained analysis of demands—including characteristics like the person's current autonomous versus controlled motivation (Deci & Ryan, 1985, 2000), their affective state, or level of fatigue—could also advance our understanding of regulatory flexibility.

Importantly, due to power concerns, we did not test the potential self-regulatory effects of strategies like *planning/scheduling*, *adopting a process focus*, *reducing distractions*, and *reappraisal*. These strategies may nevertheless have positive or negative effects, and prior research clearly attests to the effectiveness of many of them (see Table S1). To study their effectiveness in an everyday context, an even more intense or longer ambulatory assessment seems necessary, so more occasions in which participants deployed these strategies could be assessed.

Another limitation of our work lies in its strong reliance on self-report. First, there is the potential to overestimate associations between constructs due to shared method variance. Second, we cannot exclude other influences on our results; third variables like an overall positive self-regard may have inflated positive associations between strategy use and reported self-regulatory success. Moreover, a desire to experience cognitive consistency (Feldman, 1966; Festinger, 1957) may have led participants to retrospectively report using different (or fewer) strategies whenever they experienced themselves as unsuccessful in regulating their persistence. Thinking that one just has not used the right strategies may make it easier to cope with the feeling of failure. Vice versa, participants may feel that they might not have maximised persistence, if they did not use certain (or just any) strategies or they may feel that they must have maximised their persistence, if they used certain strategies and, in turn, be less or more satisfied, respectively. More generally, individuals may not always be able to properly remember and report intrapsychic processes like the deployment of self-regulatory strategies (Nisbett & Wilson, 1977). While some regulatory processes like the strategies we focus on may be deployed explicitly, there are others that operate implicitly (e.g. 'counteractive control', Fishbach et al., 2003; Fishbach, Zhang, & Trope, 2010). It is therefore important to acknowledge that this research is restricted to self-regulatory strategies that individuals use consciously, in response to the experience of a given activity as requiring the regulation of persistence.

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However, in this domain of explicitly aversive experiences, self-regulatory strategies reflect controlled processes that individuals actively deploy (e.g. Metcalfe & Mischel, 1999; Strack & Deutsch, 2004) and that are probably at the higher end of the cognitive processes that people are able to report accurately (Hofmann, Friese, & Wiers, 2008). Moreover, because many of the strategies are intrapsychic strategies (e.g. the most popular one, *thinking of the positive consequences*) and their deployment may not show in overt behaviour, neither informant reports nor any behavioural measures would be good means of assessing them 'in the wild'. Finally, it is not only common to assess regulatory attempts through self-report (like, e.g. in the emotion regulation literature), but there is also much evidence that these self-reports predict a variety of observable outcomes (e.g. English, John, Srivastava, & Gross, 2012; Gross, 1998a; Gross & John, 2003; Srivastava, Tamir, McGonigal, John, & Gross, 2009), which attests to their validity. Additionally, rather than assessing strategy use retrospectively through a global self-report scale (as most commonly practiced), we assessed it using ambulatory assessment, which should allow for an even more reliable measure than in previous research. Nevertheless, it is important to keep the shortcomings of self-report in mind, when evaluating our results.

While a more objective measure of self-regulatory success would have been desirable, it is, however, difficult to imagine how we could have attained objective information about persistence for the wide range of activities that we covered in this study including studying, housework, or social contacts. If we were focusing only on one activity, for example, persistence during exercise, this would be possible, for example, by tracking (through cellphone GPS) the time participants spend at the gym. However, it was an explicit goal of our research to not only focus on single goal-directed activities but also to cover a wide range of activities.

Finally, in the main study, participants' reports about their strategy use and self-regulatory success relied on single items, which may have increased measurement error. Note, however, that single-item measures are not, by definition, worse than multiple-item measures (Bergkvist & Rossiter, 2007). Multiple-item measures are necessary for assessing broader constructs, for example, personality. If, however, a construct is quite narrow, and we would suggest that the use of any single strategy is a narrow construct, single-item measures may, in fact, be sufficient (Sackett & Larson, 1990). Moreover, single-item measures of target constructs are very common in experience sampling studies (Friese & Hofmann, 2016; Hofmann et al., 2012; Milyavskaya et al., 2015; Milyavskaya & Inzlicht, 2017) and, in order to reduce participant burden, often the only feasible option.

CONCLUSION

According to our data, people quite frequently (in about 20% of all sampled occasions) engage in activities that are aversive or challenging. During such activities, people frequently have to somehow self-regulate their behaviour in a way that allows them to persist. In the current research, we have investigated this 'somehow' with a focus on self-control as a trait and a wide range of self-regulatory strategies. We were able to identify strategies that, according to participants' reports, prevent and strategies that promote self-regulatory success during aversive activities in daily life. That these strategies did not depend on trait self-control nor explain the effects of trait self-control on momentary self-regulatory success seems to show that trait self-control and self-regulatory strategies represent separate routes to good self-regulation.

Studying persistence-aiding strategies seems worthwhile, because it completes the picture of the various possibilities of how self-regulation may look outside of the effortful inhibition of impulses. A focus on strategies of self-regulation and their effects on daily persistence may also help to link the somewhat dissociated research streams that have focused too exclusively on either the personality or the process side of successful self-regulation (Hoyle, 2006). Furthermore, insights from the field can provide an ecologically valid basis for recommendations on how individuals may improve their self-regulation in their everyday goal pursuits. By integrating trait and process approaches OR a trait and a process approach our findings promote a more comprehensive understanding of self-regulatory success and failure during people's daily attempts to regulate their persistence during aversive activities.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Coding Scheme Developed in Pilot Study 1, Items from Pilot Study 2a, and Exemplary References to Related Constructs

Table S2. Descriptive Statistics, Reliabilities, and Intercorrelations for Measures of Activity Demands (Main Study)

Table S3. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 6) Task Enrichment, and Interactions of Demands and Use of the Strategy 6) Task Enrichment

Table S4. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 8) Distracting Oneself from the Activity, and Interactions of Demands and Use of the Strategy 8) Distracting Oneself from the Activity

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Table S5. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 10) Focusing on Negative Consequences, and Interactions of Demands and Use of the Strategy 10) Focusing on Negative Consequences

Table S6. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 11) Focusing on Positive Consequences, and Interactions of Demands and Use of the Strategy 11) Focusing on Positive Consequences

Table S7. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 12) Goal Setting, and Interactions of Demands and Use of the Strategy 12) Goal Setting

Table S8. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 13) Monitoring one's Progress, and Interactions of Demands and Use of the Strategy 13) Monitoring one's Progress

Table S9. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 17) Thinking of the Near Finish, and Interactions of Demands and Use of the Strategy 17) Thinking of the Near Finish

Table S10. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 18) Suppressing the Impulse to Quit, and Interactions of Demands and Use of the Strategy 18) Suppressing the Impulse to Quit

Table S11. Results from Multilevel Regression Models of Perceived Self-Regulatory Success on Demands, Use of the Strategy 19) Emotion Regulation (Not Further Specified), and Interactions of Demands and Use of the Strategy 19) Emotion Regulation (Not Further Specified)

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