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Understanding the Effects of Time Perspective: A Meta-Analysis Testing a Self-Regulatory Framework

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Abstract

Despite extensive evidence that time perspective is associated with a range of important outcomes across a variety of life domains (e.g., health, education, wealth), the question of *why* time perspective has such wide-reaching effects remains unknown. The present review proposes that self-regulatory processes can offer insight into why time perspective is linked to outcomes. To test this idea we classified measures of time perspective according to the dimension of time perspective that they reflected (e.g., past, present-hedonistic, future) and measures of self-regulation according to the self-regulatory process (i.e., goal setting, goal monitoring, and goal operating), ability, or outcome that they reflected. A systematic search identified 378 studies, reporting 2,000 independent tests of the associations between measures of time perspective and self-regulation. Random-effects meta-analyses with robust variance estimation found that a future time perspective had small-to-medium-sized positive associations with goal setting ($r_+ = 0.25$), goal monitoring ($r_+ = 0.19$), goal operating ($r_+ = 0.32$), self-regulatory ability ($r_+ = 0.35$), and outcomes ($r_+ = 0.16$). Present time perspective, including being present-hedonistic and present-fatalistic, was negatively associated with self-regulatory processes, ability, and outcomes (r_+ ranged from -0.00 to -0.27). Meta-analytic structural equation models found that the relationship between future time perspective and outcomes was mediated by goal monitoring, goal operating, and self-regulatory ability, but not goal setting. As the first test of why time perspective is associated with key outcomes, the findings highlight the central role of self-regulation processes and abilities for understanding why people with certain time perspectives experience better outcomes.

Keywords: Time Perspective, Self-Regulation, Control Theory, Meta-Analysis

Public Significance Statement

Time perspective has been linked to a range of important life outcomes, including those relating to people's health, wealth, happiness, academic success, and so on. The present review found that the reason why people who consider the future consequences of their present decisions and actions have better outcomes is because they are more likely to monitor how well they are doing, take action towards achieving better outcomes, and are better able to regulate their behavior. This provides the first evidence that time perspective is associated with positive outcomes through its relationship with self-regulatory processes.

Understanding the Effects of Time Perspective: A Meta-Analysis Testing a Self-Regulatory Framework

When people make decisions, their choices and subsequent actions are inevitably influenced by the time frame that they prioritize. Whether the choice is to indulge in a piece of cake for immediate pleasure or eat an apple for future health, spend on a small item for nostalgia's sake or save for a rainy day in the future, or use a traditional energy supplier to save money now or switch to a green energy provider to reduce future environmental impact, people's psychological sense of time, or time perspective, plays a key role in guiding decisions, both big and small.

This ability to reflect upon the past, focus on the present, and plan for the future is a uniquely human capacity that can have far-reaching implications for people's decisions, actions, and the outcomes that follow. Not surprisingly then, over six decades of research have demonstrated that people's time perspective has a significant and pervasive influence on their behavior and outcomes, including those relating to their health (Daugherty & Brase, 2010), wealth (Donnelly, Iyer, & Howell, 2012), happiness (Drake, Duncan, Sutherland, Abernethy, & Henry, 2008), academic success (Horstmanshof & Zimitat, 2007), pro-environmental action (Corral-Verdugo, Fraijo, & Pinheiro, 2006), and so on.

Despite the evidence demonstrating ***how*** different time perspectives are related to outcomes however, we still do not know ***why*** time perspective is associated with people's behavior and outcomes. That is, why do people who give greater consideration to the future perform better at school, have improved health outcomes, and typically live a longer and happier life? Why do people who focus on the present find it challenging to control their impulses? To answer these important questions, it is essential to understand the psychological mechanisms that explain why time perspective is associated with such a wide range of

behaviors and consequential outcomes. The present review proposes that self-regulatory processes can offer insight into these associations.

Self-regulation is "the exercise of control over oneself, especially with regard to bringing the self in line with preferred standards" (Vohs & Baumeister, 2004, p.2) and plays a critical role in the outcomes people experience (for a review, see Baumeister & Vohs, 2004). Models of self-regulation identify a number of key processes that include deciding which goals to pursue, engaging in actions to pursue these goals, monitoring progress towards these goals, and warding off temptations or challenges that may interfere with pursuing goals (Carver & Scheier, 1982; Fujita, Carnevale, & Trope, 2011). It is likely that different time perspectives are associated with one or all of these processes, and that one or more of these processes account for why time perspective is linked to certain outcomes. However, despite a large number of empirical studies looking at the relationship between time perspective and aspects of self-regulation, the empirical evidence has never been organized and reviewed in a way that permits robust tests of the idea that self-regulatory processes explain why time perspective is associated with such a broad range of outcomes.

The present review develops a taxonomy informed by key theories (i.e., Control Theory; Carver & Scheier, 1981, 1982) and frameworks (e.g., Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013) of self-regulation, to classify which self-regulatory process the different measures used in research reflect. By doing so, we are able to draw on the wealth of research to date to explore how time perspective relates to the specific processes involved in self-regulation, and importantly, test whether these processes explain why time perspective plays such a critical role in people's behavior and outcomes.

What is Time Perspective?

Scholars across a variety of disciplines have had a long-standing interest in people's perceptions and understanding of time. Philosophers, including Kant and Heidegger, have

mused on how time shapes people's experiences and perceptions (Walsh, 1967), and one of the first published books in psychology devoted an entire chapter to "The Perception of Time" (James, 1890). Yet it was not until 1942 that the notion of time perspective was formally introduced (Lewin, 1942), and later defined as "the totality of the individual's view of his psychological future and psychological past existing at a given time" (Lewin, 1951, p. 75). Extending on Lewin's ideas, scholars in behavioral decision-making (Loewenstein & Elster, 1992; Loewenstein, Read, & Baumeister, 2003) and behavioral economics (Ainslie, 2001) have sought to understand the consequences of time on people's decisions and behavior, by examining time in terms of a limited resource (Klein, 2007), an intertemporal conflict (Mischel, Shoda, & Rodriguez, 1989), and a lens through which the world is perceived (Liberman & Trope, 1998). In the 21st Century, research on time perspective burgeoned and scholars defined and operationalized the ideas in a variety of ways (Lasane & O'Donnell, 2005). This has resulted in a constellation of different terms that reflect various aspects of the experience of subjective time including, time orientation, time attitudes, temporal focus, and temporal depth. In the present review, we use the term time perspective to describe an individual's overarching temporal preference with respect to past, present and future time frames (Shipp et al., 2009).

The extent to which people develop and use one time frame over another when making decisions is typically viewed as a relatively stable individual difference (Zimbardo & Boyd, 1999). However, time perspectives can also shift, both in the short and long-term. For example, health crisis, such as pandemics (e.g., SARS, H1N1, and COVID-19), can create an "enforced presentism" that shifts attention to the current moment, and away from the future (Holman & Grisham, 2020), whereas political crises, such as senseless acts of violence against minorities, can foster a bleak view of the future that re-orients our perspective to the past and to memories of similar events as we attempt to make sense of them (Arendt, 2006).

While existing research and reviews might help to predict how shifts in time perspectives are likely to affect how people behave and the consequent outcomes (e.g., trauma that forces people to live in the present moment might lead people to be more impulsive, Lee & Song, 2011) we need to understand why shifts in time perspective change behavior – is it because future goals are less salient? And / or because people stop monitoring their behavior or are simply too stressed to exert restraint?

Dimensions of Time Perspective

Although time perspective encompasses people's views towards their past, present, and future, previous meta-analyses have focused primarily on the role of a future time perspective[1]. These reviews have found that a future time perspective (i.e., the tendency to consider the future implications of present decisions and actions) is associated with a higher grade point average (Kooij, Kanfer, Betts, & Rudolph, 2018), lower levels of procrastination (Sirois, 2014), engaging in more health protective behaviors (Murphy & Dockray, 2018), greater occupational well-being (Henry, Zacher, & Desmette, 2017), and improved life-satisfaction and subjective health (Kooij et al., 2018). Yet an individual's time perspective is not only comprised of their view of the future - individuals can place their attention to the past, present, and the future to a greater or lesser extent, with these being independent and continuous dimensions (Zimbardo & Boyd, 1999). Indeed, research that has demonstrated that each time perspective represents a distinct trait that independently predicts people's behavior (Joireman, Shaffer, Balliet, & Strathman, 2012). Consequently, research that focuses solely on future time perspective does not provide a comprehensive understanding of how people's time perspective may influence their behavior and outcomes, just as, for

[1] To our knowledge, only two previous reviews have considered more than one timeframe; a review that explored the relationship between a present time perspective and procrastination (Sirois, 2014) and a review that explored relationship between a combined past and present time perspective and pro-environmental behavior (Milfont et al., 2012). However, both tests of these associations were conducted on a small number of studies (k = 8 and k = 4 respectively), and as such, may not provide robust estimates of these relationships.

example, a review of conscientiousness does not provide a comprehensive understanding of how personality is related to people's behavior and outcomes. In the present review we therefore include and examine a range of different time perspectives and explore how each is associated with self-regulatory processes and outcomes.

The present review also acknowledges that time perspective is a multidimensional construct that encompasses people's cognitions, attention, attitudes, and behaviors (Mohammed & Marhefka, 2019; Shipp, et al., 2009). As such, researchers have used different measures to assess each dimension of time perspective. For example, while some measures of time perspective assess people's emotional and evaluative feelings toward the past, present, and future (e.g., the Time Attitude Scale; Nuttin, 1985), others assess the amount of attention that people devote to the past, present, and future, respectively (e.g., Temporal Focus Scale; Shipp et al., 2009). Research to date has, however, typically neglected these subtle and potentially important distinctions when examining how different dimensions of time perspective might influence outcomes. For example, does having a positive view of the future play a larger role in determining whether someone will be successful in reaching their goals than simply devoting attention towards the future? To address this issue, we categorized measures of time perspective according to the particular cognitive, affective, attitudinal and behavioral dimension of time perspective that they were likely to reflect. We then explored whether these distinctions in the particular dimension of time perspective had an impact on the magnitude of the relationships between time perspective and self-regulatory processes and outcomes.

Why is Time Perspective Associated with Outcomes?

We propose that time perspective affects self-regulation and we test this idea by identifying self-regulatory processes that might explain why time perspective is linked to consequential outcomes. Although there are a number of different models of self-regulation

(for a review, see Baumeister & Vohs, 2004), Control Theory (Carver & Scheier, 1982, 1998) is perhaps the most influential to date (Johnson et al., 2006). Indeed, previous reviews have used this theory to conceptualize the processes involved in self-regulation (e.g., Burnette et al., 2013). From the lens of Control Theory, self-regulation involves three main processes: (i) goal setting (i.e., establishing a specific reference value or a desired outcome), (ii) goal monitoring (i.e., comparing current progress to the standard specified by the goal), and (iii) goal operating (i.e., engaging in goal-directed action). There are a number of theoretical reasons why we might expect time perspective to be associated with these self-regulatory processes.

Goal Setting. Goals are, by definition, situated in the future and typically specify or imply a time in which they might be achieved (e.g., saving money for an upcoming holiday; Peetz, Wilson, & Strahan, 2009). Because goals are cognitive representations of future outcomes (Austin & Vancouver, 1996), individuals with a future time perspective might be more likely to set goals and be more motivated to achieve these goals, in part because the future is more salient (Lens, Paixao, Herrera, & Grobler, 2012). Indeed, a previous meta-analysis found that future time perspective was positively associated with goal intentions (Andre, van Vianen, Peetsma, & Oort, 2018). However, Andre and colleagues (2018) did not measure other dimensions of time perspective in their review, nor did they test whether intentions explained the relationship between time perspective and outcomes.

Goal Monitoring. Monitoring progress towards a goal requires effort (e.g., seeking out information on how well you are doing), and can be unpleasant (e.g., if monitoring indicates poor progress; Webb, Chang, & Benn, 2013). As a result, we might expect that individuals who have a present time perspective, and who are therefore typically motivated by immediate gratification, will be less likely to monitor their goal progress because they prefer to avoid short-term costs (e.g., effort, inconvenience, feeling bad). In contrast,

individuals who have a future time perspective may invest more time and effort towards actions that can help them achieve their long-term goals, even if in doing so they incur short-term costs. The extent to which people monitor their goals might also be expected to vary on a particular temporal dimension. For instance, people can think about how much progress they have made towards their goal (i.e., by reflecting on the past), or how much progress they still need to make (i.e., by considering the future). Thus, we might also expect a relationship between a past time perspective and goal monitoring.

Goal Operating. Time perspective is likely to be associated with goal operating through its influence on how people consider the actions needed to achieve their goals. Having a future time perspective can direct people to the long-term consequences of their current actions (Rothspan & Read, 1996). Accordingly, for individuals who have a greater future time perspective, the instrumentality of actions intended to achieve something in the future (e.g., saving money, engaging in healthy behaviors, studying) will be more salient (Eccles & Wigfield, 2002; Lens, Paixao, & Herrera, 2009). In contrast, individuals who are more oriented towards the present (e.g., their current mood), are likely to focus on actions that address those current needs over those that may be necessary for reaching long-term goals (Sirois & Pychyl, 2013). In this respect, having a present time perspective may be detrimental for goal operating (Tice, Bratslavsky & Baumeister, 2001).

