Continuity with Future Selves in Delinquent, Financial, and Health-Related Decision Making

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"It's no use going back to yesterday, because I was a different person then."

Lewis Carroll *(Alice in Wonderland)*

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"Well, then, let's take a look at your future self!"

Abstract

Enhancing people's future orientation, in particular continuity with their distant future selves, has been claimed as a promising approach to mitigate self-control-related problem behavior in various domains. Two direct replication attempts examined the impact of a brief and subtle manipulation, i.e., writing a 100- to 300-word letter to one's future self, on delinquent decisions (van Gelder et al., 2013, Study 1) and risky investments (Monroe et al., 2017, Study 1). With samples of $N = 314$ and $N = 463$, i.e., 2.5 times the original studies' sample sizes, the expected effects – fewer delinquent decisions (Study 1) and less risky investments (Study 2) – were not found. Analyses integrating the original studies' results suggested that the effects are either non-existent or smaller than originally reported, and/or dependent on factors not examined. Study 3 ($N = 210$), an attempt at a conceptual replication of van Gelder et al. (2015) and specifically an extended version of the letter task, i.e., writing e-mails on future experiences over the course of one week, did not yield relevant effects on unhealthy diet behavior. For several other unhealthy behaviors, such as alcohol consumption or smoking, no informative results could be obtained due to low base rates. Study 4 ($N = 211$) compared minimal interventions that contained elements of self-affirmation or future orientation in a 2 x 2 longitudinal design. Self-affirmation (but not future orientation) tasks successfully increased physical activity ($BF_{10} = 6.09$, $p = .005$, $d = 0.34$, 95% CI [0.12, 0.66]). Over the four studies, several measures of future orientation and related constructs were applied to test assumptions about underlying processes – which were largely not confirmed. The manipulation used in Study 2 was the only task that resulted in group differences in vividness of distant future selves ($BF_{10} = 826.66$, $p < .001$, $d = 0.41$, 95% CI [0.22, 0.59]); there was no effect on general future thinking, trait self-control, or trait future time perspective. All studies follow state-of-the-art guidelines for open science practices and thus provide informative evidence against the assumption that short writing tasks could reliably alter future orientation and/or reduce self-destructive behavior associated with temporal discounting in random online samples. Future research directions are discussed, including paying more attention to context variables and testing less subtle interventions in samples with concrete, myopia-related self-control deficits.

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Introduction

Before reading this thesis, please think about yourself 10 years from now and try to imagine this "future self" as vividly as possible. For example, what will you look like then? What will you be doing? Where will you be? What goals will you pursue? Which topics will be important and dear to you? If you now imagine addressing these questions in a letter to your future self of 10 years from now – do you think these thoughts could affect the decisions you make in the here and now?

The present research examined whether brief and straightforward writing tasks addressing one's distant future self can contribute to more far-sighted decisions and thus more responsible behavior. Theoretical accounts and various empirical findings suggest that such manipulations might have the potential to be used as "wise interventions" (Walton, 2014): with reference to the General Theory of Crime (GTC; Gottfredson & Hirschi, 1990, 2004), for example, in the context of forensic prevention or therapy programs (e.g., van Gelder et al., 2015), or generally to overcome common self-control failures (e.g., Duckworth et al., 2018). However, this would require an accurate understanding of underlying processes, and above all, that the effects found in previous research prove to be robust – which is questionable in view of relatively small effect and samples sizes in combination with rather high p-values (e.g., Open Science Collaboration, 2015; Simonsohn et al., 2014).

After an overview of theoretical concepts and empirical findings on future orientation in general, future self-continuity in particular, and related intervention approaches, the first part of the present research comprises direct replication attempts of two studies suggesting that writing a letter to one's distant future self can reduce delinquent decisions (van Gelder et al., 2013; Study 1) and risky investment decisions (Monroe et al., 2017, Study 1). In order to make an informative evaluation, the replication sample sizes were 2.5 times larger than in the original study samples, and the analyses were complemented with confidence intervals, moderation analyses, randomization checks, manipulation checks, Bayesian approaches, an additional experimental condition (Study 1), and analyses of the letter contents to elucidate possible underlying mechanisms.

The second part of the present research comprises two longitudinal studies that examine variations of the letter task regarding their effectiveness to reduce several unhealthy behaviors. Study 3 attempted to conceptually replicate intervention effects on delinquent behavior (van Gelder et al., 2015) in the health domain, and Study 4 aimed to systematically compare minimal interventions on future orientation with self-affirmation interventions (e.g., G. L. Cohen & Sherman, 2014). The sample sizes of both studies were large enough to detect possible small true effects with sufficient power and, again, various analytical methods were applied to get a comprehensive picture of the paradigm's potential to alter connections with future selves, or alternative factors, and to thus promote decisions that are more far-sighted.

Future Orientation and Self-Control Problems

Time has occupied and fascinated people since ancient times, not only as a physical quantity, but also regarding questions of how to make best use of one's lifetime (e.g., Seneca the Younger, c. 4 BC–65 AD, in his *Epistulae Morales*; see Gummere, 1917). In psychological research, the question of how temporal references affect human experience and behavior has been a recurring theme since about the middle of the 20th century (e.g., Lewin, 1939, 1951). The future in particular has been a focus of attention (e.g., Andre et al., 2018). In an increasingly popular field of research, future orientation (or future time perspective) is used as an umbrella term for a multitude of constructs that refer to different kinds of involvement with the future, e.g., its salience, how far into the future is considered, the extent to which the future is taken into account, and also plans, goals, hopes, and fears (for conceptual frameworks and overviews, see Andre et al., 2018; Clinkinbeard, 2014; Peetsma & van der Veen, 2011; Petrich & Sullivan, 2019; Shipp et al., 2009; Steinberg et al., 2009; Szpunar et al., 2014).

These constructs have a logical relationship with self-control. As the ability and motivation to modify dispositional tendencies to meet environmental standards of behavior, self-control is closely tied to elements of impulsivity and risk-taking, but also to a temporal aspect, i.e., the ability to delay gratification (e.g., Barber et al., 2009; Duckworth et al., 2013; Inzlicht et al., 2014; Pratt, 2015; Watson & Milfont, 2017; for a critical view on conceptualizing delay of gratification as a component of self-control, see Watts et al., 2018). Self-control failures in decisions with consequences that are pleasant in the present but harmful in the future are immensely common, difficult to change, and characterize many public challenges, including criminal/deviant and unhealthy behavior (e.g., Reynolds & McCrea, 2017; Rutchick et al., 2018; Siegmunt, 2016). The GTC (Gottfredson & Hirschi, 1990, 2004) identifies a lack of self-control as the key factor in delinquency – as criminal acts provide immediate gratification (e.g., fun and excitement, reduced aggression, material gains), but often go along with undesirable long-term consequences (e.g., fines, arrest, detention, social exclusion). Delinquent decisions as well as analogously self-defeating behaviors such as smoking, excessive drinking, substance abuse, gambling, and risky sexual behavior (van Gelder et al., 2015) can hardly be explained solely by economic rational choice models (e.g., Akers et al., 2017; Scott et al., 2017), as the long-term costs can be substantial. In a broader picture, freedom and health are probably the most important components for a fulfilled life. Finances, education, and work are also certainly relevant domains in human existence in which a straight "you-only-live-once" focus on the here and now is likely to lead to behaviors that do not increase chances of long-term well-being or happiness. Therefore, it would be rational to recognize that you would act in your best interest by giving more weight to long-term consequences.

However, the costs and benefits associated with any behavior can differ dramatically depending on the time that you choose to focus on (Hall, 2001). In a specific decision situation, it can be assumed that people exhibit *bounded rationality*, i.e., opt for decisions that are satisfactory instead of optimal

(Simon, 1957). They might thus lack the future orientation to even anticipate future consequences, or to not devalue future consequences in dissonance reduction processes (e.g., Cooper, 2012; Festinger, 1957). In terms of a dual-process model of decision making, the rational "cool" system is likely to be outweighed by "hot" emotions in a tempting situation. Thereby, the time horizon shortens, and immediate needs and short-term benefits prevail over future considerations (van Gelder, 2013), resulting in behavior that is disadvantageous in the long term. In the foreground of a specific decision situation, people might fail to anticipate temptations, so that no preventive measures are taken (Duckworth et al., 2016; for example, attempts to avoid a criminal or drug-using environment while trying to desist from crime or drugs, corresponding to the concept of *start control* [e.g., Boer et al., 2011; Imhoff et al., 2014]). Besides the assumption that a short-term perspective increases the risk of self-defeating behaviors, feedback loops are just as plausible, so that a focus on the present is enhanced by way of, e.g., unhealthy, or criminal acts.

The basic idea of future orientation is thus applicable to any self-control-related behavior that requires prioritizing future over present benefits (i.e., overcoming temporal/delay discounting; Rutchick et al., 2018). Whether it is about saving money, living healthier, behaving pro-environmentally, being successful in education and professional life, abiding by the law, or avoiding risks in general, it is considered advantageous to take into account the long-term consequences of decisions – unless there is high uncertainty in the future pay-off of the delayed but greater reward (e.g., Jachimowicz et al., 2017; Kidd et al., 2013). By and large, empirical findings suggest that level of future orientation obtains small to medium effects in predicting present attitudes and behavior in these life domains. In meta-analyses, attitudes towards the distant future were found to be related to various outcomes regarding education ($r = .24$, 95% CI [.20, .28], $p < .001$, $k = 28$), work ($r = .24$, 95% CI [.17, .31], $p < .001$, $k = 17$), and health ($r = .20$, 95% CI [.18, .24], $p < .001$, $k = 32$; Andre et al., 2018), in particular to body mass index (BMI; $r = .14$, 95% CI [.10, .18], $p < .001$, $k = 36$), eating behavior ($r = .16$, 95% CI [.12, .21], $p < .001$, $k = 18$), and exercise behavior ($r = .12$, 95% CI = [.09, .14], $p < 0.01$, $k = 18$; Sweeney & Culcea, 2017), as well as to environmental attitudes ($r = .17$, $p < .001$, $k = 10$) and behaviors ($r = .26$,[1] $p = .001$, $k = 13$; Milfont et al., 2012; for a review on further outcome domains, see Urminsky, 2017).

Concepts and Measures of Future Orientation

The majority of studies have operationalized future orientation via self-report scales as a relatively stable individual difference variable (Hall, 2001; Rutchick et al., 2018), and examined associations with present behavior, behavioral intentions, or attitudes toward behavior. Even with identical outcome measures, however, findings can hardly be generalized; a substantial degree of variability in results can be explained by conceptual differences in future orientation measures (Andre et al., 2018;

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[1] According to Milfont et al. (2012), the higher effect size for environmental behavior than for attitudes might reflect higher validity of behavioral measures.

Gjesme, 1983). Meta-analytic findings indicate that future orientation constructs including cognitions, emotions, and behavioral intentions towards the future are more strongly related to outcomes than are constructs including cognitions only (Andre et al., 2018). However, the extent to which people are optimistic or pessimistic about the future (e.g., Trommsdorff & Lamm, 1980) may reflect current life circumstances and personality characteristics such as degree of depression rather than temporal references (Steinberg et al., 2009). Stronger effects have been found also for future orientation measures with a specific instead of general focus (Andre et al., 2018), i.e., that explicitly refer to a certain life domain. These measures, however, are likely to result in content overlap and thus tautological relationships with dependent variables (Gjesme, 1983). Along with joint method variance in self-report measures, effect sizes can easily be inflated. For example, the Time Perspective Questionnaire – Exercise Version (TPQ-E; Fong & Hall, 2003; Hall & Fong, 2003) contains items such as "I do not have long range fitness plans" (reverse); if combined with, e.g., self-reported intentions to do sports the next week, correlations are to be expected based on the shared fitness theme alone, independent from any temporal reference (Andre et al., 2018). From a theoretical perspective, it thus seems advisable to apply measures that conceptualize future orientation as a cognitive, neutral-valence construct with a general focus (Gjesme, 1983).

Examples of Trait Measures

The most popular future orientation measures, the Future Time Perspective subscale of the Zimbardo Time Perspective Inventory (ZTPI-F; Zimbardo & Boyd, 1999) and the Consideration of Future Consequences Scale (CFCS; Strathman et al., 1994), tap into broad and relatively stable individual differences (e.g., Andre et al., 2018). In the CFCS, future and present orientation constitute opposite poles, as the majority of items requires an explicit choice between present and future outcomes (e.g., Toepoel, 2010; for a critical view, see Joireman et al., 2008; Joireman et al., 2012). In contrast, the ZTPI conceptualizes future and present time perspectives as separate factors, which have been found to account for unique variance in predicting self-control-related outcome variables (e.g., Crockett et al., 2009; Keough et al., 1999). However, the ZTPI in particular overlaps with other traits such as conscientiousness, locus of control, and indeed self-control (e.g., Crockett et al., 2009; Hall, 2001). Several items hardly contain any temporal component, thus distinctions from related constructs can hardly be examined. For example, the ZTPI-F includes the item "I make lists of things to do," and conscientiousness scales include items such as "I do things according to a plan" (Goldberg et al., 2006; cited from Park et al., 2017). Likewise, the ZTPI-F item "I am able to resist temptations when I know that there is work to be done," brings together two items of the Brief Self-Control Scale (Tangney et al., 2004), specifically, "I am good at resisting temptation" and "Pleasure and fun sometimes keep me from getting work done" (reverse). The CFCS is more reliable in terms of a temporal focus, but has been criticized for its poor readability due to technical item wording (e.g., "Since my day-to-day work has specific outcomes, it is more important to me than behavior that has distant outcomes," "I think it is more important to perform a behavior with important distant

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consequences than a behavior with less important immediate consequences"; see, e.g., Crockett et al., 2009; Hall, 2001). It is thus questionable whether the scale is valid for children, or for samples with low self-reflection abilities and/or lower educational levels. To some extent, CFCS correlations with outcome variables such as healthy and pro-environmental behavior might be confounded, i.e., attributable to people's educational background (e.g., Li & Powdthavee, 2015; Meyer, 2015).

In the present research (Study 2 & 4), the Time Perspective Questionnaire (TPQ; Fong & Hall, 2003; Hall, 2001) was used as a trait measure of general future orientation. Similar to the CFCS, this 13-item scale focuses on the valuation of short- vs. long-term outcomes. The TPQ can be meaningfully interpreted both as a correlated two-factor (i.e., future and present time perspective) model, or as a unidimensional scale (Hall, 2001), and has demonstrated good internal consistency ($\alpha > .80$) and retest-reliability ($r > .80$ over four or 10 weeks). Regarding validity, TPQ scores have been found to predict risky behavior mainly in the health domain also when controlling for related constructs, and with a predictive power that is comparable to other general self-report measures of personality ($r \sim .21$; Fong & Hall, 2003). Moreover, the items (e.g., "Short-term goals are more important to me than long-term goals" [reverse]) are easy to understand and each have a clear temporal reference.

Future Selves

Focusing on identity-related aspects of future orientation, however, might be more promising in both theoretical and practical terms, to approach intraindividual conflict in choices that have immediate benefits and long-term costs (van Gelder et al., 2015). According to multiple-self models (Loewenstein, 1996), the individual incarnates distinct identities that overlap with each other over time. Building up on this account, several theoretical approaches consider tensions between different selves in decision making (for a comprehensive overview of perspectives on the future self, see Hershfield & Bartels, 2018). For example, delay discounting effects have been modelled as a competition between simultaneously existing selves that are either far-sighted or myopic (e.g., Schelling, 1984). Self-control failures are thus attributed to a less powerful negotiation status of the future self. A positive example in this respect is Homer's *Ulysses*,

> […] who had the sophisticated insight that his future self would possess different preferences than his current self: By having his shipmates tie him to the ship's mast, he was able to listen to the songs of the Sirens (something his current self desired), while refraining from jumping overboard to his death (something his future self would want to avoid […]) (Homer, trans. by Elster, 1977, as cited in Hershfield & Bartels, 2018, p. 91f).

In a similar vein, the future self has been conceptualized as a different person, as separate from the current self (e.g., Bryan & Hershfield, 2012; Parfit, 1971; Pronin et al., 2008) – thinking about yourself in the distant future may feel like thinking about someone else, more or less appreciatively. This view is supported by findings that people take the first-person perspective when imagining a scene in the near future, but instead take an observer's perspective when imagining the distant future

(Pronin & Ross, 2006). Also, neuroscience research has found that thinking about the future self in 10 years' time (rather than thinking about the present self) is associated with neural activation patterns similar to thinking about others (Ersner-Hershfield, Wimmer, & Knutson, 2009). Accordingly, self-control failures could be attributed to a lack of concern and care for future selves. Thus, in order to increase the willingness to make present sacrifices for him or her, it would be helpful to make "friends with [your] future self" (van Gelder et al., 2015, p. 158).

Ignorance or recklessness towards future selves may also be due to a lack of imagination. As stated in Construal Level Theory and supported empirically, greater temporal distance from an object goes along with more abstract, less detailed levels of construal of that object (e.g., Trope & Liberman, 2010). People underestimate the intensity of their emotional reactions when imagining future as compared to present events (Kassam et al., 2008), and attribute less human-typical characteristics (e.g., interpersonal warmth, cognitive openness) to future selves as compared to present or past selves (Haslam & Bain, 2007, Study 3). Failures in imagining future needs are difficult to prevent when needs change fundamentally, e.g., through major life events such as parenthood or death of a beloved person. But also with regard to less dramatic contextual influences, people can easily misjudge impacts on their identity, thus misjudging which of various *possible* future selves they will become (e.g., Oyserman & Markus, 1990). As Hershfield and Bartels (2018) note, people may generally try to avoid imagining their old future selves due to negative stereotypes towards aging (Levy et al., 2002), older people in general (North & Fiske, 2012), and – in line with Terror Management Theory – in order to avoid mortality salience, i.e., thinking about death (e.g., Pyszczynski et al., 2015). Therefore, an explanation for a preference for short-term rewards might be that people are not willing or able to vividly represent their future selves and their future selves' interests (e.g., Blouin-Hudon & Pychyl, 2016).

Eventually, these theoretical approaches and empirical findings can be reduced to one possible impact factor when it comes to cost-benefit trade-offs in decision making: The personal aspect of closeness to future versions of one's identity in particular might contribute to making more far-sighted choices. In this sense, continuity theories examine how psychological overlap is perceived between selves over time, how these perceptions can determine intertemporal outcomes, and what factors determine a sense of continuity (Rutchick et al., 2018). Experiencing continuity with your future self might imply that you feel relatively similar to and connected with this future self, which could also go along with having a vivid image of this future self. As a result, you should be willing to delay commensurate rewards to this future self (Hershfield & Bartels, 2018). In the neuroscience study by Ersner-Hershfield, Wimmer, and Knutson (2009), for example, for some participants, thinking about the future self showed neural patterns similar to thinking about the present self – which was associated with more patience in waiting for financial rewards. The larger the temporal distance between two selves, however, the weaker the psychological connection between the two (Bartels & Rips, 2010; Parfit, 1971, 1992). If future self-continuity is low, you might see yourself in 10 or 20 years as a

complete stranger, or you might just not be able to imagine your future self; consequently, you are less likely to care about this future self, and more likely to make choices that do not take this future self into account.

Future self-continuity has been operationalized via self-report measures mainly of *similarity* to, or *connectedness* with, or *vividness* of, future selves in a certain temporal distance (e.g., Hershfield, 2011). For example, participants have been instructed to use numerical ratings to indicate how connected they felt with future selves, starting from one up to 40 years in the future (e.g., Bartels & Rips, 2010, Study 1), or how vividly they could imagine themselves in 15 years (van Gelder et al., 2015). Several studies also symbolized similarity to or connectedness with future selves via successively overlapping circles, based on Aron et al.'s (1992) Inclusion of the Other in the Self Scale (e.g., Ersner-Hershfield, Garton et al., 2009; Hershfield et al., 2011; Nurra & Oyserman, 2018). On a differential level, results suggest that individual differences in such measures of future self-continuity are moderately related to intertemporal choice (van Gelder et al., 2015; Urminsky, 2017), mainly in the financial domain (e.g., Bartels et al., 2013; Bartels & Rips, 2010; Bartels & Urminsky, 2015). For example, university students who felt more similar ($r = .42$, $p < .001$) and connected to their 10-years-future selves ($r = .30$, $p < .05$) preferred larger delayed rewards over smaller immediate rewards after a one-week interval. In contrast, caring for future selves ($r = .21$, $p = .11$) and liking them ($r = .14$, $p = .27$) were not significantly associated with delayed choices ($N = 65$; Ersner-Hershfield, Garton et al., 2009, Study 1). Similarity to the 10-years-future self was also positively associated with self-reported assets in adults ($r = .34$, $p < .001$), also when controlling for age and education (partial $r = .23$, $p < .01$, $N = 155$; Ersner-Hershfield, Garton et al., 2009, Study 3).

In the educational domain, similarity to and connectedness with 10-years-future selves predicted university grade point average scores ($r = .12$, $p = .02$), which was partially mediated by lower consideration of immediate consequences, higher consideration of future consequences (as measured with the CFCS), and higher trait self-control (RMSEA = .04; SRMR = .01; CFI = .10, $N = 403$; Adelman et al., 2017, Study 2). Regarding delinquency, teenagers with a more vivid picture of their 15-years-future self had shown less deviant behavior in the past year (r [-.29, -.24], $p \leq .019$); associations with deviant behavior in the past week were hardly significant, r [-.19, -.06], p [.028, $\geq$ .05]; N [87, 133]; van Gelder et al., 2015). In the health domain, both similarity to and connectedness with future selves were associated with several global health measures, such as self-reported physical and mental health, and quality of life (r [.19, .32], $p < .001$, $N = 191$; Rutchick et al., 2018, Study 1).

As their predictive value for risky behaviors thus appears to be comparable to conventional future orientation constructs, measures of future self-continuity might constitute a useful complement. Similarity to, and connectedness with, or vividness of future selves are cognitive, neutral-valence constructs with a general focus, and thus do not share content overlap with outcome variables. Also,

concrete time units are specified in these constructs (mainly 10, 15 or 20 years into the future), which has been particularly recommended for future orientation measures in order to minimize the likelihood of confounding with individual difference variables such as locus of control and conscientiousness (Andre et al., 2018).

Manipulations of Future Self-Continuity

Most importantly, the future self-continuity approach opens up a possibility of direct intervention: Simple cognitive restructuring to enhance the vividness of, or the perceived similarity to and connectedness with future versions of oneself have been reported to yield positive effects on self-control-related behaviors in laboratory and field studies (see a review by Duckworth et al., 2018). Several studies have used age-processed portrait photos, some in virtual reality environments, to make future selves more visually vivid. Mere confrontation or non-domain-specific interaction with age processed avatars of future selves (as compared to avatars of present selves) led to more hypothetical savings (d [0.52,[2] 0.77], p [.023, .035], N [38, 50]; Hershfield et al., 2011, Study 1, 3A & 3B), and a lower tendency to cheat ($\phi = .25$, $p = .04$, $N = 67$; van Gelder et al., 2013, Study 2) in laboratory settings. Comparable effects have been achieved using the simpler method of writing tasks in order to make future selves more vivid, or more relatable, in participants' imaginations (Hershfield et al., 2018). For example, participants who had summarized a text suggesting that one's personal identity was largely stable (high connectedness) instead of rapidly changing with major life events (low connectedness) were more patient in a real choice situation ($\eta_p^2 = 0.04$, $p = .017$, $N = 141$; Bartels & Urminsky, 2011, Study 1), and acted more honestly in a coin flip task ($d = 0.67$,[3] $p = .014$, $N = 75$; Sheldon & Fishbach, 2015, Study 2). Similar manipulations also led to a lower tendency to advocate inappropriate negotiation strategies ($d = 0.44$, $p = .046$, $N = 86$; Hershfield et al., 2012, Study 5), and to improved educational outcomes such as better performance in a geometry task ($d = 0.46$, $p = .019$, $N = 111$; Nurra & Oyserman, 2018, Study 3).

Two studies that used a particularly straightforward letter writing task differ in their assumptions about mediating processes. In van Gelder et al. (2013, Study 1), adolescents who had written a letter to their 20-years-future selves were less likely to choose delinquent options in hypothetical dilemma situations (e.g., illegal downloading or buying stolen goods) compared to participants who had written to their three-months-future selves ($d = 0.39$, $p = .047$,[4] $N = 111$). This pattern of results suggests it is crucial for the experimental effect to write to a distant future self rather than to a near future self. The authors concluded that an increase in the vividness of a distant future self is the decisive factor to make choices that are more far-sighted. In Monroe et al. (2017, Study 1), participants who had written a letter to their 10-years-future selves reported thinking more about the future in general than

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[2] Cohen's d calculated from M and SD provided in Hershfield et al. (2011, Study 1, p. 28).
[3] Cohen's d and p-value calculated from data in Sheldon and Fishbach (2015, p. 6).
[4] Exact p-value calculated from parameters provided in van Gelder et al. (2013, Study 1, p. 3).

participants who had written to their present self reported ($d = 0.32$, $p = .029$, $N = 187$). Most notably, participants in the future condition favored less risky investment decisions in hypothetical scenarios (e.g., savings account vs. single stock of a new company), as compared to participants who had written to their present selves ($d = 0.30$, $p = .041$, $N = 187$). The groups did not differ in emotional states after the letter task. However, 74% of participants in the future condition wrote about positive experiences such as getting married, starting a family, or achieving professional success.[5] As these positive expectations did not entail optimistic behavior in terms of risky investment decisions, the authors concluded that envisioning the distant future in general goes along with envisioning desired outcomes – in doing so, you think about what is unknown, and might thus also become aware of things that could go wrong, translating into more cautious, less risky decisions. Following this rationale, it would eventually be negligible whether people imagine positive or negative future experiences during the manipulation, as both may heighten aversion to potential loss (Bulley et al., 2019).

Of course, one-off hypothetical decisions are not very impactful, and considering the intention-behavior gap, future orientation might generally be more strongly related to attitudes and behavioral intentions than to actual behavior (Andre et al., 2018). However, recent research indicates that writing a letter to future selves might have positive effects on self-reported behavior: Undergraduates who had written a letter to their 20-years-future selves exercised 1.4 times (3.66 minutes) longer in the following days than undergraduates who had written a letter to their three-months-future selves, which is a concrete and measurable impact for a minimal intervention ($M_{20years} = 12.92$, $M_{3months} = 9.26$; $B = 0.33$, 95% CI [0.05, 0.62], $SE = 0.15$, $z = 2.28$, $p = .022$, $N = 2,917$ records of 498 participants; Rutchick et al., 2018, Study 2).

In a rare longitudinal field study, van Gelder et al. (2015) used an extended and quite modern version of the letter task. An avatar Facebook page was created for each participant featuring his or her name and a digitalized picture of his or her face. The task was to reply to a message from this avatar once a day for seven days. In the experimental condition, teenagers befriended their age-morphed 15-years-future selves and responded to questions concerning the future, starting with the next year and gradually building up to 15 years in the future. Controls befriended their present selves and responded to similar messages concerning the past or present. Delinquent or deviant behavior scores decreased from baseline to follow up (two weeks later) in the future condition, but increased in the control condition (interaction time x condition: $\eta_p^2 = 0.04$, $p = .06$);[6] the relationship between condition and change in delinquency was mediated by change in vividness of the 15-years-future self from T1 to T2 (Day 8, post-manipulation; direct effect c': 0.06, 95% CI [-0.03, 0.15]; indirect effect a x b: -0.36 x -

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[5] No other information is available on further (present condition) letter content in Monroe et al. (2017, Study 1).

[6] In van Gelder et al. (2015), a reanalysis with Box-Cox-transformed delinquency scales yielded a practically identical result ($F(1, 85) = 3.77$, $p = .06$, $\eta^2 = 0.04$). Using a 10-item measure of delinquency, the significance threshold was exceeded even more clearly ($F(1, 85) = 2.06$, $p = .160$, $\eta^2 = 0.02$).

0.07, 95% CI [0.01, 0.08], final n = 87; van Gelder et al., 2015).[7] Further indications of long-term effects after manipulations of future self-continuity were found in the educational domain: Twelfth graders read a text suggesting that to adolescents, imagining oneself as an adult would either be equivalent to imagining oneself as the same person (high connectedness), or as a different person (low connectedness). The manipulation did not even include a writing task; all participants were asked to write down what they wanted to be like as adults just to ensure they did not skip the manipulation. Participants in the high connectedness condition attained better school grades after three months (d = 0.31, 95% CI [0.02, 1.62], p = .044, N = 168), but not after six month (n = 114;[8] Nurra & Oyserman, 2018, Study 4).

Related Intervention Approaches

In view of the large number of constructs and measures related to future orientation, and the broad theoretical background of multiple-self models, several related intervention approaches have been suggested to encourage far-sighted decision making. Similarities and differences between these approaches are summarized in Table 1.

Table 1

Features of Manipulations/Interventions of Future Self-Continuity and Related Approaches.

Intervention approach	Experimental conditions	Underlying processes	Reference to self/identity	Reference to outcome domain
Future self-continuity	Distant future selves vs. present/near future selves OR high vs. low future self-continuity	Future thinking, future self-continuity, temporal trade-offs	Direct	Unspecific
Episodic future thinking (EFT)	Future events vs. present/past events	Future thinking AND/OR incentives, goals, reinforcement	Indirect	Unspecific OR specific
Possible selves	Desired/undesired selves vs. unchanged selves	Incentives, goals, reinforcement	Direct	Specific
Highlighting long-term consequences	Long-term consequences (AND long-term goal setting) vs. short-term consequences OR short-term goal setting	Future thinking, temporal trade-offs	Indirect	Specific
Self-affirmation	Self-affirmation vs. "other-affirmation"	Self-relevant values, self-esteem, reactance, avoidance	Direct	Specific IF combined with information on certain risks

Manipulations of future self-continuity, as used in the studies cited above, have three common characteristics. First, the tasks differ between the experimental conditions only in their temporal reference, i.e., they address the distant future as compared to the present or near future, or high as compared to low connections between future and present selves. Thus, effects on outcome variables

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[7] In their discussion (p. 174), van Gelder et al. (2015) referred to a partial mediation; according to the result section, however, the direct path is not significant, thus the significant indirect path suggests a full mediation.
[8] No further data on the six-month follow-up are available in Nurra and Oyserman (2018, Study 4).

can be attributed to changes in temporal trade-offs. Second, the tasks directly address personal identity, i.e. in the future conditions, they require projecting oneself into the future rather than general future thinking. Such a personal component could be particularly beneficial in encouraging effects on outcome variables (e.g., Bryan & Hershfield, 2012). Third, the tasks are unspecific in that they are not related to the outcome domain, thus the manipulation is particularly subtle with low risks of demand effects (i.e., participants alter their behavior to conform to expectations, e.g., Nichols & Maner, 2008), or vice versa, reactance effects (i.e., participants alter their behavior not to conform to expectations, e.g., Brehm & Brehm, 1981).