Self-Regulatory Ability. People's *ability* to regulate their behaviors might also explain the association between time perspective and outcomes. Self-regulatory ability can be broadly defined as the resources and attributes that an individual has that help them to attain their goals (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012). Consistent with this idea, individuals who have better self-regulatory abilities, such as those high in conscientiousness, tend to experience better outcomes (Wilmot & Ones, 2019), whereas those with weaker self-regulatory abilities, such as chronic procrastinators, tend to experience poor

outcomes across a variety of life domains (Sirois & Pychyl, 2016). Given the importance of self-regulatory ability for outcomes, we also explored how different dimensions of time perspective might be associated with people's general ability to regulate their behavior.

In summary, integrating insights and theories of self-regulation and time perspective provide support for the idea that time perspective may be linked to outcomes through its influence on key self-regulation processes and enduring self-regulatory abilities. Yet to date, no research has explicitly tested whether these self-regulatory processes and abilities explain the relationship between time perspective and outcomes. That is, do people who focus on the future experience better outcomes (e.g., attain a higher GPA) because they are more motivated to succeed and/or because they are more likely to take action when need? Similarly, do people who are focused on the present experience worse outcomes (e.g., a higher BMI) because they a less able to regulate or keep track of their behavior? The present review will provide the first empirical test of such relationships.

The Present Review

We report the findings from the most comprehensive meta-analysis to date on the relationship between time perspective and self-regulation, encompassing over 60 years of research across different life-domains, and with diverse methods and samples. Our main objective was to meta-analytically test whether self-regulatory processes and abilities could explain why different dimensions of time perspective are associated with important life outcomes. To achieve this aim, we created two taxonomies to classify the measures used in primary studies according to either (i) the dimension of time perspective or (ii) the self-regulatory process that they were likely to reflect. Deconstructing the processes involved in self-regulation and mapping them on to the ways that primary research studies have measured these processes, allowed us to explore the relationship between different dimensions of time perspective and specific self-regulatory processes. Taking this approach also meant that we

are able to conduct mediation analyses to assess which (if any) of these processes accounted for the relationship between different time perspectives and outcomes

Method

The review was conducted in accordance with PRISMA guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009), and with respect to recommendations for meta-analyses (e.g., Hedges, Tipton, & Johnson, 2010; Quintana, 2015). The protocol for the review has been published (Baird, Webb, Martin, & Sirois, 2017) and the review was registered with the International Prospective Register of Systematic Reviews (PROSPERO; https://www.crd.york.ac.uk/prospero/; registration number: CRD42017058590). Following recent recommendations for transparency and reproducibility of meta-analyses (Johnson, 2020; Lakens, Hilgard, & Staaks, 2016; Polanin, Hennessey, & Tsuji, 2020), the materials for this meta-analysis, including the raw data files, are available on the Open Science Framework (https://osf.io/jy3zu/) and we have sought to adhere to the Meta-Analysis Reporting Standards (MARS) items (American Psychological Association, 2020; Appelbaum, Cooper, Kline, Mayo-Wilson, Nezu, & Rao, 2018).

Search Strategy

Five methods were used to generate the sample of studies. First, a search of the electronic database, Web of Science[2], was conducted for articles published up to the 11th of January 2016[3], using search terms relating to time perspective (e.g., time perspective, time orientation, time attitude, temporal perspective, temporal orientation, temporal focus,

[2] Web of Science provides access to multiple databases, including MEDLINE (1950-present), the Science Citation Index Expanded (1900– present), Social Sciences Citation Index (1956–present), Arts & Humanities Citation Index (1975–present), and Conference Proceedings Citation Index —for Science and for Social Science & Humanities (1990–present).

[3] Although the database search was conducted in 2016, a number of additional search strategies were also utilised and so the present review includes studies published between 1955 to 2019 (see Table S1 in the online materials; https://osf.io/jy3zu/)

temporal depth, and future consequence). Articles that contained one or more of these search terms in the title, abstract, or keywords were considered for inclusion in the review[4]. Second, articles referenced in the appendix of a seminal book on time perspective (Stolarski, Fieulaine, & Van Beek, 2015) and articles listed on the references page of the Time Perspective Network website (http://www.timeperspective.net/) were reviewed for inclusion. Third, studies included in seven meta-analyses that have been conducted on time perspective to date (i.e., Andre et al., 2018, Henry et al., 2017, Kooij et al., 2018, Milfont et al., 2012, Murphy & Dockray, 2018, Sirois, 2014, and Sweeney & Culcea, 2017) were considered against the inclusion and exclusion criteria for the present review. Fourth, the abstract booklets from three International Conferences on Time Perspective (2012, 2014, and 2016) were screened for published articles and unpublished research/data. Finally, a call for papers and unpublished data were sent to the distribution lists of the European Association of Social Psychology (http://www.easp.eu/), the Society of Experimental Social Psychology (http://www.sesp.org/), and members of the Time Perspective Network (http://www.timeperspective.net/).

Eligibility Criteria

We sought to include all empirical studies that examined the relationship between at least one measure of time perspective and at least one self-regulatory process (i.e., goal setting, goal monitoring, or goal operating), ability, or outcome. Eligibility was not restricted by the study design, and studies using correlational (i.e., cross-sectional or longitudinal) or experimental (i.e., where time perspective was manipulated) designs were both eligible for inclusion, as were unpublished studies (e.g., those reported in dissertations). In each case, the effect size *r* was used to represent the strength and direction of the relationship between the

[4] The search string used in the electronic database search was: TOPIC: ("time perspective") OR TOPIC: ("time orientation") OR TOPIC: ("future consequence") OR TOPIC: ("past orient*") OR TOPIC: ("present orient*") OR TOPIC: ("future orient*") OR TOPIC: ("time attitude") OR TOPIC: ("temporal depth") OR TOPIC: ("temporal focus") OR TOPIC: ("temporal orientation") OR TOPIC: ("temporal perspective").

measure of time perspective and the measure of the self-regulatory process, ability, and/ or outcome. No restrictions were placed on the type of sample being studied nor the study setting; therefore, studies of healthy adults, adolescents and children, university students and clinical populations, and studies conducted in community, clinical, and academic settings were all eligible for inclusion. Articles published in a language other than English were also eligible if the relevant information could be identified using automated translation services (e.g., Google Translate; https://translate.google.co.uk/). Studies needed to include a measure of time perspective and a measure of a self-regulatory process (i.e., goal setting, goal monitoring or goal operating), ability, or outcome.

Measures of Time Perspective. Time perspective was conceptualized as a multidimensional construct that encompasses cognition, attention, attitudes, and behavior. As such, time perspective was broadly defined and included measures of time perspective such as the Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999), and measures of future orientation (e.g., the Consideration of Future Consequences Scale; Strathman, Gleicher, Boninger, & Edwards, 1994), temporal depth (e.g., the Temporal Depth Index; Bluedorn, 2002), temporal focus (e.g., the Temporal Focus Scale; Shipp et al., 2009), and attitudes toward time (e.g., the Time Attitude Scale; Nuttin, 1985). We also included measures of time perspective intended for use with specific samples (e.g., the Hypertension Temporal Orientation Scale, Brown & Segal, 1996) and measures in which time perspective is measured as a subscale (e.g., the present-hedonistic subscale of the Barrett Impulsivity Scale; Patton, Stanford, & Barratt, 1995), if it was possible to extract the bivariate correlation between the subscale reflecting time perspective and the measure of self-regulatory process, ability and/or outcome.

Measures of time perspective often have multiple subscales. For example, the Temporal Depth Index (Bluedorn, 2002), the Temporal Focus Scale (Shipp et al., 2009), and

the Time Attitude Scale (Nuttin, 1985) each contain three subscales assessing biases towards the past, present, and future, respectively. Given that different time perspectives are likely to have different associations with aspects of self-regulation, the present review used previous reviews and conceptualizations of time perspective (e.g., Andre et al., 2018; Mohammed & Marhefka, 2019; Shipp et al., 2009) to develop a taxonomy for classifying measures, along with the subscales of those measures, according to the dimension of time perspective that they were likely to reflect (the coding manual is presented in the online materials; Online Materials A). We identified 12 dimensions of time perspective (for a summary of these dimensions and the measures associated with each dimension, see Table 1).

Two of the authors of this review independently coded the measures of time perspective used in primary studies according to the dimension of time perspective that they were likely to reflect. There was a very high level of agreement (Cohen's $k = 0.92$, $p < .001$), and disagreements were resolved through discussion and by seeking out additional information relating to the convergent and discriminant validity of the measures in question (e.g., correlation matrices reported in previous studies that explore the association between different measures of time perspective; Shipp et al., 2009). In instances where measures of time perspective could be categorized as multiple dimensions of time perspective (e.g., the Zimbardo Time Perspective Inventory contains items reflecting a general future time perspective and items reflecting a positive future time perspective), these measures were classified as general measures of time perspective.

Measures of Self-Regulation. Studies also needed to include a measure of a self-regulatory process (i.e., goal setting, goal monitoring, or goal operating), ability, or outcome. Given that there is considerable variation in how these processes and behaviors have been operationalized and defined (for a review, see Vohs & Baumeister, 2004), the present review used existing theories (e.g., Control Theory; Carver & Scheier, 1982) and frameworks (e.g.,

Burnette et al., 2013) to develop a taxonomy for classifying measures according to the self-regulatory process that they were likely to reflect. To achieve this aim, a coding manual was developed (see the online materials; Online Materials B), which included (i) a definition of each self-regulatory process, self-regulatory ability, and outcomes, (ii) an example of how constructs relevant to each component are typically measured, and (iii) instructions for coders. We then independently considered measures of self-regulation extracted from eligible studies and identified whether the measure reflected a self-regulatory process (i.e., setting, monitoring or operating), ability or outcome; or did not pertain to self-regulation. There was a high level of agreement between coders (Cohen's $k = 0.78$, $p < .001$) and disagreements were resolved through discussion. Below, we outline how the components of self-regulation were conceptualized in the present review and how this was related to the measures.

Goal setting. Measures of goal setting typically assess the strength and direction of a person's motivation (Ajzen, 1991). Thus, measures of goal setting include measures of intentions (e.g., "I intend to achieve X"; Triandis, 1980), commitment or motivation (e.g., "I am strongly committed to achieving X"; Locke, Latham, & Erez, 1988), or readiness to change (e.g., precontemplation, contemplation, preparation, action, and maintenance; Prochaska & DiClemente, 1984). Measures of goal setting also include the level of concern or the level of importance that people associated with different outcomes (e.g., "How important is it to you to achieve a healthier weight", Vinkers, Adriaanse, Kroese, & de Ridder, 2014; "In order to protect the environment, we should all be willing to reduce our current standard of living", Bruderer Enzler, Diekmann, & Liebe, 2019).

Goal monitoring. Goal monitoring involves evaluating ongoing performance relative to the goal that has been set, in comparison to others, or with respect to past performance (Carver & Scheier, 1982; Webb, Chang, & Benn, 2013). Example measures of goal monitoring include the frequency with which people check their personal finances (e.g.,

Chang, Webb, Benn, & Reynolds, 2017), seek feedback on their performance at work (e.g., from supervisors or colleagues; Anseel, Lievens, & Levy, 2007), record the number of calories consumed (e.g., Boutelle, Kirschenbaum, Baker, & Mitchell, 1999) or use equipment that provides information relating to their goal progress (e.g., smartphone apps, activity wristbands, weighing scales; Hall & Epp, 2013).

Goal operating. Goal operating refers to activities and behaviors directed towards goal achievement (Carver & Scheier, 1982). Measures of goal operating include the number of hours spent preparing for an exam (e.g., Horstmanshof & Zimitat, 2007), planning for retirement (e.g., enquiring about a saving scheme; Hershey, Jacobs-Lawson, McArdle, & Hamagami, 2007), use of learning strategies (e.g., reading the information several times or creating mnemonics; Bowles, 2008), or the amount of effort exerted toward a particular goal (e.g., at work or while studying; Gutiérrez-Braojos, 2015).

Self-regulatory ability. Self-regulatory ability refers to the resources and attributes that an individual has in order to help them to achieve their goals (de Ridder et al., 2012). Therefore, measures of self-regulatory ability include measures of self-control (e.g., the Brief Self-Control Scale; Tangney, Baumeister, & Boone, 2004), delay discounting (e.g., Mischel, Shoda, & Rodriguez, 1989), impulsivity and sensation seeking (e.g., the Barrett Impulsivity Scale, Patton, Stanford, & Barratt, 1995; the Sensation-Seeking Scale, Zuckerman, Kolin, Price, & Zoon, 1964), executive function (e.g., response inhibition, Logan, Cowan, & Davis, 1984), and problem solving ability (e.g., the Raven Advanced Progressive Matrices; Raven, Raven, & Court, 1998). Measures of emotion regulation may also be relevant, including measures of proactive coping (e.g., Proactive Coping Inventory; Greenglass, Schwarzer, Jakubiec, Fiksenbaum, & Taubert, 1999), suppression of aggression (e.g., the suppression of aggression subscale of the Weinberger Adjustment Inventory, Weinberger, 1997), and emotional stability (e.g., the Emotional Stability Questionnaire; Psycom Services, 1995). We

did not include measures that assess people's perceptions of their self-regulatory ability (e.g., measures of self-efficacy or perceived behavioral control), as these measures reflect people's confidence in their ability, which may or may not be correlated with their actual ability.