Episodic Future Thinking

The approach most similar to manipulations of future self-continuity is experimental research on how *episodic future thinking* (EFT), i.e., vivid mental simulation of personal future experiences, relates to intertemporal choice (e.g., Atance, 2018; Atance & O'Neill, 2001; Schacter et al., 2017). Participants in the EFT condition typically describe in detail future events that they look forward to and can vividly imagine. Participants in control conditions do the same task referring to positive recent or past events (i.e., episodic [recent/past] thinking; e.g., Sze et al., 2017). Positive effects of EFT tasks have mainly been observed for delay discounting (the devaluation of reward with time until its receipt; Bulley et al., 2019) in monetary decisions, but also for several health behaviors (Schacter et al., 2017). For example, in samples of overweight or obese participants, EFT reduced energy intake ($d = 1.09$, $p = .011$, $N = 26$ women; Daniel et al., 2013; $d = 0.27$, $p = .046$, $N = 42$ children; Daniel et al., 2015), and demand of high-calorie foods, also when confronted with the negative narrative of having just been fired from one's job (η_p^2 [0.10, 0.12], $p < .001$, $N = 204$ adults; Sze et al., 2017, Study 2). Similarly, EFT reduced demand intensity for alcoholic drinks in alcohol-dependents (comparing curve fits: $\eta_p^2 = 0.03$,[9] $p < .001$, $N = 50$; Snider et al., 2016), demand intensity for cigarettes in smokers ($\beta = 0.19$, $p = .049$, $N = 117$; Stein et al., 2018), as well as the number of cigarette puffs in smokers ($d = 0.58$, $p = .029$, $N = 42$; Stein et al., 2016).

Notably, in a pre-registered and high-powered study ($N = 297$; Bulley et al., 2019) controlling for age, gender, and baseline affect, both positive and negative EFT reduced monetary discount rates (semi-partial r^2 [.04, .06], $R^2 = .09$, $p < .01$). The manipulation did not reduce risk-taking measured with a balloon inflation task, which indicates that effects only occur if the outcome variable includes intertemporal trade-offs (Bulley et al., 2019). Some findings suggest that EFT effects are more pronounced, or occur only, if the simulation is domain-specific (e.g., food-related; Dassen et al., 2016). In these studies, however, changes in behavior cannot clearly be attributed to generic changes in future orientation due to non-specific control tasks (Schacter et al., 2017). For example, participants who had engaged in EFT about personal health goals, or "ideal" selves, were compared to controls

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[9] η_p^2 calculated from ANOVA on initial purchase behavior estimates (Q_0) for alcoholic drinks (Snider et al., 2016, p. 4): $F(1, 513) = 14.93$, $p < .001$. $\eta_p^2 = (F * df1) / ((F * df1) + df2) = 14.93 / (14.93 + 513) = 0.03$; formula retrieved from Richardson (2011).

who had been reflecting on any kind of recent enjoyable habits (O'Neill et al., 2016), or personal or non-personal life events (Wu et al., 2017, Study 2). Theoretically, these studies can therefore instead be assigned to the account of *possible selves*.

Possible Selves

In this field of research, hoped for or feared future selves are assumed to motivate self-control, mainly with regard to delinquency (e.g., Markus & Nurius, 1986; Oyserman & Markus, 1990; Paternoster & Bushway, 2009; Silver & Ulmer, 2012; Wainwright et al., 2018). Experimental studies have been conducted mainly in the health domain, again. Participants in the experimental condition are typically confronted with avatars of desirable (e.g., weight-reduced, athletic) or non-desirable avatars of future selves, or write about such future selves, while comparison groups either deal with unchanged selves, or do unrelated tasks. Effects have been found regarding food intake (e.g., d [0.29, 0.35], $p \leq .007$, $N = 76$; Kuo et al., 2016) and physical activity (e.g., d [0.11, 0.27], $p \leq .02$, $N = 76$; Fox & Bailenson, 2009; d [0.45, 0.71], $p \leq .057$, $N = 80$; Murru & Martin Ginis, 2010; r [.15, .20], $p \leq 07$, $N = 152$; Ouellette et al., 2005). Such manipulations address effects of domain-specific incentives, goals, and reinforcement rather than mere temporal perspective shifts (which then are assumed to have subtle, self-reinforcing effects on goal-setting processes, as with the future self-continuity approach).

Highlighting Long-Term Consequences

A manipulation that explicitly addresses temporal trade-offs was used by Sjåstad (2019). Participants who had been instructed to think about the future benefits of their choices in subsequent hypothetical decisions on generosity reported being more focused on the future than did participants who had been instructed to focus on immediate benefits (Study 3: in 94.5% of the cases, $N = 500$; Study 1 & 2: $p < .001$, d [1.09, 4.63], N [200, 410]). In particular, participants with an induced future focus were more concerned about their reputation (d [0.63, 0.70], $p < .001$), which mediated the relationships between the temporal focus and the willingness to donate money (indirect effect a x b: 1.29 x 6.54, $p < .001$; direct effect c': 0.96, $p = .711$) and to volunteer for charity (indirect effect a x b: 1.18 x 0.51, $p < .001$; direct effect c': 0.22, $p =.308$; final $n = 472$; Sjåstad, 2019, Study 3).

Hall and Fong (2003) developed a more directive intervention that included information on domain-specific temporal trade-offs. Undergraduates who had signed up for fitness classes took part in three half-hour weekly learning sessions and activities to illustrate how long-term benefits outweigh the short-term costs of physical activity. These participants were compared to participants in a goal-setting condition that differed only in that it did not address a long-term time perspective, and to non-treatment controls. Participants in the long-term condition tended to show the greatest average increase in hours of physical activity after a six-month follow-up interval (vs. goal setting: $d = 0.70$, $p = .023$, $n = 56$; vs. non-treatment: $d = 0.21$, $p = .499$, $n = 46$). Directly after the intervention, however, there were no differences between conditions (vs. goal setting: $d = 0.27$, $p = .317$, $n = 56$; vs. non-

treatment: $d = 0.30$, $p = .318$, $n = 46$; Hall & Fong, 2003, Study 2).[10] These approaches that highlight long-term consequences of certain behaviors thus indicate one way of how people could benefit from temporal perspective shifts. Such interventions likely presuppose that people feel motivated and able to confront problem behavior at the time of the intervention; in the health domain, however, resistance to information on (un)healthy behavior is common, particularly among risk groups (e.g., G. L. Cohen & Sherman, 2014; Epton et al., 2015). Therefore, subtle, unspecific interventions such as on future self-continuity might constitute a useful, low-effort alternative.

Self-Affirmation

Self-affirmation interventions are subtle, minimal manipulations that are not genuinely related to future orientation but, like manipulations of future self-continuity, directly address personal identity. According to Self-Affirmation Theory (Steele, 1988), (re-)focusing on personal resources helps to deal constructively with self-esteem-threatening issues (e.g., G. L. Cohen & Sherman, 2014; van Koningsbruggen et al., 2009). In self-affirmation conditions, participants are typically instructed to write about core personal values, important personal strengths, or valued relationships. For example, they are presented with a list of values from which they should select the one most important to them and told to write a short essay explaining why this value has been important in their own life. Controls do the same task, but reflect upon the importance of values to other people (e.g., Napper et al., 2009). Subsequently, all participants are confronted with information on the risks associated with the behavior to be changed. As such messages imply criticisms of one's behavior, they represent a threat not only to future well-being, but also to self-adequacy (for a review of self-affirmation interventions, see McQueen & Klein, 2006). Empirical findings suggest that affirming the self helps processing such information, e.g., in terms of less avoidance of health-related worries, so that behavioral changes are more likely to occur. In a meta-analysis on various health problems, Epton et al. (2015) found that self-affirmation interventions promoted health message acceptance ($d = 0.17$, CI [0.03, 0.31], $p < .001$, $N = 3,433$, $k = 34$), intentions to change ($d = 0.14$, CI [0.05, 0.23], $p < .001$, $N = 5,564$, $k = 64$), and change in behavior even more so ($d = 0.32$, CI [0.19, 0.44],[11] $p < .001$, $N = 2,715$, $k = 46$). In the educational domain, however, a recent large-scale replication study speaks against the effectiveness of self-affirmation (d [<-0.01, 0.10], p [.013, .363], $N = 499$; Hanselman et al., 2017).

For the present research, the self-affirmation account is relevant from the perspective that subtle, minimal interventions could encourage more responsible and constructive behavior. Moreover, the core principle of self-affirmation also applies in the letter task (Monroe et al., 2017, Study 1; Rutchick et al., 2018, Study 2; van Gelder et al., 2013, Study 1) and similar interventions on future self-continuity (e.g., van Gelder et al., 2015): Participants are instructed to write about self-relevant values ("topics that are/will be important and dear to you/your future self"). Connections between personal

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[10] Cohen's d and p-values calculated from M and SD provided in Hall and Fong (2003, Study 2, p. 699).

[11] According to Epton et al. (2015), the higher effect size for behavior than for intentions might indicate that self-affirmation directly affects behavior that is not reflective, and that impacts on intentions may be delayed.

values and future orientation have long been discussed. According to Lewin (1948), for example, people are likely to be future-oriented if they feel that a highly valued goal is accessible to them, but a belief that the goal is beyond their reach restricts them to a present orientation (Barndt & Johnson, 1955). Research on Construal Level Theory suggests that distant future construal enhances how people's behavioral intentions match their core values (Eyal et al., 2009; for detailed considerations on future self-continuity and construal levels, see Rutchick et al., 2018). Also, according to Monroe et al. (2017), thinking about the distant future draws attention to desired experiences. Therefore, if topics and self-affirmation strategies differ depending on whether people communicate with their future or present selves, this could hint at (further) processes behind manipulations of future self-continuity. Such tasks might make people realize their core values will persist, strengthen their self-esteem, and help recognizing how each action fits into the "bigger picture" (Rutchick et al., 2018, p. 78).

Starting Point of the Present Research

Overall, numerous findings on future orientation and related accounts suggest that manipulations of future self-continuity might have the potential to be used as a *wise intervention*, i.e., "to alter a specific way in which people think or feel in the normal course of their lives to help them flourish" (Walton, 2014, p. 73). The approach is theoretically grounded, low-threshold, cost- and time-effective, and therefore particularly interesting for practitioners. Decisions seem to be influenced by subtle, non-specific metacognitive cues (Bartels & Urminsky, 2011), thus manipulations could at no expense be applied to any type of self-defeating behavior that implies intertemporal trade-offs (van Gelder et al., 2015). Tasks such as writing a letter to one's future self take only a few minutes, and if behavioral changes can be achieved without the participants even being aware of the intervention (or at least its intention; e.g., Rutchick et al., 2018; van Gelder et al., 2013), the risk of reactance or demand effects is particularly low. Rare longitudinal data suggest that effects of increased future self-continuity need boosters over time but may last over some weeks at least (Nurra & Oyserman, 2018, Study 4; van Gelder et al., 2015). It is thus conceivable that with feeling more strongly connected to your future self, it might become a personal rule or habit to act in your best long-term interest (Duckworth et al., 2018; Rutchick et al., 2018). If strengthening connections to one's distant future self might thus nudge self-reinforcing processes to improve people's outcomes in diverse circumstances, the paradigm could also complement more complex intervention programs and serve as a basis for the development of more comprehensive and/or more elaborate interventions.

In order to tap the full potential of the intervention, and to avoid unfavorable outcomes, however, a more precise understanding of the underlying processes and boundary conditions is necessary (Walton, 2014). Researchers have used various definitions of future self-continuity (Rutchick et al., 2018), mainly *vividness*, *connectedness*, and *similarity*, but only a few studies contain manipulation checks. Van Gelder et al.'s (2015) one-week intervention led to change in scores on a six-item vividness scale, which mediated intervention effects on delinquency. Bartels and Urminsky (2011)

demonstrated that the association between their manipulation and patience was distinct from uncertainty of future preferences, positive/negative affect, different trait measures of future time perspective, and self-control. Sheldon and Fishbach (2015, Study 2) found increased similarity between present and future selves in the "high connectedness" condition. Monroe et al. (2017), on the other hand, claimed that the letter task manipulation is about inducing future thinking in general. Their findings also suggest that contemplating one's distant future draws attention to self-relevant values. However, the extent to which *self-affirmation* strategies (e.g., G. L. Cohen & Sherman, 2014) could play a role in the letter task and similar accounts has not been examined yet. Moreover, different time units have been used for future and control conditions, and it is also unclear how deviations in instructions, or in completing the task, might be relevant.

The first question to be asked, however, is whether manipulations of future self-continuity actually do have relevant and robust effects on risky decisions. Doubts are warranted in this respect as many of the cited studies find small to moderate effects in relatively small samples. Figure 1 displays the *p*-curve, i.e., the distribution of all statistically significant *p*-values ($p < .05$), across 14 studies that aim to manipulate future self-continuity in order to enhance self-control-related behavior (see p. 16ff., Appendix A).

Figure 1

p-Curve Across 14 Studies that Aimed to Manipulate Future Self-Continuity in Order to Enhance Self-Control-Related Behavior.
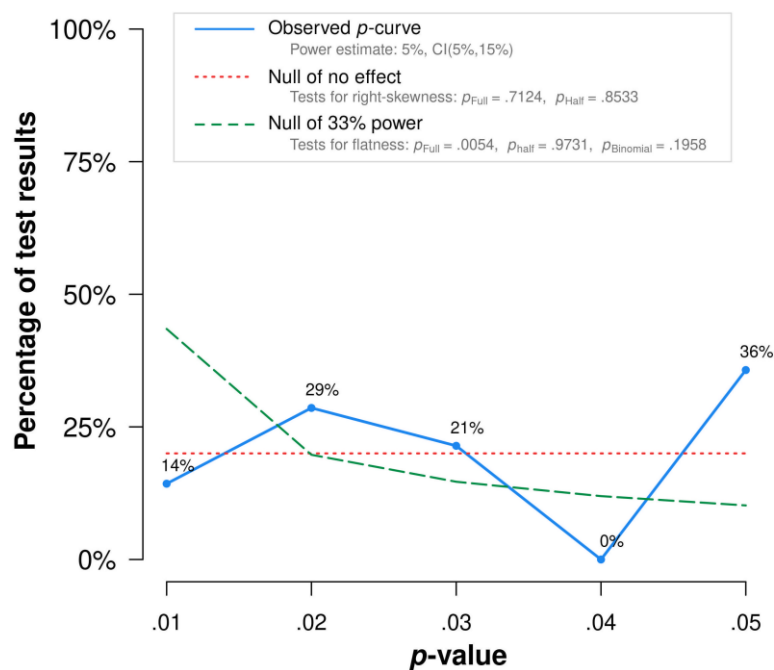
Note. The observed *p*-curve includes 14 statistically significant ($p < .05$) results, of which eight are $p < .025$. p_{Full} = full *p*-curve ($ps < .05$), p_{Half} = half *p*-curve ($ps < .025$), $p_{Binomial}$ = binomial test (share of results $p < .025$). Figure via http://www.p-curve.com/app4/ (Simonsohn et al., 2017). Inclusion criteria and detailed results on the studies included are provided in Appendix A.