Outcomes. Outcomes refer to the outcome(s) of goal pursuit (i.e., what has been achieved). Possible measures reflecting outcomes include students' grade point averages (e.g., Shell & Husman, 2001), smokers' carbon monoxide levels (e.g., Jones, Landes, Yi, & Bickel, 2009), the amount of savings or debt that people have accumulated (e.g., Antonides, de Groot & van Raaij, 2011), or a person's body mass index (e.g., Hall & Epp, 2013). Measures of outcomes may also include whether a person engages in health protective behaviors (e.g., physical activity, health screenings, medication adherence, calorie intake; Daugherty & Brase, 2010, Sansbury, Dasgupta, Guthrie, & Ward, 2014) or health risk behaviors (e.g., substance use, alcohol consumption, risky sexual behaviors, consuming fatty foods; Henson, Carey, Carey, & Maisto, 2006), and the extent to which people engage in pro-environmental behaviors, risky driving, or antisocial behaviors (e.g., gambling, violence, or expressions of aggression; Hodgins & Engel, 2002, McKay, Dempster, & Mello, 2015).

It was not always clear during coding whether the measure of self-regulation reflected a measure of goal operating or a measure of an outcome. For example, whether a person engages in a health protective behavior (e.g., exercising twice a week) could represent a goal-directed behavior (e.g., if the goal is to lose weight) or an outcome (e.g., if the goal is to exercise twice a week). Therefore, we formulated four rules to help inform the distinction between measures of goal operating and measures that reflect outcomes. First, if the study included a measure of goal setting (e.g., intentions to exercise three times a week) and also measured a behavior directly related to the specified goal (e.g., the number of exercise sessions undertaken each week), then the measure of behavior was classified as a measure reflecting outcomes (i.e., of that behavior). Second, if a study measured a distal outcome

(e.g., self-rated health), in addition to a more proximal or immediate outcome (e.g., smoking behavior), then the distal outcome was classified as a measure of an outcome and the more proximal measure was classified as a measure of goal operating (assuming that the distal and proximal goals were related). Third, if a study measured the consequences that may arise as a result of engaging in a specific behavior (e.g., the Rutgers Alcohol Problems Index assesses a number of detrimental outcomes that may arise from excessive alcohol consumption), then the measure reflecting the consequences of the behavior was classified as a measure of an outcome and the behavior itself (in this case, alcohol consumption) was classified as a measure of goal operating. Finally, for studies comparing time perspective between different groups of people (e.g., alcoholics vs. controls: Klingemann, 2001), group status was classified as an outcome.

Study Selection

The process of identifying eligible studies was conducted in two stages. First, the titles and abstracts of articles identified via the search strategies were screened to identify potentially relevant studies. Second, the full texts of articles describing potentially relevant studies were reviewed in detail against the inclusion and exclusion criteria to determine eligibility. The literature search identified 7,422 papers, of which 350 met the inclusion criteria (comprising 378 studies and 420 independent samples). The flow of studies through each phase of the review is presented in Figure 1, and articles included in the review are preceded by an asterisk in the reference list.

Data Items and Extraction

Data from individual studies was extracted using a form developed for the current review (found in the online materials; Online Materials C). The following data was extracted: (i) publication details (e.g., authors, year of publication, publication status, and language), (ii) sample characteristics (e.g., mean age, gender composition, and the type of sample being

studied), (iii) methodological details, including the time interval (in weeks) between the measure of time perspective and the measure of self-regulatory process, ability, or outcome, the country where the study was conducted, the measure(s) of time perspective and self-regulatory process(es), ability, and / or outcome(s) used in the study, whether each self-regulatory process, ability, or outcome was measured objectively (e.g., a smoker's carbon monoxide level) or via self-report (e.g., a smoker's self-reported smoking frequency), scale reliabilities (i.e., Cronbach's alphas) for self-report measures, and the setting in which the study was conducted (e.g., health, academic, financial, environmental), and (iv) statistical details, including the effect size (e.g., Pearson's *r* statistic), how this effect size was calculated, and the sample size for the effect size extracted. The standard error for each effect size was then calculated using the following formula: $SE(r) = \sqrt{1-r^2}/N-2$.

Initial data extraction was conducted by the first author and a random sample of articles (approximately 10%) were independently coded by the second author. For continuous variables, reliability between the two coders ranged from $r = 0.91$ (percentage of males) to 1.00 (reliability for the measure of time perspective). For categorical variables, Cohen's *k* ranged from $k = 0.87$ (self-report or objective measure of self-regulation) to 1.00 (publication status and domain specific measure of time perspective). Thus, there was a very high level of agreement between the two coders. Full details of the reliability analyses can be found in the online materials (Online Materials D).

Methodological Quality of Individual Studies

The methodological quality of the individual studies was assessed using a four-point tool devised for the purpose of this review. Specifically, a point was given: First, if the study used a prospective or experimental design. Cross-sectional designs can inflate the estimated effect sizes due to simultaneous measurement of study variables (i.e., common method variance; Lindell & Whitney, 2001). Second, if the measure of time perspective was

internally reliable (i.e., had a Cronbach's alpha of 0.70 or greater). Third, if an objective measure of a self-regulatory process, ability and/ or outcome was used. Objective measures reduce the influence of social desirability and recall biases (Hassan, 2006; Nederhof, 1985). Finally, a point was given if a sample size greater than 85 was recruited. According to Cohen (1992), a sample size of at least 85 people should provide sufficient (i.e., 80%) power to detect a medium effect size with an alpha of 0.05 using typical analytical approaches. Scores for methodological quality could therefore range from 0 to 4 (with 4 indicating greater methodological quality)[5].

Meta-Analytic Approach

Effect size index. The effect size metric, Pearson's *r* was used to represent the strength and direction of the relationship between time perspective and self-regulatory processes, abilities, and outcomes[6]. Where Pearson's *r* was not available, online effect size calculators (Lyons & Morris, 2013, and Psychometrica; https://psychometrica.de/effect_size) were used to convert other effect sizes (e.g., Cohen's *d*, *Odds Ratios, Eta Squared*) and statistics (e.g., means and standard deviations, *F*-statistic, *t*-statistic) into *r*. If this information was not available from the original report, then the corresponding authors were contacted and asked to provide this information. Authors were not contacted for statistical information if the article was published more than 20 years ago, as it was deemed unlikely that this information

[5] To ensure accurate estimations of whether (and how) the methodological quality of individual studies moderated the relationship between time perspective and self-regulatory processes, ability, and outcomes, methodological quality scores were only computed for studies for which data was available for each of the four-point assessment criteria. This represented 65.29% of associations included in moderation analyses. The criteria that was most often missing was the reliability (i.e., Cronbach's alpha) for measures of time perspective, with 34.71% of associations not reporting this information.

[6] Positive effect sizes indicated that the respective dimension of time perspective was positively associated with the respective self-regulatory process, ability, and/or outcome. For example, a positive correlation between a measure future time perspective and a measure of goal monitoring would indicate that the tendency to consider, anticipate, and plan for the future was associated with greater or better goal monitoring. As such, it was sometimes necessary to reverse the direct of the effect if the measure reflected a lack of the respective self-regulatory process (e.g., number of errors made on a Stroop task would indicate a lack of inhibitory control) or a failure of self-regulation (e.g., in the case of health risk behaviors).

would be available[7]. For some studies, Spearman's Rho or point-biserial correlations were used as a proxy for Pearson's *r.* As Pearson's *r* is not normally distributed, effect sizes were first converted to Fisher's *z* ($z' = \frac{1}{2}\ln(\frac{1+r}{1-r})$) for analysis and were then converted back to Pearson's *r* after analysis in order to report the average correlations and the associated 95% confidence intervals (CIs). In accordance with Cohen's classification (1992), correlations around 0.10 were considered small, 0.30 were considered medium, and 0.50 were considered large.

Meta-Analytic Strategy. A number of studies included in the present review generated multiple effect sizes concerning the same association within the same sample. For example, Rappange, Brouwer, and van Exel (2009) explored the relationship between a future time perspective and both intentions to improve diet and intentions to participate in physical activity (both constituting measures of goal setting) within the same sample of adolescents. Given that including more than one effect size from a study violates the assumption of independence, we used robust variance estimation (RVE; Hedges, Tipton, & Johnson, 2010) to control for dependencies between effect sizes. RVE is a multilevel approach that calculates standard errors that are adjusted for clustering of effect sizes (e.g., effect sizes that are nested within samples) by taking into account the correlations between the dependent effect sizes. Two types of dependencies occurred in the present review: (i) correlated effects, where primary studies provide multiple effect sizes for the same underlying association, and (ii) hierarchical effects, where papers reported multiple studies from the same authors. We used a correlated effects structure as this is recommended when correlated effects are the predominant type of dependency in a review (Tanner-Smith & Tipton, 2014). However, we also conducted our analyses controlling for the inclusion of

[7] Thirty-two studies were published more than 20 years ago and did not report sufficient information to compute an effect size.

multiple studies reported in the same paper. Table S2 in the online materials provides the full details of these analyses, but as overall findings remained unchanged the main analyses are reported without this additional control.

To calculate weighted effect sizes, meta-analysis with RVE requires an estimate of the correlation between the effect sizes reported within each relevant study (i.e., the average correlation between the dependent effect sizes). When the correlation between the effect sizes is not known or reported, then recommendations suggest assuming a Spearman's rho (ρ) of 0.80 (Hedges et al., 2010). We used this value in the present analysis, but additionally performed a series of sensitivity analyses whereby different values of ρ were tested in intervals of 0.10 to empirically test whether different estimates of the correlation between dependent effect sizes would lead to different conclusions (Table S3 and S4 in the online materials reports the average weighted effect sizes for ρ values of .50 and .10, respectively). This did not affect inferences about effect sizes, so we only report the analyses that used the default value of ρ = .80. Multilevel random-effects meta-analyses with RVE estimation was performed using the 'robumeta' package (Fisher, Tipton, & Hou, 2016), in STATA Version 16.0 (StataCorp, 2009). Random-effects models were used because they allow inferences about the correlation of time perspective with self-regulatory processes, abilities, and outcomes across a variety of procedures and settings (Hedges & Vevea, 1998).

RVE requires a minimum of 10 effect sizes and so it was not always possible to use RVE to estimate the size of the relationships (e.g., there were only nine tests of the association between a future time perspective and goal monitoring). Therefore, when there were less than 10 effect sizes, we aggregated dependent effect sizes and then conducted a random-effects meta-analysis using the 'metan' package in STATA. We then examined these estimates using meta-regression, without controlling for dependencies, which revealed almost no difference in the size of the estimates (see Table S5 in the online materials).

Estimation of Publication Bias. A multimethod approach was used to detect and adjust for publication bias (for an overview of these methods, see van Aert, Wicherts, & van Assen, 2019). We first explored whether publication status (i.e., published in a peer-reviewed journal vs. unpublished) moderated size of the relationship between time perspective and self-regulatory processes, ability, and outcomes using RVE. Next, we produced contour-enhanced funnel plots (Peters, Sutton, Jones, Abrams, & Rushton, 2008) which aggregated effect sizes at the study level to assess for signs of asymmetry and then formally tested the presence of asymmetry using Egger's regression (Egger, Davey Smith, Schneider, & Minder, 1997). We also investigated whether effect sizes could be predicted by their standard errors (i.e., using the Precision-Effect Test, PET; Stanley & Doucouliagos, 2014) using RVE. Whereas Egger's regression considers the intercept of the regression, PET considers the slope of the regression.

If there was evidence of asymmetry in the distribution of effect sizes, then trim-and-fill analyses (Duval & Tweedie, 2004) were used to correct for asymmetry by trimming the most extreme effect sizes and then imputing missing effect sizes to obtain symmetry. However, there are concerns about the imputation of studies that are based purely on hypothetical data (Higgins & Green, 2011), and thus, it is recommended that trim-and-fill is used as a form of sensitivity analysis rather than as an estimate of the unbiased effect (Hilgard, Engelhardt, & Rouder, 2010). Thus, we also examined the adjusted effect size estimates using Stanley and Doucouliago's (2014) Precision-Effect Estimate with Standard Error (PEESE), where effect sizes are predicted by the squared standard error. Simulation studies have indicated that, whereas PET tends to underestimate the size of non-zero effects, PEESE tends to overestimate the size of null effects (Stanley & Doucouliagos, 2014) and, as such, it is recommended that PEESE is used in combination with PET (i.e., the PET-PEESE procedure). If PET detects a significant effect (i.e., a significant relationship between effect

sizes and standard errors), then the PEESE estimate is considered a more valid estimate of the effect size (i.e., one that is adjusted for publication bias).