The shape of the curve is a function of the effect sizes and sample sizes of the studies included. If the null hypothesis (H_0) is true, i.e., an effect is non-existent, every *p*-value is equally likely to be observed, as indicated by the flat, dotted (red) line. If an effect exists, the distribution is right-skewed and becomes steeper with increasing effect sizes. In case of *p*-hacking or other questionable research practices (QRP), i.e., if non-significant results are deliberately or unintentionally pushed below the significance threshold of $p = .05$, a disproportionate share of high *p*-values ($\geq .025$) is to be expected, which can lead to left-skewed curves (Simonsohn et al., 2014, 2015).

For the studies examined, *p*-curve analysis via the *p*-curve app 4.06 (Simonsohn et al., 2017) indicated that the distribution was not right-skewed (full curve: $z = 0.56$, $p = .712$), and flatter than one would expect if studies were powered at 33% (dashed green line; full curve: $z = -2.55$, $p = .005$) – which calls into question the evidential value of the results. If manipulations on future self-continuity indeed have effects on risky behavior, the sample sizes used so far (*Mdn* = 87.00, *M* = 96.13, *SD* = 43.83, range = 38-187])[12] have not been sufficient to detect such effects. At least, the observed *p*-curve was not significantly left-skewed ($z = -0.56$, $p = .288$), which would indicate intense *p*-hacking or other QRP (Schönbrodt, 2018).

The interpretability of the *p*-curve analysis is limited by the small number of studies included, as well as by differences between studies regarding manipulations/interventions, sample characteristics, outcome measures, and time frames. Two of the studies included use comparable manipulations, i.e., writing letters to distant future selves (vs. present/near-future selves), and comparable outcome measures, i.e., hypothetical decisions (Monroe et al., 2017, Study 1; van Gelder et al., 2013, Study 1). Results of both studies indicate small to medium effects (*d* [0.30, 0.39]) with *p*-values just below the significance threshold of $\alpha = .05$, resulting in actual statistical power of 52% or 54%. Given a possible small true effect of $d = 0.30$, the probability to observe a significant effect with these studies' sample sizes was at 53% (for $N = 187$; Monroe et al., Study 1), or at 35% (for $N = 111$; van Gelder et al., 2013, Study 1).[13] The reported effects might thus be false positives, or substantially overestimate true effects (e.g., Colquhoun, 2014; Lindsay, 2015; Simonsohn et al., 2014).

Then again, the letter task constitutes a particularly brief and straightforward manipulation, thus even small effects would be promising. As no visual component such as age-processed avatars of future selves is required, it can be carried out at any time and place. Also, the letter task produced a measurable impact on general future thinking in a manipulation check (Monroe et al., 2017, Study 1), and there are at least indications that effects could spill over to different outcome domains, i.e., not only to delinquent and financial decisions, but also health-related decisions (Rutchick et al., 2018, Study 2).

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[12] Excluding Rutchick et al. (2018, Study 2), which estimated minutes of exercise per day in a multilevel model from $N = 2917$ records of 498 participants.

[13] Power calculations for independent-samples *t*-tests, two-sided, $\alpha = .05$.

Therefore, it seemed advisable to check the effects' robustness in direct, sufficiently powered replication attempts, regarding delinquent decisions (van Gelder et al., 2013, Study 1), and risky investment decisions (Monroe et al., 2017, Study 1), which are presented in Study 1 and 2 of the present research. In the second part of the present research, variations of the letter task are examined with respect to longer-term effects on several unhealthy behaviors: In a conceptual replication attempt on van Gelder et al.'s (2015) longitudinal study on self-reported delinquency (Study 3), and in a systematic comparison of brief future self-continuity and self-affirmation interventions over four weeks (Study 4). The research questions that were addressed in all studies are illustrated in Figure 2. Specifically, can brief writing tasks on future selves reliably alter 1) behavioral choices in self-control-related outcome measures, and 2) aspects of future orientation, in particular continuity with future selves? If so, are effects on outcome variables mediated by changes in future self-continuity, or by alternative underlying processes?

Figure 2

Mediation Model of the Relationships Tested in the Present Research.
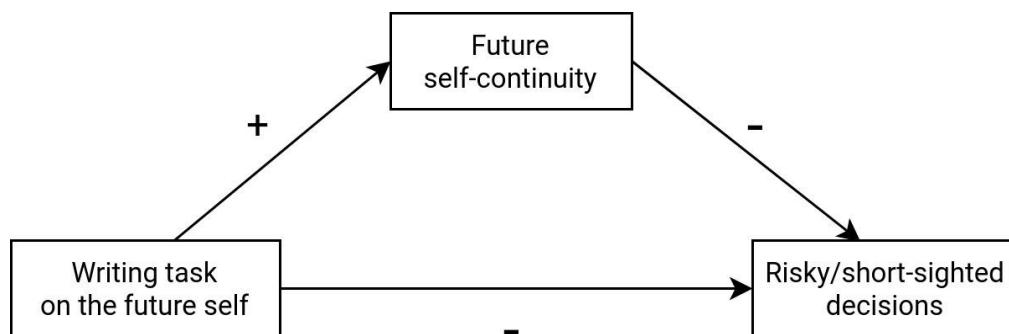
Note. Future self-continuity is operationalized via self-report scales on vividness of (Study 1-4), connectedness with (Study 1 & 2), and similarity to (Study 1) the distant future self.

Replication Attempts on Future Self-Continuity, Delinquent Decisions, and Risky Investments

The aim of conducting two direct replication attempts on van Gelder et al. (2013, Study 1) and Monroe et al. (2017, Study 1) was, as a first step, to examine the practical relevance of the letter task paradigm in two different outcome domains. To ensure transparency in our[14] procedure and analyses, the studies were pre-registered in the Open Science Framework (OSF). The pre-registrations,[15] materials, and detailed information on data analyses are available in Appendix B-E, data sets and syntax files can be provided on request. Measures and analyses supplementing the pre-registrations are explained in detail in the following sections.

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[14] The direct replication attempts have been accepted for publication (preliminary reference: Quinten, L., Murmann, A., Genau, H., Warkentin, R., & Banse, R. (in press). Letters to our future selves? High-powered replication attempts question effects on future orientation, delinquent decisions, and risky investments. *Social Cognition*. Penultimate draft, June 2020. For this reason, I refer to "we" when reporting on Study 1 and Study 2.

[15] Weblinks to pre-registrations: https://osf.io/mcd2g/ (Study 1) and https://osf.io/q7yuv/ (Study 2).

To achieve direct comparability, all items and instructions were obtained from the authors of the original studies who kindly provided all materials. The replication studies deviated from the original experimental procedures only in that the participants were recruited from the Prolific Academic (ProA)[16] participant pool instead of via Amazon Mechanical Turk (MTurk)[17], as MTurk registration for requesters from outside the United States had not yet been possible. ProA also offers advantages in terms of usability (e.g., flexible prescreening) and data quality, and systematic differences between the two platforms with regard to potentially biasing demographics such as education and ethnicity are not to be expected (Peer et al., 2017). In order to obtain informative replication results, we followed the recommendation of Simonsohn (2015) and aimed for replication samples 2.5 times the size of the original samples, taking into account that published effect sizes are often inflated because of power issues and publication bias. Due to settings in ProA, the samples in both replication studies were slightly larger than pre-registered. The probability in the replication attempts to detect a possible small true effect of $d = 0.30$ was at 75% (for $n = 314$, Study 1), or at 90% (for $N = 463$, Study 2).[18]

For the evaluation of replication success, we first applied the respective analyses of the original studies to the new data and compared the results. To consider sampling error and to avoid the interpretation problems of conventional significance testing, the analyses on the main effects, i.e., the relationship between the letter task condition and delinquent decisions or risky investment decisions, respectively, were supplemented with 1) comparisons of confidence intervals to examine whether the replication effects are among the potential true values that could have led to the effects observed in the original studies (Stanley & Spence, 2014), 2) the "small telescope" approach to test whether the replication effect sizes are larger than the smallest effects that could have been detected with the respective original sample size (Simonsohn, 2015), and 3) Bayesian replication tests on whether the replication effect sizes are comparable or not comparable to the respective original effect size, or whether they are not different from zero (Verhagen & Wagenmakers, 2014; Appendix E).

The second aim of the direct replication attempts was to examine processes underlying the letter task as well as its boundary conditions, since the original studies are based on different theoretical perspectives. We added a third experimental condition (Study 1), and several measures that might be relevant to understanding how and under which conditions letter task manipulations work or work best. We tested for group differences in demographics (randomization check), measures of future self-continuity (manipulation check), and related traits (self-control, future time perspective; Study 2), as well as for overall correlations. All newly added materials were presented after the original materials to prevent any interference. Supplementing the pre-registered analyses, the content of the letters was analyzed to explore whether individual differences in writing styles affected the results. Specifically, we looked at whether the task was processed seriously, whether the future self was addressed

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[16] https://www.prolific.co/

[17] https://www.mturk.com/

[18] Power calculations for independent-samples t-tests, two-sided, $\alpha = .05$.

personally (i.e., "Dear [future] self," "you"), what temporal focus was used (i.e., whether the participants wrote about the present only, both present and future, or the future only), to what degree self-affirmation was expressed, and what topics/values were addressed. A total of 936 letters over both replication studies were divided among six independent raters. A sample of 240 letters (26%) were rated twice, thus each rater had 80 letters that were also rated by one other rater. Cohen's K as measure of agreement ranged between $K = .61$ and $K = 1.00$. Cases of disagreement were discussed and resolved by consensus. The rating variables were also tested for group differences and relationships with other variables to obtain a more comprehensive picture of possible moderators and mediators of the letter task effect. Detailed information on the coding procedure, example letters, and all Cohen's K are available in Appendix D.

Study 1: Direct Replication of van Gelder et al. (2013, Study 1)

In the first direct replication attempt, it was examined whether the letter task had a relevant effect on hypothetical delinquent decisions (van Gelder et al., 2013, Study 1), and if so, whether this effect was mediated by vividness of the 20-years-future self and/or other measures of future self-continuity.

Sample

Sample characteristics of the original study and Study 1 are shown in Table 2. For the replication attempt, ProA prescreening filters were used to achieve a comparable age range and gender ratio.

Table 2

Sample Characteristics of van Gelder et al. (2013, Study 1) and Study 1.

	van Gelder et al. (2013, Study 1)	Study 1
Excluded participants (letter task not completed)	3	1
Final sample	$N = 111$	$N = 473$
Reward	$0.30	£1.20 (~ $1.57)[a]
Gender	Approx. balanced[b]	50% female, 48% male, 2% other
Age (years)	$M = 22.80$ (SD --), range = 20-25	$M = 22.00$ ($SD = 1.49$), range = 18-26
Education	--	71% college/university, 27% high school
Experimental conditions (letter task)	three-months future ($n = 55$) vs. 20-years future ($n = 56$)	one-week future ($n = 159$) vs. three-months future ($n = 168$) vs. 20-years future ($n = 146$)

Note. [a] Reward per hour £5.54; estimated completion time 13 min (actual completion time 8.15 min); [b] personal message by the first author of the original study.

Design and Procedure

The original study suggested that writing to one's distant future self (20 years) reduces the tendency to make delinquent decisions in the present. The control group wrote to their near future selves (three months), indicating that the effect cannot be explained by writing to oneself *sometime* in the future;

differences in delinquency scores can rather be attributed to writing to the *distant* future self (Rutchick et al., 2018; van Gelder et al., 2013). In the replication attempt, we added a third experimental condition, with participants writing letters to their *very-near-future* selves (one week). In order to test the mediation hypothesis that is formulated only theoretically in the original study, we then added measures of future self-continuity. Overall, we expected 1) delinquency scores in the 20-years condition to be significantly lower than in the three-months condition *(replication hypothesis)*, 2) a monotonic decrease in delinquency scores over the three conditions, from the one-week condition to the three-months condition to the 20-years condition, and 3) continuity with the 20-years-future self to be higher in the 20-years condition than in the two other conditions *(manipulation check)*.

Participants read a cover story indicating that the research was about how people see themselves in the future. They were randomly assigned to one of the three conditions and were first instructed to write a 200- to 300-word letter to their (one-week-, three-months-, or 20-years-) future selves. As in the original study, the instructions were ambiguously formulated regarding the temporal focus, i.e., it was unclear whether one should describe to one's three-months-/20-years-future self what the present was like, or how one imagined the future (Appendix D). Next, we presented van Gelder et al.'s (2013, Study 1) five delinquent-choice dilemma scenarios on theft, insurance fraud, illegal downloading, and buying stolen goods. The participants rated on a seven-point scale how likely it was that they would choose the delinquent behavioral option. A total delinquency score was calculated from the mean values of the items, with higher values indicating an increased tendency to make delinquent decisions ($\alpha = .56$ with three conditions or $\alpha = .53$ with two conditions; vs. $\alpha = .69$ in van Gelder et al., 2013, Study 1).

Following the measures of the original study, we assessed three different measures of future self-continuity. *Similarity* between the present and the 20-years-future self (similarity$_{20}$) was assessed with two reversely poled items to rate on a seven-point scale ("I perceive me and my future self as"… "one and the same person," "two different people"), and a slider to be positioned between the poles "one and the same person" and "two different people," whereby answers were linearly transformed onto a seven-point scale. A total score was calculated from the mean values, with higher values indicating a greater similarity between the present- and the 20-years-future self ($\alpha = .92$). *Vividness* of the 20-years-future self (vividness$_{20}$) was assessed with five items adopted from van Gelder et al. (2015),[19] e.g., "I find it easy to imagine myself 20 years from now," rated on a five-point scale, with higher values reflecting a more vivid picture of the 20-years-future self ($\alpha = .92$). To assess *connectedness* with the 20-years-future self (connectedness$_{20}$), eight items were generated, e.g., "I feel connected to myself 20 years from now." Again, participants indicated their agreement on a five-point scale. After

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[19] Translated from Dutch into English; in van Gelder et al. (2015), a sixth vividness item consisted of five images of a face with an emotionally neutral expression that grew increasingly vague. Participants rated which of the pictures best reflected their image of their own future self. In the present research, we did not use this item as we considered a visual component unnecessary.

excluding one item with a low item-total correlation ($r = .10$), the internal consistency increased from $\alpha = .69$ to $\alpha = .73$. Therefore, the total score was calculated from the remaining seven items, with higher values reflecting a stronger connection to the 20-years-future self. Finally, participants stated their gender, age, and highest educational level. The pre-registration and all instructions and measures of Study 1 are listed in Appendix B and C. After data collection, the content of the letters was rated for exploratory analyses (see Appendix D).

Results

Evaluation of Replication Success. All results concerning the experimental conditions and variables assessed both in the original study and Study 1 are listed and compared in Table 3. Regarding differences in delinquent decisions between the three-months and 20-years conditions, the original study reported a significant t-test ($t(109) = 2.01$, $d = 0.39$, 90% CI [0.07, 0.70], 95% CI [0.01, 0.76], $p = .047$, $N = 111$). In the replication study, the three-months and 20-years conditions did not differ significantly ($t(312) = 1.49$, $d = 0.17$, 90% CI [-0.02, 0.36], 95% CI [-0.05, 0.39], $p = .137$, $n = 314$). Bayesian analysis resulted in a Bayes Factor (BF_{10}) of 0.36, thus the H_0 was $BF_{01} = 1/0.36 = 2.78$ times more likely than the model with a main effect of condition. The length of the letters differed between the groups in the replication study but not in the original study (Table 3). Therefore, we controlled for the number of words in the letters, which did not have a critical impact on the group differences in delinquent decisions ($F(1, 311) = 1.22$, $\eta_p^2 < 0.01$, $p = .269$).