Finally, we performed sensitivity analyses to investigate whether different conclusions would be drawn if different selection models were adopted. Specifically, we used Vevea and Woods' (2005) weight function model for publication bias, using an online tool (https://vevealab.shinyapps.io/WeightFunctionModel/). Vevea and Woods' sensitivity analysis involves estimating a weight function representing the relative likelihood that studies with *p*-values in different ranges will survive the publication selection process (Vevea & Hedges, 1995). We used the *p*-value ranges and weights specified by Vevea and Woods (2005; Table 1, p. 435) in four different scenarios (i.e., moderate one-tailed, moderate two-tailed, severe one-tailed, and severe two-tailed).

Mediation Analyses. To explore whether self-regulatory processes and self-regulatory ability mediated the relationship between time perspective and outcomes, we created a correlation matrix based on the sample-weighted estimated effect sizes from the meta-analysis. We used the dimension of time perspective reflecting a future time perspective for these analyses as it was the dimension of time perspective that had the strongest relationship with each self-regulatory process and self-regulatory ability and represented 45% (k = 908) of the available comparisons. A present-hedonistic time perspective had the next most available comparisons; however, there were substantially fewer associations (representing only 11%; k = 219).

Data from the present review was used to estimate the size of the relationship between a future time perspective and each self-regulatory process, self-regulatory ability, and outcomes (i.e., the *a* paths and the c' path; see Figure 2). In order to estimate the relationship between self-regulatory processes, self-regulatory ability and outcomes (i.e., the *b* path; see Figure 2), we used data from previous meta-analyses that conducted empirical tests of these

relations.[8] We used a review conducted by Webb and Sheeran (2006) to estimate the size of the relationship between goal setting and outcomes ($d_+ = 0.36$, $k = 47$, $N = 8{,}802$). A review conducted by Harkin and colleagues (2016) was used to estimate the size of the relationship between goal monitoring and outcomes ($d_+ = 0.40$, $k = 138$, $N = 13{,}398$). For both of these reviews, the effect size *d* was converted to *r* prior to analysis (i.e., $r = 0.18$ and $r = 0.20$ for reviews of the relationship between goal setting and goal monitoring on outcomes, respectively). A review conducted by Carraro and Gaudreau (2013) was used to estimate the relationship between goal operating and outcomes ($r_+ = 0.43$, $k = 19$, $N = 4{,}330$)[9]. Finally, a review by de Ridder and colleagues (2012) was to estimate the relationship between self-regulatory ability and outcomes ($r_+ = 0.26$, $k = 20$, $N = 15{,}455$).

The sample-weighted correlations between time perspective and each self-regulatory process, ability, and outcomes were entered using the matrix input function in SPSS (the syntax for inputting this matrix can be found online; Online Materials E). We then used AMOS 26 software (SPSS Inc., 2013) to perform a meta-analytic Structural Equation Model (SEM) using the correlation matrix described above and the harmonic mean of the sample size. In this analysis the harmonic mean of $N = 6{,}630$ is smaller than the average mean of $N = 27{,}616$ and is suggestive of a more conservative approach (Viswesvaran & Ones, 1995). Mediation was tested by the significance of the bias-corrected bootstrap confidence intervals (CIs).

[8] Using data from previous meta-analyses allowed us to include all of the data collected for the present review. An alternative approach would be to extract the correlations between the self-regulatory processes and ability with outcomes from studies included in the review. While this approach would mean that the mediation analyses could be conducted on the same measures of the self-regulatory processes, among the same samples, and in the same contexts, there is also the risk that few studies will report these relations, and thus, may weaken the power of such analyses.

[9] Although planning is only one example of a measure that was classified as a goal operating, planning represented 21% of the measures that were classified as goal operating in the present review and, as such, the meta-analysis by Carraro and Gaudreau (2013) was deemed representative for these analyses.

Moderation Analyses. The present review also explored potential theoretical and methodological moderators of the relationships between time perspective and self-regulatory processes, ability, and outcomes. Continuous moderators (e.g., the average age of the sample, percentage of males in the sample, and methodological quality of individual studies) were entered into a regression equation as a predictor using the RVE approach. Categorical moderators (e.g., whether it was a domain specific measure of time perspective) were first dummy coded and also entered into meta-regression equations (again using RVE). The significance of the regression coefficient for the predictor variable in these models tests whether the variable significantly moderates the respective relationship. For categorical moderators with more than two levels, we then conducted Approximate Hotelling-Zhang with small sample corrections using the '*reg-sandwich*' package in STATA (Tyszler, Pustejovsky, & Tipton, 2017) to produce an *F*-value that indicates whether there is a significant difference between levels of the moderator.

Results

The Relationship between Time Perspective and Self-Regulatory Processes, Ability, and Outcomes.

Table 2 shows the sample-weighted average correlations between each dimension of time perspective and each self-regulatory process, self-regulatory ability, and outcomes. A total of 2,000 effect sizes were extracted from 378 primary studies. There were 142 tests of the association between time perspective and goal setting, 25 tests of the association between time perspective and goal monitoring, 456 tests of the association between time perspective and goal operating, 594 tests of the association between time perspective and self-regulatory ability, and 783 tests of the association between time perspective and outcomes. A detailed summary of the studies included in each analysis, along with the effect sizes extracted from primary studies, can be found in the online materials (Table S1).

In support of our initial hypotheses, a future time perspective was found to be positively correlated with self-regulatory processes, abilities, and outcomes. Specifically, a future time perspective had small-to-medium sized, positive associations with goal setting, ($r_+ = 0.25$), goal monitoring ($r_+ = 0.19$), and goal operating, ($r_+ = 0.24$), indicating that people with a greater future time perspective are more likely to have stronger intentions to achieve their goals, monitor their progress towards these goals, and engage in behaviors and actions directed towards achieving their goals. A future time perspective was also associated with self-regulatory ability ($r_+ = 0.35$) and outcomes ($r_+ = 0.18$), indicating that people with a greater future time perspective are better able to regulate their behavior and tend to have more positive outcomes (e.g., higher GPA, lower BMI).

A present time perspective, including being present-hedonistic and present-fatalistic, was negatively associated with self-regulatory processes, ability, and outcomes. Specifically, present-hedonistic and present-fatalistic time perspectives were negatively associated with self-regulatory ability ($r_+ = -0.23$ and -0.27, respectively) and outcomes ($r_+ = -0.14$ and -0.15, respectively), suggesting that people who are motivated by immediate gratification or have a belief in predetermined fate, are less able to regulate their behavior and tend to have worse outcomes. Similar relationships were also observed with a general present time perspective and self-regulatory ability ($r_+ = -0.21$) and outcomes ($r_+ = -0.13$).

There were fewer notable relationships with a past and a balanced time perspective. A positive view of the past was positively associated with goal setting ($r_+ = 0.12$) and goal monitoring ($r_+ = 0.13$), while a negative view of the past was negatively associated with self-regulatory ability ($r_+ = -0.20$). These findings suggest that people who reflect on positive experiences from their past have stronger intentions to achieve their goals and are more likely to monitor their progress towards these goals, whereas people who have a negative view of their past are less able to regulate their behavior. A balanced time perspective was positively

associated with self-regulatory ability ($r_+ = 0.39$), suggesting that people who are able to draw from multiple time frames and switch flexibly between them in order to meet situational demands are also better able to regulate their behavior. Unfortunately, there was insufficient evidence to estimate the size of the relationships between a balanced time perspective and self-regulatory processes.

In addition to exploring the relationship between a future time perspective and self-regulatory processes, we also considered whether people viewed their future as positive or negative. Having a positive view of the future was positively associated with self-regulatory ability and outcomes ($r_+ = 0.11$ and 0.15, respectively), while having a negative view of the future was negatively associated with outcomes ($r_+ = -0.16$). This suggests that it is not only the extent to which people consider the future that is important, but also whether that future is viewed as positive or negative.

Assessment and Correction of Publication Bias

Tests of publication bias are only reported for the association between a future time perspective and self-regulatory processes, abilities, and outcomes in order to inform subsequent mediation analyses; however, the tests for the other dimensions of time perspective are reported in the online materials (Online Materials F). As detailed below, publication bias was not considered a significant concern in the present review.

Assessment of Publication Bias. Figure 3 presents the contour-enhanced funnel plots and Table 3 presents formal tests of asymmetry (e.g., Egger's regression and PET). One hundred and fifty of the effect size estimates in the present review (7.43%) were obtained from unpublished sources. Publication status was not found to moderate the size of the relationship between a future time perspective and goal setting, goal operating, nor outcomes. However, publication status was found to moderate the size of the relationship between a future time perspective and self-regulatory ability. Contrary to what might be expected,

however, effect sizes from unpublished studies were significantly higher ($r_+ = 0.50$, CIs [0.38, 0.62]) than effect sizes from published effects ($r_+ = 0.33$, CIs [0.26, 0.40]).

Visual inspection of the contour-enhanced funnel plots (Peters, Sutton, Jones, Abrams, & Rushton, 2008) indicated some signs of asymmetry, suggestive of publication bias (see Figure 3), and Egger's test was significant for the relationship between a future time perspective and goal setting and a future time perspective and outcomes. RVE was also used to predict effect sizes by their standard errors (i.e., PET) and, corresponding with the results from Egger's regression, the regression slopes were significant for the relationship between a future time perspective and goal setting and the relationship between a future time perspective and outcomes. Egger's test and the PET were not significant for the relationship between a future time perspective and goal monitoring, goal operating, nor self-regulatory ability.

Correcting for Publication Bias. Table 4 reports the sample-weighted average correlations between future time perspective and each self-regulatory process, self-regulatory ability, and outcomes following analyses to correct for publication bias. Trim-and-fill analyses imputed an additional 21 studies for the relationship between time perspective and goal setting and estimated that the bias-adjusted effect size was slightly larger than the average effect size obtained from primary studies (i.e., r_+ increased from 0.24 to 0.30). The PEESE estimate for this relationship was also larger (i.e., $r_+ = 0.32$). These findings suggest that the relationship between time perspective and goal setting may be stronger than our initial analyses suggested. However, in order to be conservative about this estimate, we used the effect from our initial analyses in subsequent mediation models (i.e., $r_+ = 0.24$)[10]. There was also evidence of publication bias for the relationship between a future time perspective

[10] We also ran mediation analyses using the PEESE estimate for the relationship between time perspective and goal setting, but this did not change the findings.

and outcomes (as indicated by a significant Egger's test and PET). Although trim-and-fill analyses did not suggest that it was necessary to impute additionally studies, we used the PEESE estimate for this relationship in subsequent mediation models as this estimate was smaller than the unadjusted estimate (i.e., $r_+ = 0.16$ vs. $r_+ = 0.18$), and thus provides a more conservative estimate of the effect.

Finally, we conducted sensitivity analyses to investigate whether different conclusions would be drawn if different selection models were adopted (Vevea & Woods, 2005). As can be seen in Table 4, the adjusted estimates were similar in both direction and magnitude to the unadjusted estimates. The only exception was the relationship between a future time perspective and outcomes, where the adjusted estimate ($r_+ = 0.08$) was smaller than the unadjusted estimate ($r_+ = 0.18$). However, this is the most stringent test of publication bias and, even if we were to assume that moderate publication bias was present, then the size of the estimates for the relationship between time perspective and self-regulatory processes, abilities, and outcomes were only slightly reduced.

Mediators of the Relationship between Time Perspective and Outcomes

The primary aim of the present review was to explore whether self-regulatory processes and / or self-regulatory ability mediated the relationship between time perspective and outcomes. As described below and presented in Figure 4, we found that goal monitoring, goal operating, and self-regulatory ability mediated the relationship between time perspective and outcomes; however, goal setting did not.

A future time perspective was positively associated with goal setting, goal monitoring, goal operating, and self-regulatory ability. However, while goal monitoring, goal operating, and self-regulatory ability were significantly associated with outcomes, goal setting was not (see Table 5). The direct relationship between a future time perspective and outcomes was not significant when the mediators were included and the total indirect effect

for the relationship between time perspective and outcomes, via self-regulatory processes was significant (see Table 5). Tests of the specific indirect effects revealed that goal monitoring, goal operating, and self-regulatory ability significantly mediated the relationship between time perspective and outcomes; however, goal setting did not (see Table 5). Taken together, these findings suggest that a future time perspective is associated with better outcomes because people with a future time perspective are more likely to monitor their progress, take action that helps them to achieve their goals, and are better able to regulate their behavior.

Moderators of the Relationship between Time Perspective Self-Regulatory Processes, Ability, and Outcomes.

Tables 6 and 7 report the results from the continuous and categorical moderation analyses, respectively. Despite some evidence of heterogeneity within the effect sizes from the primary studies, on the whole, variability could not be explained by our proposed moderators. There was, however, some evidence that the nature of the measure of time perspective, the methodological quality of individual studies, and the proportion of males in the sample moderated the size of some of the relationships as detailed below.