Table 3

Comparisons of Results of van Gelder et al. (2013, Study 1) and Study 1.

	van Gelder et al. (2013, Study 1) $N = 111$			Study 1 $N = 314$			Between-study d (p)
	3-months M (SD)	20-years M (SD)	Between-condition d (p)	3-months M (SD)	20-years M (SD)	Between-condition d (p)	
No. of words letter task	--	--	n.s.	126.70 (52.82)	152.81 (59.90)	-0.46 ($< .001$)	
	Overall $M = 151$ (SD = 73)			Overall $M = 138.84$ (SD = 57.63)			0.18 ($< .001$)
Delinquent decisions (1-7)[a]	3-months M (SD)	20-years M (SD)	Between-condition d (p)	3-months M (SD)	20-years M (SD)	Between-condition d (p)	
Theft 1	4.32 (2.10)	3.92 (2.07)	0.19 (.32)	4.43 (2.06)	4.47 (2.04)	-0.02 (.849)	
Theft 2	4.72 (1.83)	3.92 (2.18)	0.40 (.04)	4.38 (2.07)	4.18 (2.12)	0.10 (.407)	
Insurance fraud	3.45 (2.10)	3.29 (2.06)	0.08 (.70)	3.33 (2.10)	2.90 (1.94)	0.21 (.066)	
Buying stolen goods	3.22 (1.98)	2.98 (2.05)	0.12 (.54)	3.20 (2.03)	3.12 (2.00)	0.04 (.729)	
Illegal downloading	5.43 (1.77)	4.45 (2.04)	0.51 (.01)	5.66 (1.57)	5.33 (1.96)	0.19 (.102)	
Total scale	4.23 (1.24)	3.71 (1.45)	0.39 (.05)	4.20 (1.18)	4.00 (1.16)	0.17 (.137)	
	$\alpha = .69$ Overall $M = 3.97$ (SD = 1.35)			$\alpha = .53$ Overall $M = 4.11$ (SD = 1.17)			-0.11 (.039)

Note. [a] Higher scores indicate higher self-reported likelihood of choosing the delinquent behavioral option(s).

Comparison of Confidence Intervals. As the 90% and 95% confidence intervals of the original study effect and the replication effect overlap, the replication effect is one of the potential true values that could have led to the effect observed in the original study (Figure 3). It is thus possible that the replication effect – although not significant – is based on a small true effect, and that the sampling error could explain the differing results (Stanley & Spence, 2014).

Figure 3

Letter Task Effects on Delinquent Decisions, Comparing the Original Study (van Gelder et al., 2013, Study 1) and Replication Study 1.
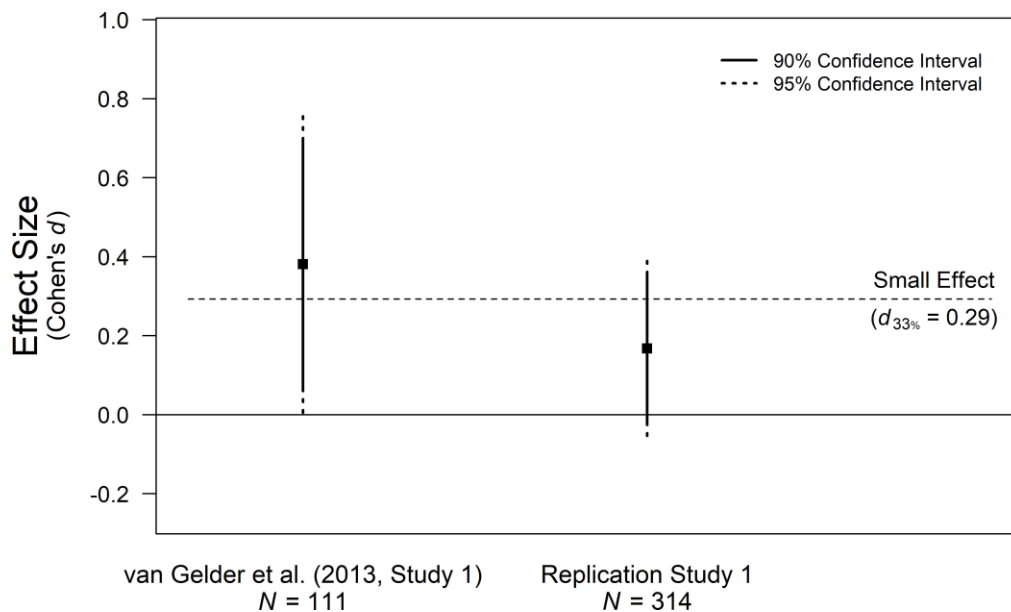
Note. The markers indicate effect size estimates, and the vertical bars their confidence intervals. The dashed line indicates the effect size that would give the original study ($N = 111$) 33% power. See Simonsohn (2015) and Appendix E for the calculations behind this figure.

"Small Telescope" Test. In this approach, studies powered below 33% are considered to be severely underpowered, thus a "small effect" is defined as one that would give 33% power to the original study ($d_{33\%}$; Simonsohn, 2015). The effect that would have led to a power of 33% in van Gelder et al. (2013, Study 1) was $d_{33\%} = 0.29$, i.e., the original study had 33% power to detect an effect with an effect size of $d_{33\%} = 0.29$. The 90% and 95% confidence intervals of the replication study contained this small effect (Figure 3). The significance test based on the non-central t-distribution with H_0: $d_{\text{Replication}} = d_{33\%}$ and H_1: $d_{\text{Replication}} < d_{33\%}$ was not significant ($t(312) = 1.49$, ncp[20] $= 2.59$, $p = .136$). The effect of the replication study was not smaller than $d_{33\%}$, thus large enough to have been detectable with the original sample size, and the sampling error alone might account for the smaller replication effect size. As indicated by the p-value, the probability that a t-test with the replication study sample size ($n_1 = 146$, $n_2 = 168$) with a true effect of $d_{33\%} = 0.29$ would result in an effect equal

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[20] Calculation of the noncentrality parameter in Study 1: ncp($d_{33\%}$) = sqrt($n_1 * n_2 / (n_1 + n_2)$) * 0.29 = 2.59.

to or smaller than the effect of the replication study ($d = 0.17$) was 14%; if $d_{33\%} = 0.29$ were the true effect, an effect size equal to or smaller than the replication effect size would still be observed in 14% of the cases.

Bayesian Replication Test. As indicated by the overlapping dots (Figure 4), neither the posterior nor the prior distribution assigned more mass to $d = 0$, i.e., the data of the replication study neither increased nor decreased the credibility of the H_0. The Bayesian replication test yielded $BF_{r0} = 0.98$, thus both hypotheses were equally likely; there was no support for or against the hypothesis of equal effects (Verhagen & Wagenmakers, 2014).

Figure 4

Results from the Bayesian Replication Test Applied to van Gelder et al. (2013, Study 1) and Study 1.
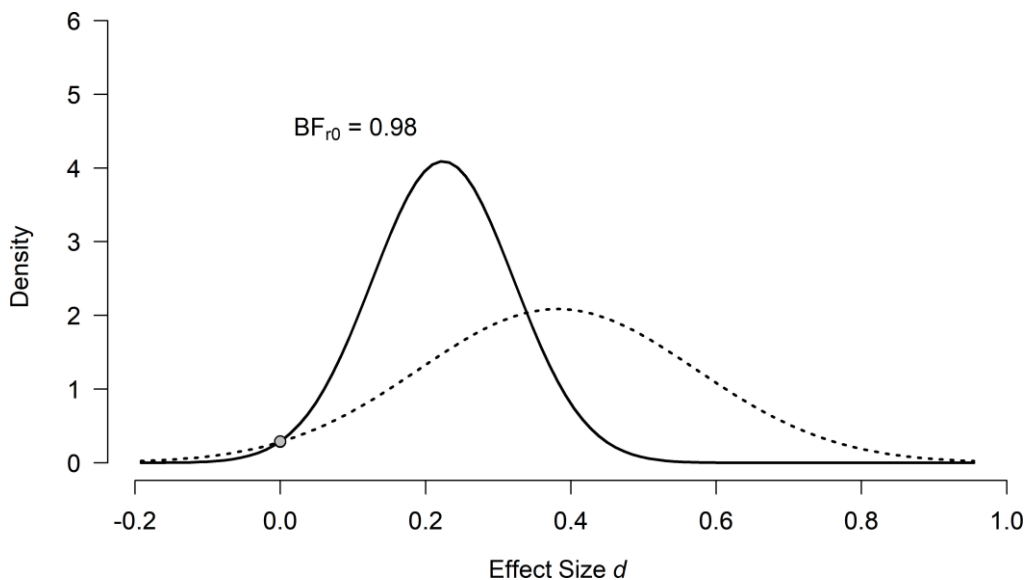
Note. The dotted line represents the posterior distribution from the original study, which is used as prior for effect size in the replication test. The solid line represents the posterior distribution after the data from Study 1 are taken into account. The gray dots (here: overlapping) indicate the ordinates of this prior and posterior at H_0 that the effect size is zero. The ratio of these two ordinates gives the result of the replication test. See Verhagen and Wagenmakers (2014) and Appendix E for the calculations behind this figure.

Additional Results. After the content analysis of the letters, four further cases were excluded since they had not completed the letter task correctly. Three of these cases were in the additional experimental condition (one-week future), and excluding one case from the 3-months condition had no impact on the results of previous analyses.[21] In all following analyses, the additional experimental condition (one-week future) was included. Spearman correlations or Phi/Cramer's *V* coefficients for

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[21] For $n = 313$: Difference in delinquency total scores between the 3-months and the 20-years conditions: $t(311) = 1.44$, $d = 0.16$, 90% CI [-0.02, 0.35], 95% CI [-0.06, 0.39], $p = .150$, $BF_{10} = 0.34$; controlling for number of words in the letters: $F(1, 310) = 1.16$, $\eta_p^2 < .01$, $p = .283$; "small telescope" test: $d_{33\%} = 0.29$; $t(311) = 1.44$, ncp = 2.59, $p = .126$; Bayesian replication test: $BF_{r0} = 0.89$.

all measures of Study 1 are listed in Table 4. All three measures of future self-continuity were positively intercorrelated, though vividness$_{20}$ and connectedness$_{20}$ were associated more strongly with each other ($z = 0.46$, 95% CI [0.37, 0.55]) than with similarity$_{20}$, respectively (vividness$_{20}$ − similarity$_{20}$: $z = 0.21$, 95% CI [0.12, 0.30]; connectedness$_{20}$ − similarity$_{20}$: $z = 0.18$, 95% CI [0.09, 0.27]).

Main Effect with Third Condition. In analysis of variance (ANOVA) with three experimental conditions, there were still no differences in the overall delinquency score ($F(2, 466) = 1.10$, $\eta_p^2 = 0.01$, $p = .333$, nor in any of the single dilemma scenarios ($\eta_p^2 \leq 0.01$, $p = [.184, .942]$).[22] The default BF test for the total score resulted in BF$_{10} = 0.07 \pm .02\%$, i.e., the H$_0$ was BF$_{01} = 1/0.07 = 14.29$ times more likely than the model with an effect of condition. There were no indications of the expected monotonic decrease in delinquent choices from the very near future condition to the distant future condition (one-week condition: $M = 4.04$, $SD = 1.29$; three-months condition: $M = 4.19$, $SD = 1.18$; 20-years condition: $M = 4.00$, $SD = 1.16$), and again, controlling for the number of words in the letters had no impact on the results ($F(2, 465) = 0.89$, $\eta_p^2 < 0.01$, $p = .410$).

Randomization Check. The randomization was successful, as the participants in the experimental conditions did not differ in age ($F(2, 466) = 0.24$, $\eta_p^2 < 0.01$, $p = .789$), gender[23] ($\chi^2(2) = 1.76$, $V = .06$, $p = .417$), or education ($\chi^2(6) = 4.22$, $V = .07$, $p = .722$), and demographics were not considerably associated with other variables (Table 4).

Manipulation Check: Change in Future Self-Continuity. In ANOVAs on measures of future self-continuity, the three conditions did not differ in similarity$_{20}$ ($F(2, 466) = 2.86$, $\eta_p^2 = 0.01$, $p = .058$), but did differ in vividness$_{20}$ ($F(2, 466) = 10.11$, $\eta_p^2 = 0.04$, $p < .001$), and connectedness$_{20}$ ($F(2, 466) = 5.44$, $\eta_p^2 = 0.02$, $p = .005$). Regarding the comparison of the original study, i.e., between the 20-years and the three-months conditions, the expected differences were found: Scores were higher in the 20-years condition (vividness$_{20}$: $M = 2.73$, $SD = 1.03$; connectedness$_{20}$: $M = 3.59$, $SD = 0.61$) than in the three-months condition (vividness$_{20}$: $M = 2.24$, $SD = 0.93$; $t(311) = 4.47$, $d = 0.50$, 95% CI [0.28, 0.73], $p < .001$, BF$_{10} = 1384.46$; connectedness$_{20}$: $M = 3.36$, $SD = 0.56$; $t(311) = 3.40$, $d = 0.39$, 95% CI [0.16, 0.61], $p = .001$, BF$_{10} = 28.85$). In the one-week condition, however, vividness$_{20}$ scores ($M = 2.53$, $SD = 0.99$) were higher than in the three-months condition ($t(321) = 2.74$, $d = 0.30$, 95% CI [0.09, 0.53], $p = .007$, BF$_{10} = 4.30$; connectedness$_{20}$: $M = 3.46$, $SD = 0.64$, $t(308.78) = 1.43$, $d = 0.17$, 95% CI [-0.06, 0.38], $p = .153$, BF$_{10} = 0.33$), and both vividness$_{20}$ and connectedness$_{20}$ scores in the one-week condition did not differ from the 20-years condition ($t(300) = [1.75, 1.79]$, $d = [-0.22, -0.20]$, 95% CI [-0.02, 0.43], p [.074, .081], BF$_{10}$ [0.54, 0.58]). As continuity with the 20-years-future self had been expected to be higher in the 20-years condition than in the two other conditions, the manipulation check was not successful.

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[22] Levene's test for item on illegal downloading: $F(2, 466) = 4.99$, $p = .007$; Welch's test: $F(2, 301.091) = 1.59$, $p = .206$.
[23] For analyses, gender was dichotomously coded.

Table 4

Measures of Association (Spearman or Phi/Cramer's V) and Internal Consistencies of All Study 1 Measures.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Experimental condition	--											
2. Delinquent decisions (DV)	.00	α = .56										
Measures of future self-continuity												
3. Vividness$_{20}$	.08	-.03	α = .92	.								
4. Connectedness$_{20}$	**.10***	-.06	**.43****	α = .73								
5. Similarity$_{20}$	-.01	-.03	**.21****	**.18****	α = .92							
Rating variables (letter content analysis)												
6. Self-affirm.	**.19****	-.08	**.10****	**.15****	**.10***	--						
7. Temporal focus	.07	-.05	.06	**-.04**	.04	*.07*	--					
8. Personal address	.04	-.03	-.08	**.02**	**-.12***	*.06*	*.16***	--				
Further letter task characteristics												
9. No. of words	**.24****	-.06	-.03	**.15****	-.03	**.18****	**-.17****	**.15****	--			
10. Time	**.15****	-.02	-.05	.07	-.04	.06	**-.15****	**.21****	**.60****	--		
Demographics												
11. Age	-.02	-.09	.01	-.02	-.02	.05	.03	-.02	-.02	.01	**--**	
12. Gender	.06	**-.13****	.03	.04	-.05	*.13**	*.02*	*.06*	.07	.05	.08	--
13. Education	.07	-.04	.08	.04	.01	*.13**	*.07*	*.05*	-.03	-.07	**.17****	*.07*

Note. **1. Experimental condition:** 1 = one-week future, 2 = three-months future, 3 = 20-years future; **6. Self-affirmation:** 1 = negative, 2 = ambivalent/neutral, 3 = positive; **7. Temporal focus:** 1 = present, 2 = present & future, 3 = future; **8. Addressing present/future self personally:** 0 = no, 1 = yes; **11. Age:** Range = 18-26; **12. Gender:** 1 = male, 2 = female; **13. Education:** 1 = no degree, 2 = high school, 3 = college/university; all other variables: higher values indicate higher manifestations;
for 1., 6., 7., 8., 12., 13.: Phi/Cramer's V; all other coefficients: Spearman; N = 469; for **12. Gender:** n = 461; for **13. Education:** n = 465; between **12., 13.:** n = 458;
* $p < .05$, ** $p < .01$.

Rated Letter Content. The topics most frequently discussed in letters were those related to education and jobs, followed by family, health, romance, and finances or property. Several self-relevant values such as family and romance, and plans or wishes such as political engagement or travelling, were mentioned more often in the three-months and 20-years conditions than in the one-week condition ($\chi^2(2)$ [12.89, 53.58], V [.17, .34], $p \leq .002$; Figure 5). The extent to which self-affirmation was expressed in the letters increased from the one-week condition ($M = 2.22$, $SD = 0.54$) to the three-months condition ($M = 2.44$, $SD = 0.54$, $\chi^2(2) = 12.90$, $V = .20$, $p = .002$) to the 20-years condition ($M = 2.50$, $SD = 0.62$, vs. three-months condition: $\chi^2(2) = 9.26$, $V = .17$, $p = .010$; vs. one-week condition: ($\chi^2(2) = 29.02$, $V = .31$, $p < .001$).

Figure 5

Topics/Values Mentioned in the Letters of Study 1: Frequencies (%) and Group Differences (χ^2-tests).
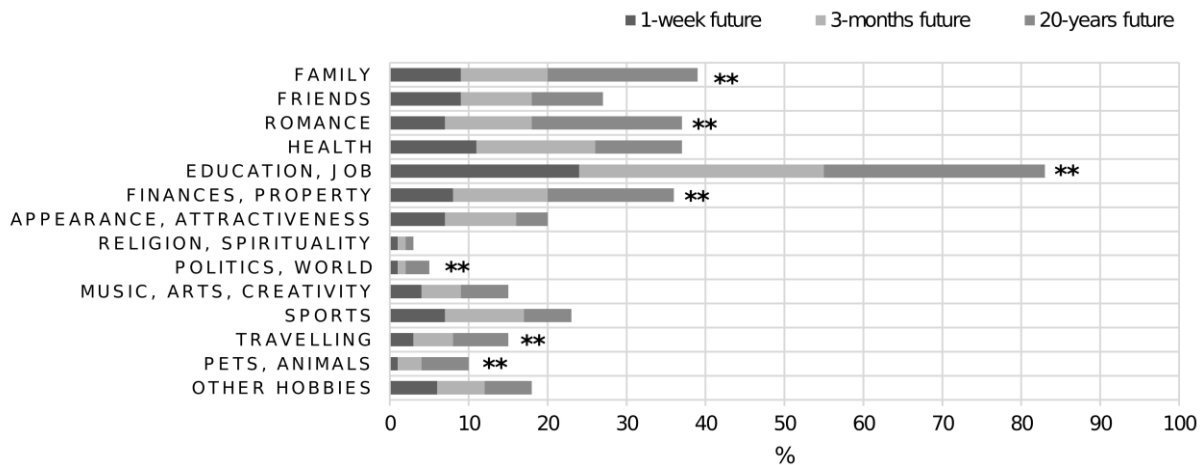
*Note. N = 469; ** p < .01.*

Regarding linguistic styles, the relationship between condition and measures of future self-continuity was not moderated by the actual temporal focus of the letters (i.e., whether the participants wrote about the present only [13%], both present and [one-week, three-months or 20-years] future [64%], or the future only [23%]; overall model: $F(8, 460)$ [0.94, 3.76], R^2 [.02, .05], p [<.001, .483]; interaction predictors: $t(460)$ [-1.65, 2.00], b [-1.27, 1.66], p [.051, .999]; overall interaction: $F(4, 460)$ [0.19, 1.45], $\Delta R^2 \leq .01$, p [.215, 942]). Likewise, whether the participants addressed their future self personally (62%) had no effect on the relationship between condition and vividness$_{20}$ and similarity$_{20}$, respectively (overall model: $F(5, 463)$ [2.28, 6.42], R^2 [.02, .05], $p \leq .046$; interaction predictors: $t(463)$ [-0.40, 1.08], b [-0.08, 0.36], p [.281, .911]; overall interaction: $F(2, 463)$ [0.02, 0.70], ΔR^2 < .01, p [.498, 984]). However, addressing one's future self as "Dear…,"/"you" was related to higher connectedness$_{20}$ scores in the 20-years condition, and to lower connectedness$_{20}$ scores in the three-months condition, but was not related to connectedness$_{20}$ in the one-week condition (overall model: $F(5, 463) = 3.64$, $R^2 = .04$, $p = .003$; interaction predictors: $t(463)$ [-0.29, 2.60], b [-0.04, 0.35], p [.010, .770]; overall interaction: $F(2, 463) = 3.50$, $\Delta R^2 = .01$, $p = .031$). Detailed information on the statistical analyses is provided in Appendix E.

Discussion

In the original study (van Gelder et al., 2013, Study 1), writing to one's distant future self reduced delinquent decisions. Our results did not clearly indicate that the non-significant replication effect was comparable to that of the original study, nor that the effect does not exist. Overall, the replication results suggested that the true effect on delinquent decisions – if existent – is smaller than the effect found in the original study. Analyses with an additional experimental condition did not confirm the expectation of a monotonic decrease in delinquency scores with considering more distant futures. The overall rate of delinquent decisions was higher than in the original study; however, delinquency scores in both the original and the current study were still close to the scale midpoint, such that systematic baseline deviations are unlikely to explain the differing results.

Regarding possible mediators, the original study assumed, but did not test vividness of the distant future self as the underlying mechanism of the effect on delinquency. In the replication study, we applied a manipulation check on vividness$_{20}$ and two further measures of future self-continuity, which, however, was not successful: As compared to writing to very near future selves (i.e., one week in the future), writing to distant future selves (i.e., 20 years in the future) did not increase vividness of, or connectedness with or similarity to, that distant future self. Van Gelder et al. (2013, Study 1) and also Rutchick et al. (2018, Study 2) used a three-months condition as control rather than a "very near future" or "present" condition, in order to ensure that effects could be attributed to distant rather than general future considerations. If we had considered the 20-years and the three-months condition only, i.e., the comparison of the original study, our manipulation check would indeed have been successful for vividness$_{20}$ and connectedness$_{20}$. With the additional one-week condition, however, the results of Study 1 raise doubts on the assumption that the letter task can reliably alter future self-continuity. Moderation analyses yielded evidence that for effects on connectedness$_{20}$, it might be favorable to address one's future self personally. Then again, the fact that vividness$_{20}$, connectedness$_{20}$, and similarity$_{20}$ were not substantially correlated with delinquency scores calls into question whether future self-continuity is in fact relevant in predicting self-control-related decisions. The letter content analysis indicated that the participants took the task seriously; however, it might be that our measurements were not valid, or not sensitive enough, to map future self-continuity and/or delinquent decisions, or that alternative processes are more relevant if comparable manipulations do have effects on outcome variables. In exploratory analyses, we found that participants who had been instructed to think about their distant future selves addressed personal values more often than participants who had been instructed to think about their near future selves. Also, the degree of self-affirmation expressed in the letters increased with the distance of the future self, along with the number of words and processing time in the letter task – which might indicate that thinking about long-term wishes and hopes is more challenging and/or more enjoyable than thinking about daily routines. However, self-affirmation was not associated with delinquency, and further individual differences in writing styles also had no effect on the non-significant main result.

Study 2: Direct Replication of Monroe et al. (2017, Study 1)

The results of Study 1 did not support the view that the letter task could increase future self-continuity and/or reduce hypothetical delinquent decisions. In a second direct replication attempt, it was examined whether a letter task version with different temporal comparison groups (i.e., present vs. 10-years future) had a robust impact on future self-continuity and hypothetical risky investment decisions. In the original study (Monroe et al., 2017, Study 1), future thinking in general rather than future self-continuity was conceptualized as the crucial mediating factor. Therefore, the second aim of the replication attempt was to elucidate alternative underlying processes in additional analyses.

Sample

Sample characteristics of the original study and Study 2 are shown in Table 5. For the replication attempt, no prescreening filters were applied, except that only native English speakers who had not taken part in Study 1 were chosen.

Table 5

Sample Characteristics of Monroe et al. (2017, Study 1) and Study 2.

	Monroe et al. (2017, Study 1)	Study 2
Excluded participants (letter task not completed)	13	--
Final sample	$N = 187$	$N = 463$
Reward	--	£1.25 (~ $1.64)[a]
Gender	58% female	75% female, 24% male, 1% other
Age (years)	--	$M = 35.19$ ($SD = 10.51$), range = 13-84
Education	--	69% college/university, 28% high school
Experimental conditions (letter task)	Present ($n = 93$) vs. 10-years future ($n = 94$)	Present ($n = 231$) vs. 10-years future ($n = 232$)

Note. [a] Reward per hour £5.00; estimated completion time 15 min (actual completion time 11.73 min).

Design and Procedure

The original study suggests that writing to one's distant future self (10 years) enhances current future-oriented thinking and reduces the tendency to make risky investment decisions. The control group wrote about their present selves ("today"). Therefore, in the replication attempt we expected 1) risky investment decisions to be lower in the future condition than in the present condition *(replication hypothesis)*, and 2) state future-oriented thinking to be higher in the future condition than in the present condition *(manipulation check)*. As in the original study, participants read a cover story indicating that the research was about how people thought about themselves. They were randomly assigned to conditions and asked to write a 100- to 300-word letter to their present or to their 10-years-future selves. As in the original study, and contrary to van Gelder et al. (2013, Study 1) and Study 1,

the instructions were unambiguous regarding the intended temporal focus, i.e., the participants were explicitly instructed not only to address, but also to actually write about their present or future selves (Appendix D). Next, participants' current mood, a control variable, was assessed with the Brief Mood Introspection Scale (Mayer & Gaschke, 1988). Participants rated on a four-point scale how well 16 adjectives reflected their current mood, and how their overall mood was ("very unpleasant" to "very pleasant"). A positive emotion subscale and a negative emotion subscale were calculated (sum scores), with higher values reflecting a more positive mood ($\alpha = .86$) or a more negative mood ($\alpha = .90$) depending on the scale. Participants then rated the degree to which they were currently thinking about the future, with higher values indicating more state future thinking, and were then confronted with Monroe et al.'s (2017) four investment scenarios. The investment strategies to choose ranged from conservative (low risk/low reward, e.g., savings account) to aggressive (high risk/high reward, e.g., single stock of a brand-new company). Answers given on five- to 11-point scales were linearly transformed onto a 10-point scale, with higher scores reflecting riskier strategies ($\alpha = .67$; vs. $\alpha = .72$ in Monroe et al., 2017, Study 1).

Following the measures of the original study, we again added measures of future self-continuity. *Vividness* of the 10-years-future self (vividness$_{10}$) was again assessed with five items adopted from van Gelder et al. (2015). The internal consistency was $\alpha = .91$. *Connectedness* with the 10-years-future self (connectedness$_{10}$) was assessed with the eight items from Study 1, and again, after excluding one item (item-total correlation $r = -.34$), the internal consistency increased from $\alpha = .61$ to $\alpha = .75$. Therefore, the total score was calculated from the remaining seven items. Since in Study 1, intercorrelations were stronger between vividness and connectedness than with similarity, and due to theoretical considerations (see p. 78 in the General Discussion section), similarity was no longer assessed. Instead, two further measures were added to get an idea of how the letter task and measures of future self-continuity are associated with related personality constructs. *Self-control* was assessed with the Brief Self-Control Scale (Tangney et al., 2004). Participants indicated their agreement with 13 items (e.g., "I am good at resisting temptation") on a five-point scale. For total score calculation, items were (re-)coded so that higher values reflect higher trait self-control ($\alpha = .82$). *Future time perspective* was assessed with the TPQ (Fong & Hall, 2003). Participants indicated their agreement with 13 items on a seven-point scale. Items were (re-)coded so that higher values reflect a future time perspective ($\alpha = .85$).[24] As in Study 1, at the end of the surveys participants provided their gender, age, and highest educational achievement. All instructions and measures of Study 2 are listed in Appendix C.[25] After data collection, the content of the letters was rated for exploratory analyses (Appendix D).

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[24] The quite similar trait measures of self-control and future time perspective were chosen for their differing connotations: The items of the Brief Self-Control Scale (Tangney et al., 2004) contain hardly any temporal references, but are ability-related; inversely scored, they imply dissatisfaction and motivation for change (e.g., "I wish I had more self-discipline"). The items of the TPQ (Fong & Hall, 2003), however, are all time-related and do not imply any problem awareness.

[25] In Study 2, nine "worldly wisdom" items and one item on general future vs. present orientation were accidently listed in the pre-registration. We did not collect any data concerning these two measures in the replication attempt (see Appendix B, C).

Results

Evaluation of Replication Success. All results on the variables assessed both in the original study and Study 2 are presented and compared in Table 6. The original study found group differences in risky investment decisions ($t(185) = 2.06$, $p = .041$, $d = 0.30$, 90% CI [0.06, 0.54], 95% CI [0.01, 0.59], $N = 187$). In the replication study, however, there were no differences between conditions ($t(461) = -0.04$, $d = -0.01$, 90% CI [-0.16, 0.15], 95% CI [-0.19, 0.18], $p = .965$, $N = 463$). Bayesian analyses indicated a BF_{10} of 0.10, thus the H_0 was $BF_{01} = 1/0.10 = 10$ times more likely than the model with a main effect of condition. Overall, participants in Study 2 were more risk-averse than in the original study. Risk scores in both studies, however, were below the scale midpoint (Table 6).

Table 6

Comparisons of Results of Monroe et al. (2017, Study 1) and Study 2.

	Monroe et al. (2017, Study 1) N = 187			Study 2 N = 463			Between-study d (p)
Risky investments (1-10)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	
	4.94 (1.82)	4.41 (1.68)	0.30 (.041)	3.95 (1.58)	3.96 (1.75)	-0.01 (.965)	
	α = .72 Overall M = 4.68 (SD = 1.75)			α = .67 Overall M = 3.95 (SD = 1.67)			0.43 (<.001)
Test against scale midpoint	**Present** p (d)	**10-years** d (p)		**Present** d (p)	**10-years** d (p)		
	.003 (-0.31)	-0.65 (< .001)		-0.98 (< .001)	-0.88 (< .001)		
State future thinking (1-100)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	
	70.6 (24.3)	77.9 (20.8)	-0.32 (.029)	77.55 (21.58)	74.34 (23.40)	0.14 (.126)	
	Overall M = 74.25 (SD = 22.55)			Overall M = 76.19 (SD = 22.33)			-0.09 (.640)
State positive mood (9-36)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	
	--	--	0.18 (.180)	26.05 (5.46)	27.01 (4.24)	-0.22 (.035)	
	-- --			α = .86 Overall M = 26.53 (SD = 4.85)			--
State negative mood (9-36)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	**Present** M (SD)	**10-years** M (SD)	**Between-condition** d (p)	
	--	--	0.14 (.320)	19.10 (6.00)	18.34 (5.64)	0.18 (.164)	
	-- --			α = .90 Overall M = 18.72 (SD = 5.83)			--

Note. Higher scores indicate higher manifestations of the variables.