First, whether the measure of time perspective was specific to the goal being studied or general was found to moderate the relationship between a future time perspective and goal operating, such that the relationship between time perspective and goal operating was stronger when a domain specific measure of time perspective was used (B_1 = .104, p = .044; Table 7). Second, the methodological quality of individual studies was found to moderate the magnitude of the relationship between a future time perspective and self-regulatory ability and a present time perspective and outcomes, such that studies with more robust methods found stronger relationships between time perspective and self-regulatory processes (B_1 = .134, p = .019 and B_1 = .210, p = .004, respectively; Table 6). Third, the proportion of male participants in the sample moderated the magnitude of the relationships between a present-

fatalistic time perspective and both self-regulatory ability and outcomes, such that the size of these relationships was weaker in studies that had a higher proportion of males in the sample (B_1 = .003, p = .026 and B_1 = .003, p = .012, respectively; Table 6).

Discussion

The current review aimed to address two important yet unanswered questions regarding time perspective; namely, how are different dimensions of time perspective related to a broad range of important outcomes in life, and crucially, *why* does time perspective have such far-reaching effects? Our proposal was that a self-regulatory framework might help to understand the relationship between time perspective and outcomes. In order to test this hypothesis, we organized and synthesized the empirical evidence to date by (i) classifying measures of time perspective according to the dimension that they were likely to reflect (e.g., future, past, present), and (ii) decomposing measures reflecting aspects of self-regulation into its three key processes (i.e., goal setting, monitoring, and operating) and self-regulatory ability. We then used meta-analysis to estimate the relations between each dimension of time perspective and each self-regulatory process to provide insights into the effects of time perspective on outcomes. The following sections discuss our main findings, their theoretical and practical significance, and point to potential directions for future research.

Overview of the Main Findings

It is noteworthy that, similar to previous reviews (e.g., Milfont, Wilson, & Diniz, 2012; Murphy & Dockray, 2018; Sweeny & Culcea, 2017), we found that a future time perspective was linked to better outcomes. However, our review went beyond this previous work by addressing the critical question of why (future, but also other) time perspective might be so influential. Consistent with our proposed self-regulatory framework, we found that a future time perspective was associated with better self-regulation, and specifically each of the three self-regulatory processes (i.e., goal setting, goal monitoring, and goal operating)

and self-regulatory ability. We also found that a present time perspective, including being present-hedonistic and present-fatalistic, was associated with poor outcomes and self-regulation as reflected by self-regulatory processes, and ability. In addition, a positive view of the past was associated with better self-regulatory processes and outcomes, while a negative view of the past was associated with poor self-regulatory processes and outcomes.

More detailed analyses examined which self-regulatory processes are involved, by examining the relationship between time perspective and three key self-regulatory processes (goal setting, goal monitoring, and goal outcomes) along with general self-regulatory ability using meta-analytic mediation models. Because the majority of the effects tested examined future time perspective, our mediation analyses were limited to this dimension of time perspective. In line with our self-regulation framework, goal monitoring, goal operating, and self-regulatory ability each explained the association between future time perspective and outcomes. This indicates that people with a future time perspective are more likely to experience positive outcomes because they are: (i) more likely to monitor their progress towards their goals, (ii) more likely to engage in actions and behaviors directed towards achieving their goals, and (iii) better able to regulate their behavior.

It is noteworthy, however, that the self-regulatory process of setting goals did not explain why time perspective was associated with better outcomes. From this it could be concluded that time perspective does not influence people's motivation or the strength or direction of their intentions to obtain better outcomes. Yet drawing this conclusion seems inconsistent with the current findings as well as those from previous research (e.g., Andre et al., 2018), which suggest that a future time perspective is typically associated with stronger goal intentions, and that goal intentions are associated with better outcomes (e.g., Webb & Sheeran, 2006). One possible explanation for this unexpected finding is that is that goal setting may work sequentially with the other self-regulatory processes. That is, a future time

perspective promotes goal setting which then directs people to monitor their goal progress and engage in actions to achieve a positive outcome. Control Theory supports such an explanation: self-regulation is initiated when people set goals and then, once a goal has been set, people engage in the volitional processes of monitoring their behavior and taking action when needed (Carver & Scheier, 1981, 1982). Empirical research also supports the idea that goal setting precedes goal monitoring and operating, with self-regulatory processes mediating the relationship between intentions and outcomes (e.g., in relation to medication adherence and physical activity; de Bruin et al., 2012)

The notion that time perspective is linked to better outcomes because goal setting works sequentially with other self-regulatory processes makes theoretical sense, but until now has not been empirically tested. To address this, we conducted a serial mediation analysis, in addition to the parallel model reported in the results section (see Figure 5 for an overview of this serial model). Our findings indicated that time perspective was associated with self-regulatory processes like goal monitoring and operating because it was associated with goal getting (full details of these analyses and results can be found in the online materials; Table S6 and Figure S1). This provides novel and important evidence that goal setting is a more distal determinant of the outcomes linked to time perspective, whereas monitoring one's goal progress, engaging in goal directed action, and regulating behavior are more proximal determinants. Taken together, we conclude that time perspective is likely associated with better outcomes because it affects goal setting (a distal self-regulatory process) that, in turn, influences goal monitoring and operating (more proximal self-regulatory processes).

Theoretical Contributions and Future Directions

The present review makes an important contribution to our understanding of the effects of time perspective by providing insight into why time perspective is associated with

so many important outcomes – namely, because it is associated with self-regulatory processes and ability. This contribution was achieved, in part, by developing a taxonomy for classifying measures according to the processes of self-regulation that they are likely to reflect; thereby deconstructing the possesses involved in self-regulation and integrating this into a comprehensive and theory-driven model of how and why time perceptive has been associated with a broad range of important outcomes. By doing so, the present review provides theoretical coherence to the existing evidence on how time perspective influences self-regulation, as well as an agenda for future research. In addition to helping to answer questions about time perspective (as in the present review), the new taxonomy might also provide a framework for testing other antecedents and consequences of self-regulatory processes, and for conducting formal tests of a self-regulation framework as we have done here. For example, researchers could classify measures of self-regulation used by primary studies in other domains and explore the influence of other dispositional influences on behavior such as locus of control (Rotter, 1954) or perfectionism (Hewitt & Flett, 1991) on specific self-regulatory processes and abilities, and, in turn, their impact on important outcomes, such as health.

The present review also contributes to our understanding of the effects of time perspective by including a range of different time perspectives (i.e., those relating to the past, present, and future) and examining how these dimensions relate to self-regulation. Taking a multidimensional view of time perceptive revealed nuances in the way that time perspective relates to self-regulatory processes that warrant further investigation. For example, a past-positive time perspective was associated with goal setting and goal monitoring, but not goal operating, self-regulatory ability, or outcomes. A possible explanation for this could be that reflecting positively on the past leads people to be more optimistic about their goals and the extent to which they are making progress towards them, which in turn, leads to the illusion of

goal progress. However, research has indicated that having an 'illusion of goal progress' can be detrimental to actual goal progress (Besharat, Carrillat, & Ladik, 2014), as it fails to prompt people to take action when needed, hence why a past positive time perspective may not associated with goal operating and outcomes. Although our review has identified why time perspective is associated with outcomes, one fruitful area for future research would be to investigate why particular time perspectives have stronger links with some self-regulatory processes compared to others.

Another important question for future research concerns differences in the way that people construe different time perspectives – e.g., that different people may have different time frames in mind when they consider the future or the past. That is, although the physical passing of time can be objectively measured, mental representations of time are abstract concepts that can differ between individuals, much as representations of other concepts do (Lord & Lepper, 1999). For example, while some people may perceive 10 years from now as belonging to the distant future, others may perceive 10 years from now to be part of the near future (Bluedorn, 2002). Similarly, some individuals may view their future as clear and concrete, whereas others might view their future as vague and abstract (e.g., Temporal Construal Theory; Liberman & Trope, 1998). Much of the previous research on time perspective has tended to measure people's predisposition towards the past, present, and future in broad and undifferentiated terms, which may neglect subtle, but potentially important, variations in how these time frames are conceptualized (e.g., with respect to affect, expansion, and abstraction). It would therefore be interesting to consider whether the way that people conceptualize the future or the past influences their behavior and outcomes, if we are to gain a more precise view of the effects of time perspective on self-regulation and outcomes.

Practical Implications

The present review has a number of practical implications, not least for informing the development of interventions and strategies designed to promote positive life outcomes. Although time perspective is considered a stable individual difference (Zimbardo & Boyd, 1999), experimental studies have demonstrated that it is possible to change people's time perspective (e.g., Hall & Fong, 2003; Hershfield et al., 2011). Furthermore, we found that the association between time perspective and outcomes was stronger when time perspective was experimentally manipulated, as opposed to self-reported. An important implication of this finding is that modifying people's time perspective could be a promising avenue for interventions designed to promote behavior change. Past research has found that different time perspectives are distinct traits that independently predict people's behavior (Joireman et al., 2012). It is therefore likely that interventions designed to modify people's time perspective would be most effective if they focused on promoting time perspectives that positively affect behavior, and minimizing time perspectives known to have a negative effect. As the first review to date that has shown how different time perspectives relate to self-regulation, the findings can inform the design of subsequent interventions by identifying which (combination of) time perspective(s) are most beneficial for achieving a range of positive life outcomes. For example, our findings suggest that interventions designed to encourage people with diabetes to monitor their blood glucose more frequently may want to focus on increasing a past-positive and future time perspective (both of which were found to be positively associated with goal monitoring), while reducing present-fatalistic views (which was found to be negatively associated with goal monitoring). Such research would not only be important for improving health outcomes from a practical perspective, but would also provide some of the first experimental tests of the how targeting self-regulatory processes might enhance the link between time perspective and people's behavior and outcomes.

The example above highlights the importance of considering the practical implications of a balanced time perspective, where people are able to draw from multiple frames in order to meet the situational demands (Boniwell et al., 2010). Previous research has shown how a balanced time perspective could be implemented; for example, for the treatment of post-traumatic stress disorder (Sword, Sword, Brunskill, & Zimbardo, 2014). Sword and colleagues (2014) recommend a step-by-step approach to help people achieve a balance among their different past, present, and future time perspectives. First, an individual's time perspective profile is assessed in order to identify biases towards negative or harmful time perspectives (e.g., a preoccupation with past failings and regret). Then, biases in an individual's time perspective are explained and efforts are made to minimize these time perspectives while promoting time perspectives that will have a positive influence (e.g., by asking the individual to think about successes in their past that they may have ignored).

Despite the promise of this approach, however, to date, there is no empirical evidence to support its effectiveness. Indeed, in general, we found very few experimental tests of the effects of manipulating time perspective (k = 8, representing 0.4% of effect sizes in the present review). To inform interventions, and to provide causal evidence for the role of time perspective, we recommend that future studies explore how best to manipulate time perspective. For example, there is evidence that presenting people with aged-progressed versions of their own faces can prompt them to think about themselves in the future (Hershfield et al., 2011). Alternatively, asking people to list the long-term benefits of engaging in certain behaviors can encourage them to see the links between their current actions and future outcomes (Hall & Fong, 2003). One important finding from the current review was that that associations between time perspective and self-regulatory processes and

outcomes were stronger when the measure of time perspective was specific to the domain being studied. Given this, future research would be wise to consider, and test, whether interventions that align the time perspective to the domain of the behavior or outcome being targeted are more effective than those that focus on more general time perspectives.

Strengths and Limitations

Our meta-analysis is the single most comprehensive analysis of the relationship between time perspective and important life outcomes, and the self-regulatory processes involved. The systematic review of 378 empirical studies examined 2,000 associations between a range of time perspectives, self-regulatory processes, and outcomes across diverse life-domains (e.g., academic, health, environmental, finance) and included studies with diverse methods (cross-sectional, longitudinal, and experimental) and of diverse populations (e.g., over 37 different countries). The breadth of the research reviewed allowed us to conduct robust tests of how time perspective is linked to consequential outcomes, as well as provide insights into the role of self-regulatory processes and ability in explaining this association.

By synthesizing insights across accumulated evidence, systematic reviews also draw attention to gaps and limitations within the existing evidence base. Most notably, our review revealed a clear bias towards research focusing on a future time perspective, with less research focused on the effects of past and present time perspectives. Indeed, over half of the effect sizes included in the review (51%) were for a future time perspective. Therefore, although our intention when we conceptualized the review was to take a broad and multidimensional view of time perspective (Baird et al., 2017), the limitations within the evidence base meant that it was not possible to formally test whether self-regulatory processes and ability explained the effects of other dimensions of time perspectives on outcomes (i.e., using meta-analytic mediation models). Nonetheless, the classification

frameworks that we developed in the present review will be useful for addressing this question as the evidence-base with respect to other time perspectives develops. For example, our review was the first review to date to include research on a balanced time perspective and we found that a balanced time perspective had stronger associations with self-regulatory ability than did a future time perspective. This finding is consistent with arguments that suggest that the ability to draw from multiple timeframes and switch flexibly between them in order to meet situational demands is perhaps the most beneficial time perspective (Boniwell et al., 2010; Boniwell & Zimbardo, 2004). However, because there was limited research on balanced time perspective, it was not possible to estimate the size of the relationship between a balanced time perspective and self-regulatory processes.