Also, the proportion of women in the replication sample was larger than in the original sample (Table 5), but the relationship between condition and risky investment decisions was not moderated by gender (overall model: $F(3, 457) = 3.23$, $R^2 = .02$, $p = .022$; interaction: $t(457) = -0.32$, $b = -0.12$, $p = .748$; $F(1, 457) = 0.10$, $\Delta R^2 < .01$). The original study's manipulation check failed in the replication study; there was no effect of condition on state future thinking ($t(461) = 1.53$, $d = 0.14$, 95% CI [-0.04,

0.32], $p = .126$, $\text{BF}_{10} = 0.32$). Also contrary to the original study, we found that participants' current mood was better in the future condition than in the present condition (Table 6). Therefore, we controlled for positive mood in the main analysis, which did not have a critical impact on the group differences in risky investment decisions ($F(4, 460) < 0.01$, $\eta_p^2 < 0.01$, $p = .996$).

Comparison of Confidence Intervals. Even for this actual zero effect, agreement with the effect of the original study could not be ruled out on the basis of confidence intervals (Figure 6). As the 90% and 95% confidence intervals of the original study effect encompass effect sizes from close to zero up to nearly 0.60, overlaps with the replication study confidence intervals are almost inevitable.

Figure 6

Letter Task Effects on Risky Investment Decisions (Cohen's d), Comparing Monroe et al. (2017, Study 1) and Study 2.
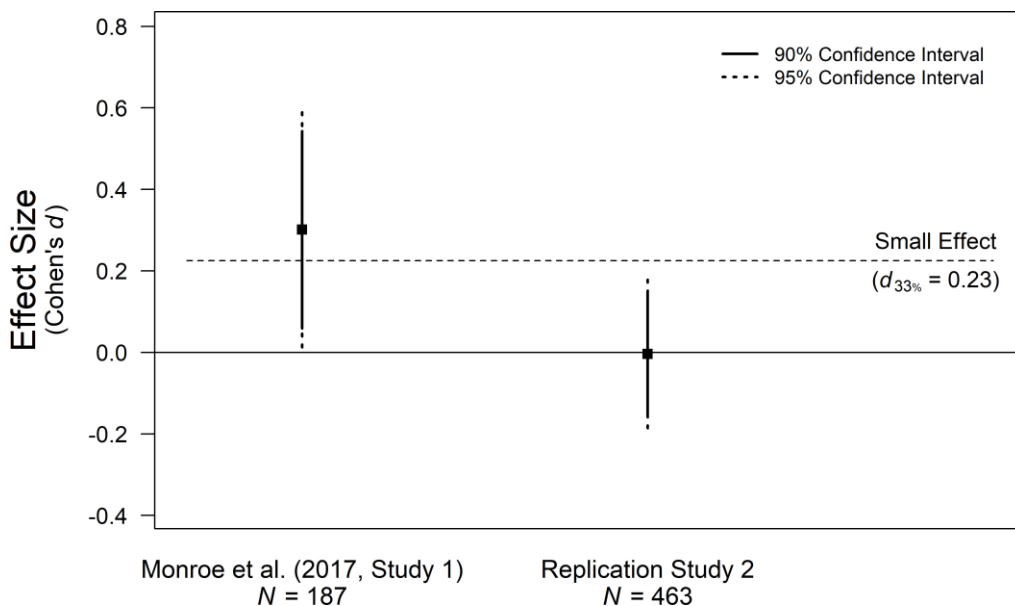
Note. The markers indicate effect size estimates, and the vertical bars their confidence intervals. The dashed line indicates the effect size that would give the original study ($N = 187$) 33% power. See Simonsohn (2015) and Appendix E for the calculations behind this figure.

"Small Telescope" Test. The effect size that would have led to a power of 33% in the original study was $d_{33\%} = 0.23$, so the original study had 33% power to reveal an effect of $d_{33\%} = 0.23$. The confidence intervals of the replication effect did not contain this small effect (Figure 6). The effect of the replication study was significantly smaller than $d_{33\%}$ ($t(460) = 0.02$, ncp[26] $= 2.40$, $p = .008$), i.e., the probability that a t-test with the sample size $n_1 = 231$ and $n_2 = 232$ with a true effect of $d_{33\%} = 0.23$ would result in an effect equal to or smaller than the effect of the replication study ($d = -0.01$) was

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[26] Calculation of the noncentrality parameter in Study 2: $\text{ncp}(d_{33\%}) = \text{sqrt}(n_1 * n_2 / (n_1 + n_2)) * .223 = 2.399$

0.8%. Therefore, if $d_{33\%} = 0.23$ was the true effect, an effect size equal to or even smaller than the replication effect size would be observed in less than 1% of the cases.

Bayesian Replication Test. The posterior distribution assigned more mass to $d = 0$ than did the prior distribution (Figure 7), and the Bayesian replication test yielded $BF_{r0} = 0.11$, indicating that the replication data were $1/0.11 = 9.09$ times more likely under H_0 than under the replication hypothesis. This constitutes moderate evidence against the replication hypothesis of equal effects (Verhagen & Wagenmakers, 2014).

Figure 7

Results from the Bayesian Replication Test Applied to Monroe et al. (2017, Study 1) and Study 2.
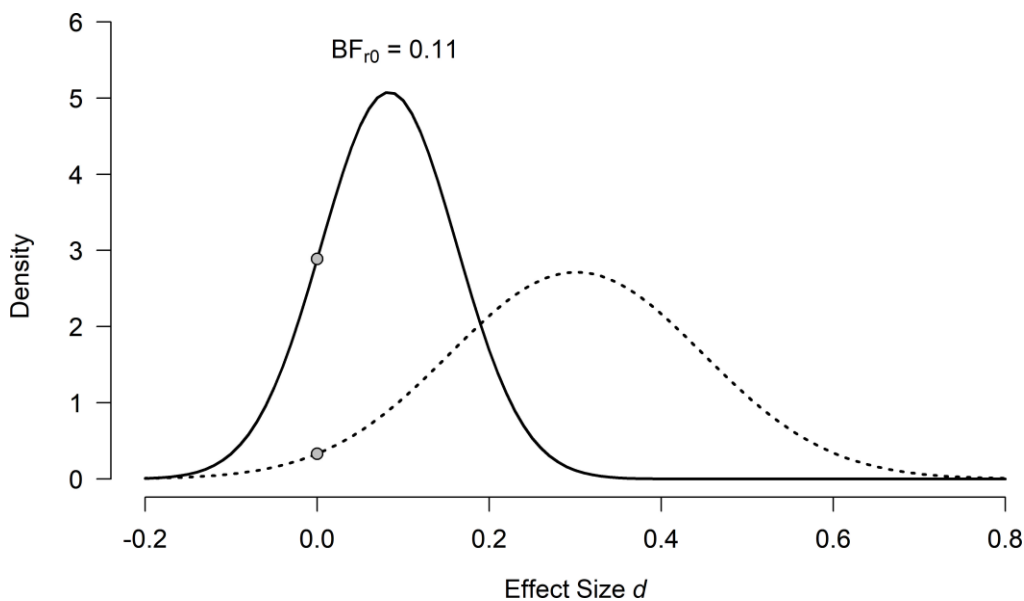
Note. The dotted line represents the posterior distribution from the original study, which is used as prior for effect size in the replication test. The solid line represents the posterior distribution after the data from Study 2 are taken into account. The gray dots indicate the ordinates of this prior and posterior at H_0 that the effect size is zero. The ratio of these two ordinates gives the result of the replication test. See Verhagen and Wagenmakers (2014) and Appendix E for calculations behind this figure.

Additional Results. After the letter content analysis, eight cases (five in the present condition, three in the future condition) were excluded from further analyses because they had not completed the letter task correctly. Again, excluding these cases had no significant effect on the evaluation of replication success.[27] Spearman correlations or Phi/Cramer's *V* coefficients for all measures used in Study 2 are shown in Table 7.

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[27] For $n = 455$: Difference in risky investment decision total scores: $t(453) = 0.05$, $d = 0.01$, 90% CI [-0.15, 0.16], 95% CI [-0.18, 0.19], $p = .959$, $BF_{10} = 0.10$; "small telescope" test: $d_{33\%} = 0.23$; $t(453) = 0.05$, ncp = 2.40, $p = .009$; Bayesian replication test: $BF_{r0} = 0.13$.

Table 7

Measures of Association (Spearman or Phi/Cramer's V) and Internal Consistencies of All Study 2 Measures.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Experimental condition	--															
2. Risky investment decisions (DV)	-.02	α =.67														
Measures of future self-continuity																
3. Vividness$_{10}$	**.20****	**.10***	α =.91													
4. Connectedness$_{10}$	**.11***	.00	**.61****	α=.75												
Further state or trait variables																
5. State future thinking	-.05	-.03	**.20****	**.33****	--											
6. State positive mood	.05	.03	**.38****	**.28****	**.21****	α =.86										
7. State negative mood	-.07	-.03	**-.29****	**-.28****	**-.08**	**-.61****	α =.90									
8. Trait self-control	.01	-.05	**.24****	**.21****	.08	**.28****	**-.31****	α =.82								
9. Trait future time perspective	.00	-.02	**.42****	**.47****	**.30****	**.10***	**-.12***	**.33****	α =.85							
Rating variables (letter content analysis)																
10. Self-affirmation	*.40***	.05	**.21****	**.19****	**.14****	**.26****	**-.21****	.08	.06	--						
11. Temporal focus	*.80***	.00	**.22****	.09	.01	.04	-.06	.01	.01	*.24***	--					
12. Personal address	*.10**	-.01	-.01	.02	.04	**-.14****	.08	-.05	.05	*.04*	**.15****	--				
Further letter task characteristics																
13. No. of words	-.01	-.05	.02	**.16****	**.15****	-.02	.02	.01	**.09***	.06	-.06	**.20****	--			
14. Time	.07	.00	.01	.06	.04	-.02	-.02	.05	.03	.04	.01	**.20****	**.60****	--		
Demographics																
15. Age	.07	-.02	.06	-.02	**-.10***	**.14****	**-.10****	**.14****	-.07	-.04	.07	.00	.05	**.15****	--	
16. Gender	*.00*	**-.12****	.04	.03	.01	**.12***	.03	-.01	.02	*.13**	*.05*	*.10*	-.04	-.05	-.01	--
17. Education	*.05*	-.03	.07	**.10***	**.10***	.04	.01	-.06	.06	*.05*	*.08*	*.10*	**.10***	-.05	**-.11***	*.02*

Note. **1. Experimental condition:** 1 = present, 2 = 10-years future; **10. Self-affirmation:** 1 = negative, 2 = ambivalent/neutral, 3 = positive; **11. Temporal focus:** 1 = present, 2 = present & future, 3 = future; **12. Addressing present/future self personally:** 0 = no, 1 = yes; **16. Gender:** 1 = male, 2 = female; **17. Education:** 1 = no degree, 2 = high school, 3 = college/university; all other variables: higher values indicate higher manifestations; *for 1., 10., 11., 12., 16., 17.: Phi/Cramer's V;* all other coefficients: Spearman; N = 455; for **16. Gender:** n = 453; for **17. Education:** n = 447; between **16., 17.:** n = 445; * $p < .05$, ** $p < .01$.

Randomization Check. The randomization was successful in that the groups did not differ in age ($t(453) = -1.31$, $d = -0.12$, $p = .192$), gender ($\chi^2(1) = 0.01$, $\phi < .01$, $p = 1.00$), or education ($\chi^2(3) = 1.39$, $V = .06$, $p = .720$), and demographics were not considerably associated with other variables (Table 7). There also were no group differences in the number of words ($M_{present} = 114.17$, $SD = 52.30$; $M_{future} = 111.16$, $SD = 47.68$; $t(453) = 0.64$, $d = 0.06$, $p = .521$) and processing time (seconds; $M_{present} = 359.77$, $SD = 1046.03$; $M_{future} = 323.66$, $SD = 194.24$; $t(453) = 0.51$, $d = 0.05$, $p = .608$) of the letter task. Regarding the trait variables, the groups did not differ in self-control ($M_{present} = 2.97$, $SD = 0.67$; $M_{future} = 3.01$, $SD = 0.60$; $t(453) = -0.70$, $d = -0.06$, $p = .483$) or in future time perspective ($M_{present} = 4.12$, $SD = 0.79$; $M_{future} = 4.13$, $SD = 0.74$; $t(453) = -0.17$, $d = -0.01$, $p = .865$). Also, the relationship between condition and risky investment decisions was neither moderated by self-control (overall model: $F(3, 451) = 2.20$, $R^2 = .01$, $p = .088$; interaction: $t(451) = 1.84$, $b = 0.46$, $p = .067$; $F(1, 451) = 3.37$, $\Delta R^2 = .01$) nor by future time perspective (overall model: $F(3, 451) = 0.54$, $R^2 = .01$, $p = .654$; interaction: $t(451) = -0.96$, $b = -0.23$, $p = .338$; $F(1, 451) = 0.92$, $\Delta R^2 < .01$).

Manipulation Check: Change in Future Self-Continuity. The additional manipulation check on measures of future self-continuity was successful; for both vividness$_{10}$ and connectedness$_{10}$, scores were higher in the future condition than in the present condition (vividness$_{10}$: $M_{present} = 2.84$, $SD = 0.97$; $M_{future} = 3.22$, $SD = 0.90$; $t(453) = -4.34$, $d = -0.41$, 95% CI [-0.59, -0.22], $p < .001$, $BF_{10} = 826.66$; connectedness$_{10}$: $M_{present} = 3.53$, $SD = 0.58$; $M_{future} = 3.66$, $SD = 0.68$; $t(443.54) = -2.23$, $d = -0.21$, 95% CI [-0.39, -0.02], $p = .026$, $BF_{10} = 1.44$).

Rated Letter Content. In Study 2, participants most often mentioned their family, followed by topics related to education/jobs, finances, and romance. These topics as well as travelling were addressed more often in the future condition than in the present condition ($\chi^2(1)$ [20.08, 57.94], V [.21, .36], $p \leq .001$; Figure 8).

Figure 8

Topics/Values Mentioned in the Letters of Study 2: Frequencies (%) and Group Differences (χ^2-tests).