The present review also provided evidence that having a future time perspective is associated with the extent to which people monitor the progress they make towards their goals. Consistent with theoretical models of self-regulation (e.g., Control Theory, Carver & Scheier, 1981, 1982) and empirical evidence (e.g., Harkin et al., 2016), monitoring goal progress was one of the key self-regulatory processes that explained why future time perspective was associated with better outcomes. However, due to limitations within the evidence base, it was not possible to examine whether and how other dimensions of time perspective were linked to goal monitoring. Given the importance of monitoring for goal striving, future research that investigates how different time perspectives are associated with goal monitoring would be well placed to further extend our understanding of why time perspective is linked to life outcomes.

Finally, the present review offers insights that can be useful for informing the design and methodology of future studies. For example, adequate statistical power is an important criterion for a robust empirical study and has received increased attention in light of the replication crisis facing psychological research (Maxwell, 2004). Yet, research into this issue

has found that effect sizes are often chosen based on an inappropriate rationale, and are sometimes estimated rather than empirically informed (Cribbie, Beribisky, & Alter 2019). The present review provides effect sizes (and indeed the confidence intervals of these effect sizes) that can help inform the sample size of future studies on time perspective to that research studies are adequately powered and reduce the risk of making a Type 1 error. The present study also provided evidence to suggest that studies that used more robust methods tend to find stronger relationships between time perspective and self-regulatory processes. This reemphasizes the importance of adequate statistical power and also highlights the importance of future studies using (i) reliable measures of time perspective, (ii) objective measures of self-regulatory processes, abilities, and outcomes where possible, and (iii) prospective or experimental designs.

Conclusions

The association between time perspective and outcomes is one of the oldest and most thoroughly researched questions in the social and behavioral sciences. Yet, despite extensive research showing that time perspective is linked to a wide range of important outcomes, until now, we have had little insight into *why* time perspective has such wide-ranging effects. The current review provided evidence to address this important issue by proposing that self-regulatory processes can offer insight into these associations. Drawing on the research to date (2,000 individual effect sizes) we developed a taxonomy informed by key theories (i.e., Control Theory; Carver & Scheier, 1981, 1982) and frameworks (e.g., Burnette et al., 2013) of self-regulation, to classify measures according to the process of self-regulation that they reflect and provide theoretical coherence to the existing evidence on how time perspective influences self-regulation and subsequent outcomes. We then created a similar taxonomy to classify measures of time perspective and then used this framework to explore why different dimensions of time perspective are linked to specific processes involved in self-regulation,

and importantly, to test whether self-regulatory processes explain why time perspective has such a crucial role in people's behavior and outcomes.

Overall, our findings supported a self-regulatory framework for understanding the effects of time perspective. We found that self-regulatory processes and ability explained the benefits of a future time perspective for important life outcomes. Although the majority of the research focused on a future time perspective, there was some evidence linking other dimensions of time perspective, including a balanced time perspective, to better or worse outcomes. Taken together, our findings support the view that time perspective is associated with outcomes because time perspective is associated with the extent to which people set goals, which in turn directs people to monitor the progress they make towards these goals, and engage in the actions needed to achieve their goals. However, it is also clear that more research with other time perspectives is needed to provide a more complete understanding of the role of self-regulatory processes for explaining the wide-reaching effects of time perspective. We hope that the current findings and the frameworks that we have developed will encourage researchers to continue with this line of enquiry and expand our understanding of the effects of time perspective and the role of self-regulatory processes for explaining consequential outcomes.

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Table 1

Summary of the Dimensions of Time Perspective and Associated Measures

Dimension	Definition	Example Associated Measures
Past Time Perspective	The extent to which people consider and/ or devote their attention towards their past	Past subscale of the Temporal Focus Scale (Shipp et al., 2009); Past subscale of the Temporal Orientation Scale (Jones et al., 2004); Past dominance subscale of Cottle's Circles Test (Cottle, 1967); Accepting the past subscale of the Experiential Time Perspective Scale (Shirai, 1994); Past subscale of the Temporal Depth Index (Bluedorn, 2002)
Past-Positive Time Perspective	Positive feelings about the past (e.g., warm and sentimental view of the past)	Past-Positive subscale of the ZTPI (Zimbardo & Boyd, 1999); Past subscale of the Time Attitude Scale (Nuttin, 1985); Past-Positive subscale of the Adolescent Time Attitude Scale (Worrell & Mello, 2007); Past-Positive subscale of the Time Reference Inventory (Roos & Albers, 1965)
Past-Negative Time Perspective	Negative feelings about the past (e.g., feelings of regret and past failures)	Past-Negative subscale of the ZTPI (Zimbardo & Boyd, 1999); Past-Negative subscale of the Adolescent Time Attitude Scale (Worrell & Mello, 2007); Past dominance specifically related to injury (Tatsumi, 2014)
Present Time Perspective	The extent to which people consider and/ or devote their attention towards their present	Present subscale of the Temporal Focus Scale (Shipp et al., 2009); Present subscale of the Temporal Orientation Scale (Jones et al., 2004); Immediate subscale of the Consideration of Future Consequences Scale (Strathman, et al., 1994), Present dominance subscale of Cottle's Circles Test (Cottle, 1967); Present Orientation subscale of LaGrange & Silverman (1999) Low Self-Control Scale; Present subscale of the Time Orientation Scale (Holman & Silver, 1998)
Present-Positive Time Perspective	Positive feelings about the present (e.g., feeling content with life in the present)	Present-Positive subscale of the Adolescent Time Attitude Scale (Worrell & Mello, 2007); Present-Positive subscale of the Time Reference Inventory (Roos & Albers, 1965); Present Life Fulfilment subscale of the Experiential Time Perspective Scale (Shirai, 1994)
Present-Negative Time Perspective	Negative feelings about the present (e.g., feeling unhappy and dissatisfied with life in the present)	Present-Negative subscale of the Adolescent Time Attitude Scale (Worrell & Mello, 2007); Present-Negative subscale of the Time Reference Inventory (Roos & Albers, 1965)
Present-Hedonistic Time Perspective	A pleasure seeking and risk-taking attitude towards life	Present-Hedonistic subscale of ZTPI (Zimbardo & Boyd, 1999); Present-Hedonistic subscale of the Barrett Impulsivity Scale (Patton & Stanford, 1995); Present Orientation measured by Kim & Oh (2013)
Present- Fatalistic Time Perspective	The belief that life is determined by fate	Present-fatalistic subscale of ZTPI (Zimbardo & Boyd, 1999); Short-term and fatalistic thinking about HIV (measured in Nemeroff et al., 2008).
Future Time Perspective	The extent to which people consider and/ or devote their attention towards their future	Future subscale of ZTPI (Zimbardo & Boyd, 1999); Total and Future subscale of the Consideration of Future Consequences Scale (Strathman, et al., 1994); Future subscale of the Temporal Focus Scale (Shipp et

		al., 2009); Future subscale of the Temporal Orientation Scale (Jones et al., 2004); Future Dominance subscale of the Cottle's Circles Test (Cottle, 1967); Goal Pursuit subscale of the Experiential Time Perspective Scale (Shirai, 1994); Future Time Perspective Scale (Carstensen & Lang, 1996); Future Time Orientation Scale (Gjesme, 1979); Future Events Test (Wallace, 1956); Future Extension subscale of the Time Reference Inventory (Roos & Albers, 1965)
Future-Positive Time Perspective	Positive feelings about the future (e.g., feeling that the future will be good and full of possibilities)	Future-Positive subscale of the Adolescent Time Attitude Scale (Worrell & Mello, 2007); Future-Positive subscale of the Time Reference Inventory (Roos & Albers, 1965); Open-ended subscale of the Future Time Perspective scale (Carstensen & Lang, 1996); Future Time Perspective Inventory (Heimberg, 1961, 1963); Thoughts of positive future events and likelihood of those events occurring (Godley et al., 2001)
Future-Negative Time Perspective	Negative feelings about the future (e.g., feeling that the future is bleak and hopeless)	Future-Negative subscale of the Adolescent Time Attitude Scale (Worrell & Mello, 2007); Limited Future subscale of the Future Time Perspective Scale (Carstensen & Lang, 1996); Ambiguous Future (Brothers et al., 2014)
Balanced Time Perspective	The ability to draw from multiple time frames and/ or switch flexibly between them to meet situational demands	Balanced Time Perspective Scale (Webster, 2011); Deviation from a balanced time perspective calculated using scores on the ZTPI (Zimbardo & Boyd)

Notes. 'Hedonistic' and 'Fatalistic' aspects of time perspective were only applied to a present time perspective because no measure to date has applied 'hedonism' and fatalism' to the past or future dimensions of time perspective. A full list measures associated with each dimension of time perspective can be found in the online materials (https://osf.io/jy3zu/).

Table 2

Estimated Overall Effects for the Relationships Between Dimensions of Time Perspective and Self-Regulatory Processes, Self-Regulatory Ability, and Outcomes.

	k (s)	*N*	r_+	*95% CI*	T^2	*p*
Goal Setting						
Past	3 (2)	3,705	-	-	-	-
Past Positive*	5 (5)	1,959	0.12	0.06, 0.18	0.00	<.001
Past Negative*	5 (5)	1,959	0.00	-0.04, 0.05	0.00	.957
Present	16 (14)	2,622	-0.05	-0.24, 0.13	0.03	.543
Present Positive	1 (1)	3,512	-	-	-	-
Present Negative	0 (0)	0	-	-	-	-
Present Hedonistic*	9 (8)	2,961	-0.07	-0.16, 0.02	0.01	.148
Present Fatalistic*	4 (4)	1,269	-0.08	-0.18, 0.03	0.01	.142
Future	91 (75)	42,095	0.25	0.22, 0.30	0.00	<.001
Future Positive*	8 (8)	5,561	0.06	-0.09, 0.20	0.04	.433
Future Negative	0 (0)	0	-	-	-	
Balanced	0 (0)	0	-	-	-	-
Goal Monitoring						
Past	1 (1)	278	-	-	-	-
Past Positive*	3 (3)	700	0.13	0.05, 0.21	0.00	.002
Past Negative*	3 (3)	698	0.03	-0.09, 0.14	0.01	.643
Present	0 (0)	0	-	-	-	-
Present Positive	0 (0)	0	-	-	-	-
Present Negative	0 (0)	0	-	-	-	-
Present Hedonistic*	4 (4)	740	-0.00	-0.10, 0.10	0.00	.997
Present Fatalistic*	3 (3)	699	-0.10	-0.24, 0.03	0.01	.131
Future*	9 (6)	1,822	0.19	0.13, 0.24	0.03	<.001
Future Positive	0 (0)	0	-	-	-	-
Future Negative	0 (0)	0	-	-	-	-
Balanced	2 (2)	442	-	-	-	-
Goal Operating						
Past	14 (6)	3,377	-0.10	-0.21, 0.01	0.00	.062
Past Positive	39 (17)	14,109	0.07	0.03, 0.12	0.00	.005
Past Negative	38 (16)	13,572	-0.02	-0.09, 0.06	0.00	.666
Present	25 (13)	3,966	-0.09	-0.25, 0.08	0.01	.288
Present Positive	4 (2)	666	-	-	-	-
Present Negative	0 (0)	0	-	-	-	-
Present Hedonistic	58 (21)	22,556	-0.09	-0.17, -0.00	0.00	.042
Present Fatalistic	51 (18)	18,695	-0.09	-0.18, 0.01	0.00	.065
Future	204 (90)	76,729	0.24	0.20, 0.29	0.00	<.001
Future Positive	14 (12)	6,837	0.32	0.17, 0.46	0.01	.001
Future Negative	4 (4)	2,041	-	-	-	-
Balanced	5 (2)	1,536	-	-	-	-
Self-Regulatory Ability						
Past	17 (11)	3,437	0.02	-0.11, 0.14	0.00	.779
Past Positive	58 (39)	14,796	0.09	0.04, 0.14	0.00	<.001

Past Negative	62 (41)	16,366	-0.20	-0.24, -0.15	0.00	<.001
Present	50 (22)	16,200	-0.21	-0.31, -0.11	0.01	<.001
Present Positive*	3 (3)	2,479	-0.02	-0.07, 0.03	0.00	.438
Present Negative	2 (2)	2,393	-	-	-	-
Present Hedonistic	67 (43)	15,425	-0.23	-0.29, -0.17	0.00	<.001
Present Fatalistic	64 (42)	14,277	-0.27	-0.31, -0.23	0.00	<.001
Future	237 (119)	85,909	0.35	0.30, 0.39	0.03	<.001
Future Positive	15 (13)	4,948	0.11	-0.07, 0.28	0.01	.200
Future Negative	11 (9)	4,112	-0.05	-0.21, 0.12	0.00	.485
Balanced*	8 (6)	1,667	0.39	0.17, 0.41	0.02	<.001
Outcomes						
Past	12 (11)	9,329	-0.06	-0.18, 0.06	0.00	.274
Past Positive	56 (39)	19,674	0.07	0.03, 0.11	0.00	.003
Past Negative	57 (39)	20,667	-0.15	-0.22, -0.08	0.00	<.001
Present	75 (38)	43,883	-0.13	-0.21, -0.05	0.00	.002
Present Positive*	4 (4)	3,987	0.15	-0.03, 0.32	0.03	.096
Present Negative	2 (2)	362	-	-	-	-
Present Hedonistic	81 (52)	36,470	-0.14	-0.19, -0.09	0.00	<.001
Present Fatalistic	69 (43)	26,840	-0.15	-0.21, -0.09	0.00	<.001
Future	367 (210)	160,927	0.18	0.16, 0.20	0.00	<.001
Future Positive	36 (31)	1,5135	0.15	0.08, 0.22	0.00	<.001
Future Negative	19 (11)	6,455	-0.16	-0.21, 0.11	0.00	<.001
Balanced*	5 (3)	1,646	0.13	-0.03, 0.28	0.02	.123

Notes. k = number of effect sizes, s = number of independent samples, N = total sample size, r_+ = average sample-weighted correlation, 95% CI = the 95% confidence intervals, T^2 = tau-squared measure of between-study heterogeneity. *indicates cases where effect sizes have been aggregated as there was an insufficient number of independent effect sizes to conduct RVE.

Table 3

Results from Publication Bias Tests used to Detect for Publication Bias.

Aspect of Self-Regulation	Publication status as a moderator			Egger's regression		PET using RVE		
	B	95% CI	*p*	*z*	*p*	*B*	95% CI	*p*
Goal Setting	-0.10	-0.80, 0.60	.690	-2.24	.025	-2.24	-4.05, -0.42	.020
Goal Monitoring	-	-	-	-1.10	.271	-	-	-
Goal Operating	0.10	-0.18, 0.38	.151	0.67	.501	0.96	-1.05, 2.96	.329
Self-Regulatory Ability	-0.17	-0.31, -0.03	.021	-1.73	.084	-1.03	-3.02, 0.95	.297
Outcomes	0.06	-0.01, 0.13	.066	2.10	.036	0.74	0.19, 1.28	.009

Notes. B = unstandardized beta coefficient, 95% CI = the 95% confidence intervals. A significant z-value in the Egger's regression test indicates funnel plot asymmetry (Egger et al., 1997). PET = Precision Effect test. Tests of publication status and Egger's regression were conducted using aggregated date, whereas PET was conducted using RVE.

Table 4

Results from Publication Bias Tests used to Adjust for Publication Bias.

Aspect of Self-Regulation	Trim-and-Fill					PEESE estimate		Selection models			
	Observed *k*	Unadj. r_+	Imputed *k*	Adj. r_+	Change	*B*	95% CI	Moderate one-tailed	Severe one-tailed	Moderate two-tailed	Severe two-tailed
Goal Setting	75	0.24	21	0.30	0.07	0.32	0.24, 0.42	0.23	0.17	0.24	0.20
Goal Monitoring	6	0.18	2	0.21	0.03	-	-	-	-	-	-
Goal Operating	90	0.25	0	0.25	0.00	0.23	0.16, 0.31	0.21	0.16	0.22	0.19
Self-Regulatory Ability	119	0.35	0	0.35	0.00	0.37	0.31, 0.46	0.30	0.23	0.31	0.27
Outcomes	210	0.18	0	0.19	0.00	0.16	0.14, 0.19	0.14	0.08	0.16	0.13

Notes. Observed *k* = number of aggregated effect sizes included in analyses, Unadj. r_+ = unadjusted effect size estimate, imputed *k* = number of additional effect sizes added by trim-and-fill analyses, Adj. r_+ = adjusted effect size estimate (i.e., including imputed studies), PEESE = precision effect estimate with standard error, *B* = unstandardized beta coefficient, 95% CI = the 95% confidence intervals. The weights corresponding to the four different selection models can be found in Vevea and Woods (2005; Table 1, p.435). Trim-and-fill analyses and selection model estimates were computed using aggregated data, whereas PEESE estimates were computed using RVE.

Table 5

Mediation of the Relationship between a Future Time Perspective and Outcomes via Self-Regulatory Processes and Self-Regulatory Ability.

	β	*SE*	95% CI	*p*
Total direct effect (i.e., time perspective on outcomes)	.02	.01	-.01, .04	.197
Time perspective on goal setting	.25	.01	.22, .26	.001
Time perspective on goal monitoring	.19	.01	.15, .19	.001
Time perspective on goal operating	.24	.01	.24, .28	.001
Time perspective on self-regulatory ability	.35	.01	.31, .35	.001
Goal setting on outcomes	.01	.01	-.01, .04	.218
Goal monitoring on outcomes	.04	.01	.02, .07	.001
Goal operating on outcomes	.37	.11	.34, .39	.001
Self-regulatory ability on outcomes	.13	.01	-10, .14	.001
Total indirect effect	.15	.01	.13, .16	.001
Indirect effect via goal setting	.00	.00	-.00, .01	.217
Indirect effect via goal monitoring	.01	.00	.00, .01	.001
Indirect effect via goal operating	.09	.01	.08, .10	.001
Indirect effect via self-regulatory ability	.04	.01	.04, .05	.001

Notes. *β* = unstandardized beta coefficient, *SE* = Standard Error, 95% CI = the 95% confidence intervals.

Table 6

Continuous Moderators of the Relationship between Dimensions of Time Perspective and Goal Setting, Goal Operating, Self-Regulatory Ability, and Outcomes.

Aspect of Self-Regulation	Dimension of Time Perspective	Age of Participants					Percentage of Male Participants					Methodological Quality of Individual Studies				
		s	*k*	B_1	95% CI	*p*	*s*	*k*	B_1	95% CI	*p*	*s*	*k*	B_1	95% CI	*p*
Goal Setting	Present	10	12	.011[a]	-.008, .031	.111	13	15	.005[a]	-.003, .013	.154	13	15	.007[a]	-.721, .734	.982
	Future	57	71	.003	-.001, .007	.104	65	81	-.001	-.004, .001	.240	64	78	.009	-.116, .134	.882
Goal Operating	Past-Positive	13	30	.002	-.004, .007	.403	13	29	.000	-.005, .005	.967	11	27	-.031	-.209, .148	.685
	Past-Negative	12	28	-.008	-.017, .002	.092	12	28	.006	-.013, .021	.547	10	25	-	-	-
	Present	8	11	.003[a]	-.022, .027	.592	9	15	.002[a]	-.014, .017	.609	7	11	-.626[a]	-2.16, .913	.197
	Present-Hedonistic	17	49	.007	-.000, .014	.060	17	49	.002	-.013, .017	.778	14	45	-	-	-
	Present-Fatalistic	15	44	-.002	-.012, .008	.683	16	46	.009	-.006, .024	.172	12	40	-.106	-.464, .252	.515
	Future	61	134	-.001	-.004, .003	.687	70	165	-.001	-.003, .001	.292	57	138	.042	-.113, .196	.580
Ability	Past	9	15	.001[a]	-.014, .015	.897	11	17	-.002	-.011, .008	.698	4	8	-	-	-
	Past-Positive	33	52	-.002	-.007, .003	.494	37	56	-.002	-.005, .002	.249	23	33	.052	-.206, .310	.618
	Past-Negative	34	55	-.001	-.005, .004	.692	37	58	.001	-.003, .004	.616	25	37	-.020[a]	-2.43, 2.23	.714
	Present	15	37	.003[a]	-.019, .026	.612	17	45	-.001	-.012, .010	.771	17	44	-.171	-.398, .056	.122
	Present-Hedonistic	37	61	.002	-.004, .008	.395	39	63	-.004	-.009, .001	.131	23	37	-.173[a]	-.488, .143	.094
	Present-Fatalistic	33	54	.002	-.002, .006	.237	38	59	**-.003**	-.005, -.000	.026	22	33	-.019	-.114, .077	.678
	Future	86	197	.001	-.004, .005	.762	90	193	.000	-.002, .003	.731	68	133	**.134**	.025, .243	.019
	Future-Positive	10	12	-.003[a]	-.059, .052	.827	13	15	.006[a]	-.018, .030	.491	7	9	-	-	-
Outcomes	Past-Positive	29	42	-.000	-.005, .005	.983	32	44	.001	-.002, .004	.442	20	31	.002	-.107, .110	.974
	Past-Negative	29	43	-.004	-.010, .002	.138	31	43	-.002	-.006, .003	.379	19	31	.021[a]	-.391, .433	.879
	Present	15	37	.002	-.003, .006	.432	32	69	-.000	-.011, .011	.980	29	65	**.210**	.080, .341	.004
	Present-Hedonistic	39	62	.000	-.003, .004	.769	41	59	-.002	-.004, .000	.080	25	43	-.012	-.180, .155	.856
	Present-Fatalistic	32	54	.000	-.005, .006	.881	35	53	**-.003**	-.005, -.000	.012	22	39	.010	-.096, .116	.841
	Future	144	245	.000	-.001, .002	.493	168	298	-.000	-.002, .001	.744	124	252	.015	-.024, .053	.448
	Future-Positive	24	29	.001	-.005, .006	.823	29	34	.000	-.002, .002	.997	25	27	-.095	-.275, .085	.237

Notes. s = number of independent samples, k = the number of independent tests of the association included in the analysis; B = unstandardized beta coefficients, 95% CI = the 95% confidence intervals. Confidence intervals that do not contain zero are significant at the $p < .05$ level. Dashes indicate where there were insufficient observations to run moderation analyses (i.e., $k < 10$); beta-coefficients in bold are significant at the $p < .05$ level. Mean age of the sample ranged from 10.51 to 84.92, the percentage of males in the sample range from 0 to 100, and the methodological quality score for individual studies range from 0 to 3.

Table 7

Categorical Moderators of the Relationship between Dimensions of Time Perspective and Goal Setting, Goal Operating, Self-Regulatory Ability, and Outcomes.

Aspect of Self-Regulation	Dimension of Time Perspective	Moderator	*s*	*k*	r_+	*F*	B_1	95% CI	*p*
Setting	Future	**Measure of TP**	75	91	-	-	.007	-.080, .093	.839
		Domain Specific	5	6	.271	-	-	.217, .325	<.001
		Domain General	70	85	.264	-	-	.214, .315	<.001
Operating	Future	**Measure of TP**	90	204	-	-	.104	.004, .205	.044
		Domain Specific	12	18	.329	-	-	.243, .415	<.001
		Domain General	80	186	.235	-	-	.183, .287	<.001
Outcome	Future	**Measure of TP**	210	365	-	-	.033	-.068, .135	.491
		Domain Specific	18	26	.234	-	-	.123, .344	.001
		Domain General	195	341	.176	-	-	.150, .201	<.001
Outcome	Past-Positive	**Level of Inference**	39	56	-	-	.058	-.031, .148	.189
		Low inference	25	29	.045	-	-	-.012, .102	.117
		High Inference	14	27	.103	-	-	.029, .177	.011
	Past-Negative	**Level of Inference**	39	57	-	-	-.084	-.213, .046	.194
		Low inference	25	30	-.118	-	-	-.214, .023	.017
		High Inference	14	27	-.200	-	-	-.297, -.107	.001
	Present	**Level of Inference**	38	75	-	-	-.114	-.276, .049	.155
		Low inference	13	14	-.033	-	-	-.148, .082	.526
		High Inference	27	61	-.160	-	-	-.253, -.067	.002
	Present-Hedonistic	**Level of Inference**	81	52	-	-	-.090	-.193, .013	.085
		Low inference	30	38	-.106	-	-	-.163, -.049	.001
		High Inference	22	40	-.200	-	-	-.286, -.106	.001
	Present-Fatalistic	**Level of Inference**	43	69	-	-	-.073	-.188, .041	.202
		Low inference	24	29	-.112	-	-	-.193, -.032	.009
		High Inference	19	40	-.186	-	-	-.273, .098	<.001
	Future	**Level of Inference**	210	367	-	-	.001	-.050, .053	.961
		Low inference	96	113	.177	-	-	.134, .220	<.001
		High Inference	122	254	.180	-	-	.146, .214	<.001
Outcome	Future	**Study Design**	350	213	-	21.30	-	-	<.001
		Cross-sectional	327	180	.182	-	-	.115, .208	<.001
		Longitudinal	16	26	.118	-	-	.071, .164	<.001
		Experimental	7	7	.275	-	-	.216, .335	<.001
Outcome	Future	**Domain of Study**	231	281	-	-	0.496	-	.797
		Academic	36	41	.232	-	-	.160, .304	<.001
		Health	151	258	.158	-	-	.134, .182	<.001
		Environmental	11	28	.207	-	-	.122, .291	.001
		Finance	9	10	.267	-	-	.094, .439	.009
		Emotion-Reg	11	27	.155	-	-	.053, .255	.007
		Pro-Social	13	17	.191	-	-	-.099, .482	.177

Notes. s = number of independent samples, k = the number of independent tests of the association included in the analysis; r_+ = average sample-weighted correlation for each level of the moderator, F values are from Approximate Hotelling-Zhang with small sample correction omnibus tests of the effects of moderators with more than two levels, B_1 = unstandardized beta coefficients, 95% CI = the 95% confidence intervals.

Figure 1

Flow of Information Through the Review.

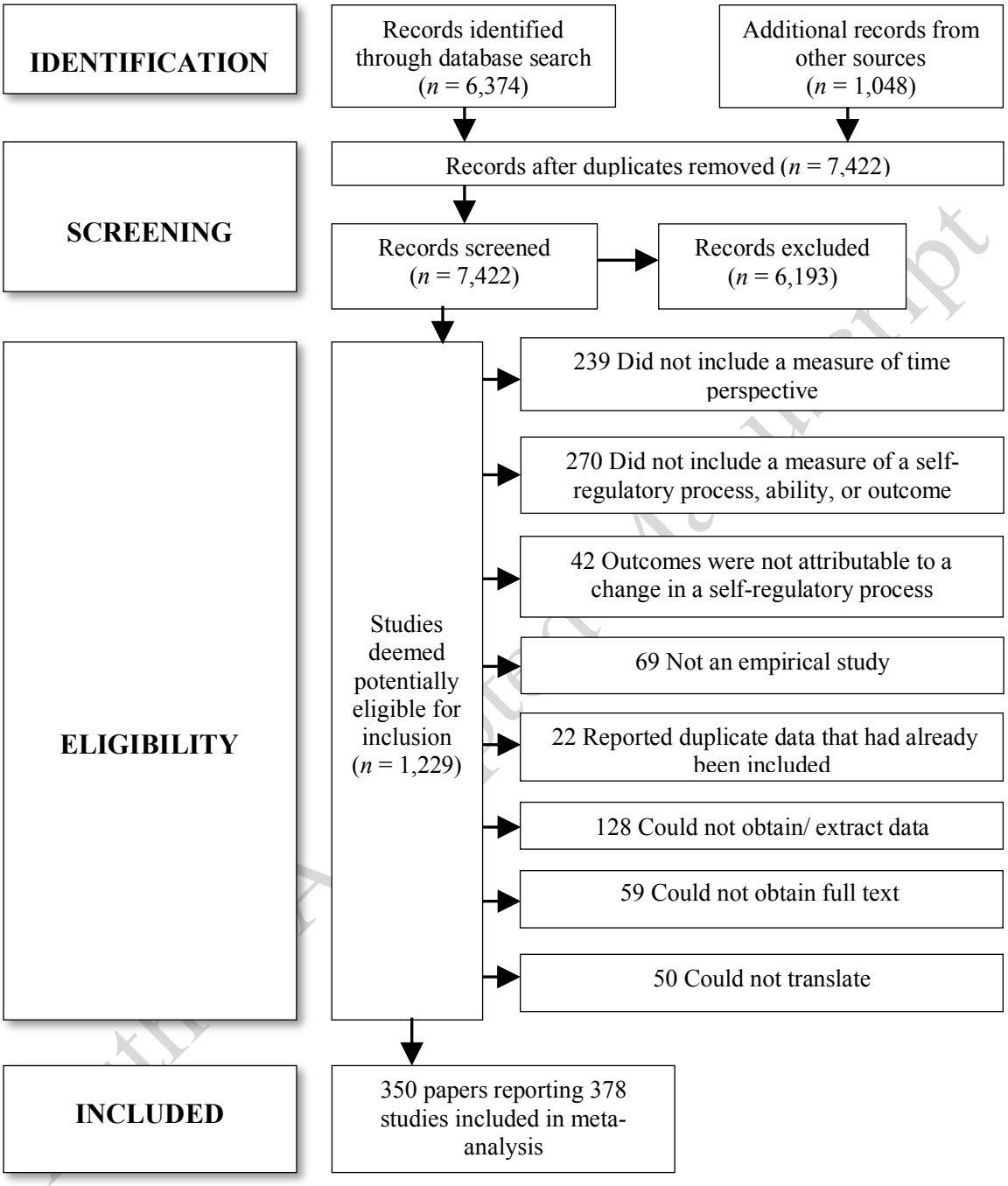


Figure 2

Proposed Mediation Model for the Relationship between a Future Time Perspective and Outcomes via Self-Regulatory Processes and Ability.

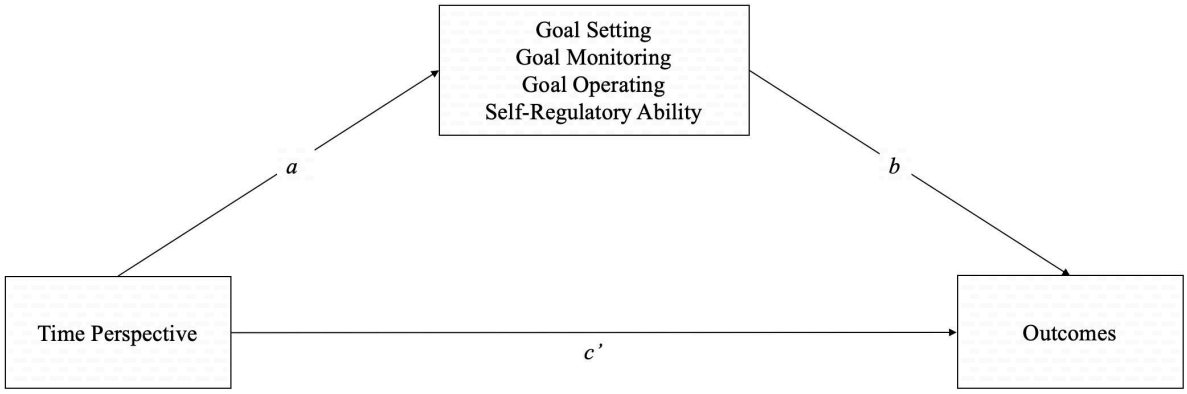
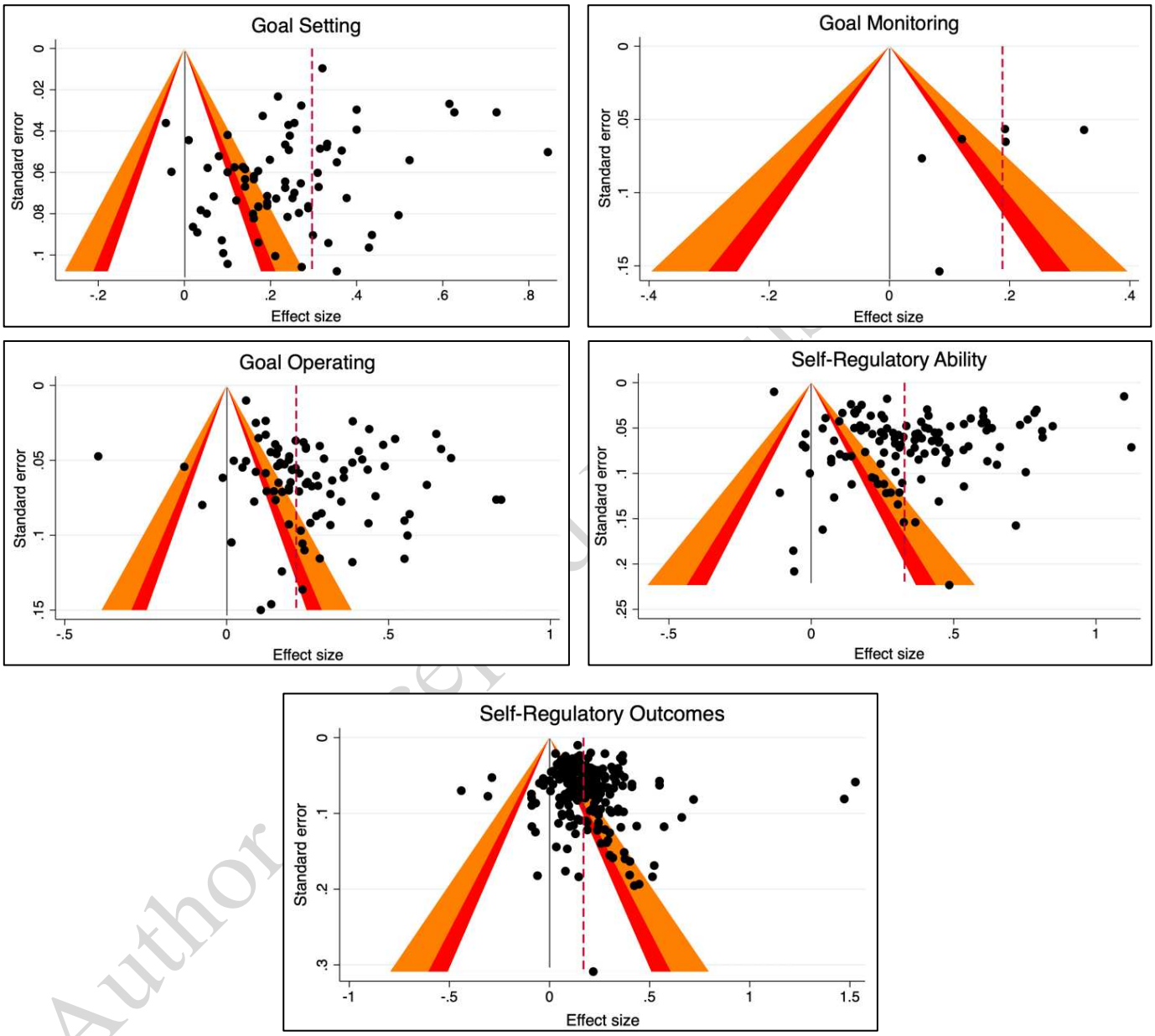


Figure 3

Contour-Enhanced Funnel Plots for the Relationship between Time Perspective and Goal Setting, Goal Monitoring, Goal Operating, Self-Regulatory Ability, and Outcomes.

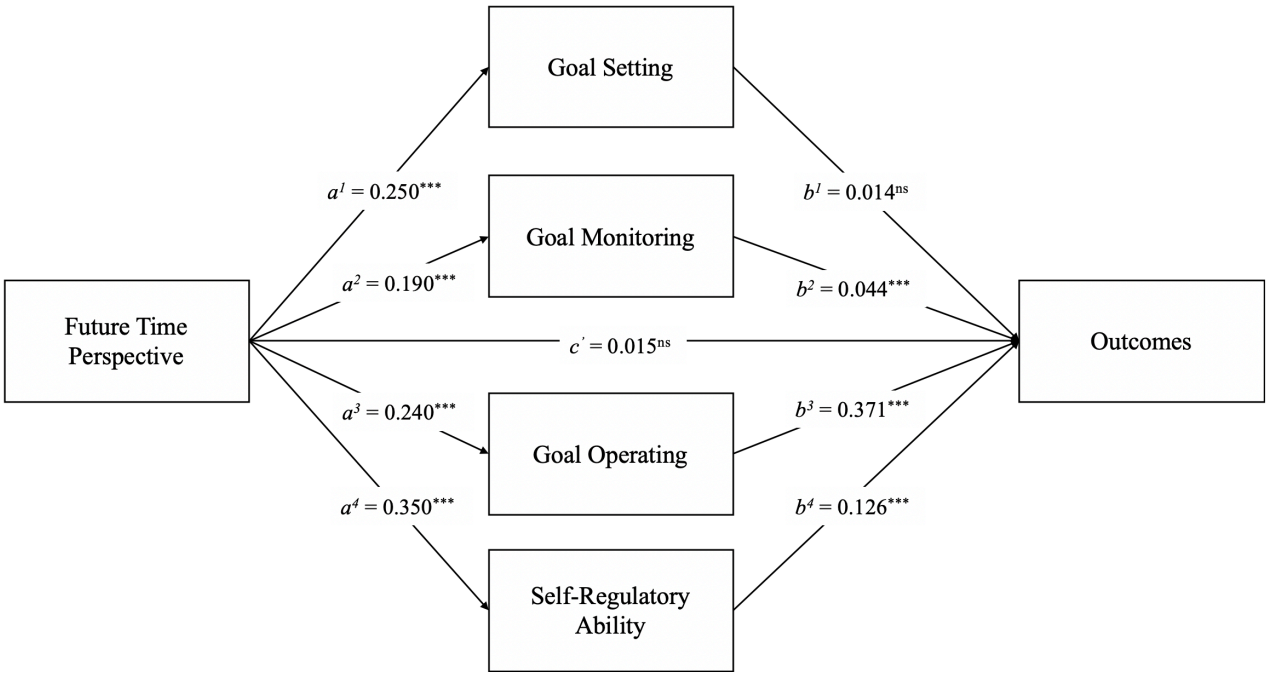


Notes. Dot indicate aggregated estimates (*z*-transformed) that were included in the present meta-analysis. Dashed red line indicates overall effect size estimate. Contour lines allow the consideration of the statistical significance of study estimates. White background colour indicates $p > .10$, red background colour indicates $.05 < p < .10$, orange background colour

indicates .001 < p < .05, and area outside of the funnel indicates p <.01. The standard errors intervals reported on the y-axis differ between funnel pots.

Figure 4

Path model (N = 6,630) of the Relationship between a Future Time Perspective and Outcomes, via Self-Regulatory Processes and Ability



Notes. Values represent standardised regression weights. *** indicates statistically significant paths at $p < .01$ level.

Figure 5

Proposed Serial Mediation Model for the Relationship between Time Perspective, Self-Regulatory Processes, Self-Regulatory Ability, and Outcomes.