*Note. N = 455; * p < .05, ** p < .01.*

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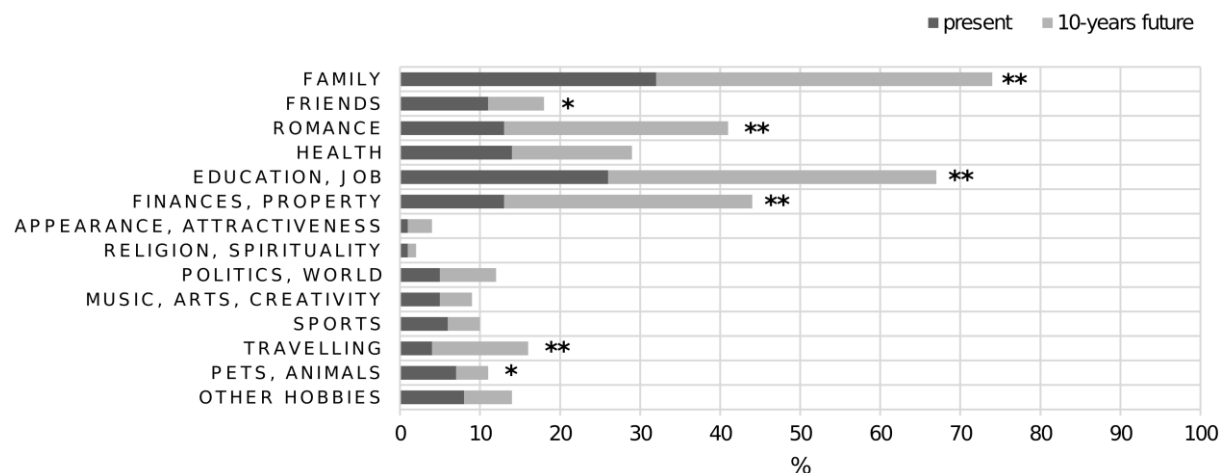
Also, self-affirmation was higher in the future condition than in the present condition ($\chi^2(2) = 73.94$, $V = .40$, $p < .001$). Approximately one-third of the participants wrote in their letters about only the present (32%), only the future (37%), or both present and future (31%). The temporal focus of the letters was strongly associated with the experimental conditions (Table 7), thus a moderating influence of temporal focus on the relationship between condition and measures of future orientation could be ruled out. Whether the participants addressed their future self personally (41%) also had no impact on the relationships between condition and measures of general future thinking, vividness of, or connectedness with the future self (model summary: $F(3, 451)$ [0.64, 6.51], R^2 [< .01, .12], p [.003, .589]; interaction: $t(451)$ [0.10, 1. 25], b [0.10, 0.45], p [.210, .918]; $F(1, 451)$ [0.01, 1.57], ΔR^2 < .01; for detailed information on the statistical analyses, see also Appendix E).

Discussion

Although the original study found that writing a letter to (and about) one's distant future self reduced risky investment decisions, the replication study results go against the existence of an effect of an impactful size. Participants in the replication attempt were generally more risk-averse than in the original study, which may reflect the higher proportion of women (75% vs. 58%). As we observed men to be more risk-tolerant than women, one could speculate that attempts to reduce risky investment decisions are more likely to be successful for men, as has been found for other interventions to increase self-control (Friese et al., 2017). However, the distribution of the risk scores showed no floor effect, but potential for change in both directions; gender had no significant effect on the main result; and the original sample was also rather risk-averse overall (Monroe et al., 2017, Study 1). The relationship between condition and risky investments was also not moderated by trait self-control, or by trait future time perspective.

Also contrary to the original study, we found no evidence that writing to one's distant future self enhances state future thinking in general. Instead, the manipulation check was successful with measures of future self-continuity, particularly with vividness of the future self, suggesting that this construct is different from mere future considerations, and indeed manipulable, thus supporting the view that interventions might benefit from focusing on identity-based aspects of future orientation (e.g., Bryan & Hershfield, 2012). It is conceivable that you may not continue to think about the future when the task is complete, but your future self may still feel more relatable then. These findings also indicated that the self-report measure used is sensitive to short-term changes, and that the ProA sample had processed the letter task thoroughly enough to produce differences between the experimental conditions. The letter content analysis again indicated that the participants had completed the task as instructed, and individual differences in writing styles could not explain the manipulation check results. Overall, however, the results speak against the assumption that the letter task could reliably alter future orientation. Moreover, future thinking, and – as in Replication Study 1 – vividness of and connectedness with the distant future self were not associated with the dependent variable. Likewise,

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the degree of self-affirmation expressed in the letters was higher in the future condition than in the present condition, but self-affirmation was also not associated with risky investments. Therefore, no mediation analyses were conducted.

Interim Conclusion

Before the open science movement, both replication attempts would have been "cases for the file drawer" (Simonsohn et al., 2014): Contrary to the original studies, there were non-significant results with a small effect size (Study 1), or an effect of zero (Study 2). We thus found no support of the idea that the letter task affects delinquent decisions or risky investment decisions. On the other hand, even if it is rather unlikely – especially concerning Study 2 – it cannot be ruled out that the divergent results of the original and replication studies are based on the same true effects. So, what is interesting about such ambiguous findings?

Generally, individual replication attempts can never prove that an effect exists, nor can they prove that an effect does not exist (Harms et al., 2018). Nevertheless, each methodically accurate replication study provides pieces of evidence and contributes to a more precise estimation of a possible true effect. The present results provide relevant evidence to dampen expectations in the letter task: As possible true effects on delinquent or risky decisions are at least considerably smaller than the original studies suggest, the data speak against its relevance for the outcome variables and/or samples examined here. Regarding replicability as a quality feature of studies, the different analytical approaches applied to evaluate the replications' success illustrate the importance of using sufficient sample sizes and adequate statistical power. For the original studies we have attempted to replicate, the observed statistical power lies somewhat above 50% and is thus hardly lower than is typical in psychological research (J. Cohen, 1962; Colquhoun, 2014). Still, the confidence intervals of both original studies include effect sizes from close to zero to medium or large. Almost every possible result of a replication attempt is thus theoretically compatible with the results of the original studies. Nevertheless, attempts should be made to also replicate such published studies, with further analytical methods so that insufficient statistical power does not protect effects against being critically tested. In other words, publishing weak effects should not be a successful strategy of self-immunization.

Moreover, the results illustrate the importance of information on sample characteristics and study procedures. Sample error and measurement error alone have a large impact on the variability of effects in replications (Stanley & Spence, 2014). Even if the samples of two identical studies were based on the same population, the chance that the mean of one variable in one study was within the 95% confidence interval of the respective mean in the other study is only about 80% (Cumming et al., 2004). Therefore, to draw any conclusions in comparison to the original studies, it is crucial to keep constant as many other variables as possible. For the replication attempts, the original studies' authors kindly provided us with all items and instructions, thus the materials and procedures were identical to

the respective original studies. Known demographics were largely kept constant between original studies and replication studies via prescreening, and systematic deviations in additional, theoretically relevant sample characteristics, such as educational background (e.g., Toepoel, 2010) and trait self-control (e.g., Barber et al., 2009), are rather unlikely due to comparable survey platforms (Peer et al., 2017). The content analysis of the letters provided no evidence that ProA participants might have been less motivated: Nearly every participant had taken the task seriously, i.e., produced a meaningful text in accordance with the instructions. Also, controlling for variables with deviating scores between the original and replication studies, e.g., the number of words in the letters (Study 1) or current positive mood (Study 2), had no impact on the relationship between experimental conditions and outcome variables. Still, it cannot be ruled out that the letter task effects depend on factors that were not examined in the original studies and/or in the replication studies, such as income or nationality (Peer et al., 2017; Steinberg et al., 2009).

Our results thus speak against using the letter task as a wise intervention against criminal or risky financial behavior – (wise) interventions can only be effective if they change the targeted psychological processes (Walton, 2014). In the replication attempts, none of the future self-continuity constructs assumed as mediators were associated with the outcome variables. However, since trait self-control as an established correlate of risky behavior (e.g., Zuckerman & Kuhlman, 2000) was also not related to the outcome variable in Study 2, the decision-making measures might not be valid for the present research question and/or sample. Is the letter task even suitable to increase future self-continuity? In Study 1, the manipulation failed, but in Study 2, participants who had written to their *distant future* selves reported higher connectedness with, and in particular higher vividness of these future selves than participants who had written to their *present* selves reported. The comparison chosen in Study 2, present vs. 10 years future, was possibly less conservative; the difference in manipulation between the conditions might have been greater here than in the comparison of different (albeit temporally more distant) future conditions in Study 1. Exploratory analyses of the letter content yielded mixed results regarding the question of whether individual differences in completing the letter task might affect the manipulations check variables. In Replication Study 1, but not in Replication Study 2, there were larger differences between the experimental conditions regarding connectedness in participants who addressed their future selves personally ("Dear…," "you"). Also, the results indicated that deviations between the studies in the letter task instructions affected the temporal focus of the letters (i.e., whether the participants wrote about the present only, about both present and future, or about the future only), but the temporal focus had no impact on the relationships between condition and measures of future orientation. In contrast to the measures of future self-continuity, trait measures of self-control and future time perspective were not affected by the manipulation in Replication Study 2. Therefore, and as vividness and connectedness were moderately and positively correlated with these constructs, focusing on identity-related aspects of future orientation might still be promising for intervention approaches.

In exploratory analyses, we found evidence that writing to one's *distant* future self also activates self-relevant values and increases self-affirmation. In line with the reasoning of Monroe et al. (2017), envisioning one's distant future largely corresponded to having positive expectations: The further into the future you think, the less you have to deal with everyday problems and adjust your ideas to your current reality, and the easier it is to be optimistic and confident. Therefore, self-affirmation strategies might constitute a relevant factor when future orientation interventions do have effects on decisions related to self-control (e.g., Hershfield et al., 2012; Rutchick et al., 2018; van Gelder et al., 2015). Also, the effectiveness of common future orientation and self-affirmation interventions (see, e.g., McQueen & Klein, 2006) might be increased if combined, i.e., explicitly reflecting self-relevant values regarding the distant future. This idea was taken up in Study 4 of the present research. For the effectiveness of self-affirmation interventions, however, the time of implementation is crucial: Transition processes only begin when self-esteem is subjectively threatened (G. L. Cohen & Sherman, 2014), thus self-relevant behavioral problems have to be evident or made salient.

Regarding the replication studies, this would presuppose that the participants actually had self-control problems regarding everyday delinquency and financial decisions – but neither the data nor other expectable sample characteristics provide any evidence of this. If people are not "morally flexible" at all, an intervention that actually increases continuity with future selves and activates personal values will hardly change their hypothetical (non-)delinquent decisions (e.g., Nagin & Paternoster, 1993). If people occasionally download a TV series illegally, but at the same time consider future consequences to be unlikely and moral costs to be negligible, such an intervention will hardly prevent them from hypothetical illegal downloading. Regarding finances, if people regularly invest money, with more or less risk, and are reasonably successful with their investments, or if people are just not interested in investment strategies, such an intervention will hardly influence their hypothetical financial investment decisions. In order to reasonably explore the potential of the future self-continuity account, it thus seemed advisable to choose an outcome domain where a broad range of people would benefit from behavioral changes. Also, in order to test the paradigm's potential to be used as a (wise) intervention, it should be examined whether tasks on future self-continuity could produce enduring rather than only ephemeral effects (Hall, 2001). Therefore, in development of later studies, unhealthy behaviors were considered suitable outcome measures both in theoretical and practical terms.

Intervention Attempts on Future Self-Continuity and Unhealthy Behavior

A large number of studies revolve around health topics in the field of future orientation research and related intervention approaches (for meta-analyses, see Andre et al., 2018; Epton et al., 2015; Sweeney & Culcea, 2017), which makes sense from a self-control-theoretical perspective. Eating high-calorie food (e.g., candy) in particular often serves as a prime example of self-control failures (Imhoff et al., 2014) – though it may also play a role here that persons who include high-calorie and sugar-rich food in their diets on a regular basis are more easily recruited as study participants than

persons with, e.g., deviant or criminal lifestyles. Analogous to crime, unhealthy behavior is often associated with immediate benefits and few immediate costs, while in the long term benefits diminish, and both personal and social costs can become immense (as for the example of quitting smoking: withdrawal symptoms and peer-rejection in the short term vs. improved health and higher life expectancy in the long term; e.g., Hall, 2001; van Gelder et al., 2015). This pattern by no means only applies to consuming substances that are explicitly understood to be harmful. Calorie- and sugar-rich diets, lack of exercise, as well as alcohol consumption each account for five to 10% of the global burden of disease and premature mortality (e.g., Jardim et al., 2019; I.-M. Lee et al., 2012; Rayner & Scarborough, 2005; Sarris et al., 2015; World Health Organization, 2018; for reviews, see, e.g., Candari et al., 2017; Withrow & Alter, 2011). In view of such figures, even modest intervention effects could have an important impact on public health (Rutchick et al., 2018) – but this is not a simple matter. According to Fong and Hall (2003), "there are few endeavors as humbling as trying to change people's health behaviors" (p. 103), as it is difficult to achieve even moderate behavioral changes, and initial successes are often marred by high relapse rates. That might be due to the fact that, on the one hand, many unhealthy behaviors are addictive. On the other hand, health outcomes are relatively hard to quantify and may take a long time to be realized. As Rutchick et al. (2018) illustrated, going to an exercise class and forgoing chocolate today does not necessarily lead to a reduction in BMI in the future. Moreover, to a certain extent, definitions of, e.g., "unhealthy diet" or "low physical activity," are dependent on changes in the state of research, myths, trends, and comparison groups. Therefore, neglecting long-term consequences of isolated unhealthy behaviors is relatively easy.

Recognizing connections to one's future self might facilitate recognizing temporal trade-offs, and might therefore be more successful in encouraging sustainable behavioral changes than, e.g., mere appeals to reason (e.g., Bryan & Hershfield, 2012). The potential of the future self-continuity approach to improve health outcomes is supported by experimental research on EFT in which unspecific mental simulation of future experiences has been found to reduce demand of unhealthy food, alcohol, and cigarettes (e.g., Daniel et al., 2013; Daniel et al., 2015; Snider et al., 2016; Stein et al., 2016; Stein et al., 2018; Sze et al., 2017; see p. 18 of the present research). As first direct evidence with manipulations of future self-continuity, Rutchick et al. (2018) successfully applied the letter task to increase exercise behavior (see p. 17 of the present research), and suggested that such effects could emerge also for other health domains. Van Gelder et al. (2015) noted that enhancing vividness of the future self could reduce not only delinquency, but other types of self-defeating behavior and self-control dilemmas such as smoking, alcohol and drug abuse, all of which are substantially correlated with crime. The intervention in their longitudinal study essentially corresponded to the letter task, but was extended over seven days, and added a visual component: "Making friends" with avatars of future (vs. present) selves on social media, and exchanging daily text messages over one week, increased vividness of the 15-years-future self, which mediated intervention effects on self-reported delinquency

in the past week at a two-week follow-up (see p. 17 of the present research). As with several findings on future self-continuity and related intervention approaches, however, the robustness and relevance of these effects is questionable. For the interaction effect of $\eta_p^2 = 0.04$ between time and condition, van Gelder et al. (2015) reported a non-significant *p*-value of .06, and the statistical power to detect such a possible small true effect of $\eta_p^2 = 0.04$ with their sample size ($N = 87$) was limited at 47%.[28] Therefore, in order to put the evidential value of the letter task paradigm to another critical test, Study 3 was conducted as a high-powered attempt to conceptually replicate the findings from van Gelder et al (2015) in the outcome domain of unhealthy behavior.

Study 3: Conceptual Replication of van Gelder et al. (2015)

Study 2 provided evidence that the letter task, comparing distant future and present conditions, can indeed induce a more vivid picture of future selves. However, the hypothetical dilemma situations might not have been valid outcome measures of risky decisions in random online samples; health behavior might be more suitable in this respect. Therefore in Study 3, a pre-registered[29] (Appendix F) attempt to conceptually replicate the findings from van Gelder et al. (2015) in a German-speaking sample, a one-week vividness intervention was examined to determine its effectiveness in reducing a variety of unhealthy behaviors, such as alcohol consumption, smoking, drug use, unhealthy diet, physical inactivity, and tanning, at a one-week follow-up. The first author of the original study kindly provided all materials, which were translated from Dutch into German and were largely adopted. All materials are provided in Appendix G, data sets and syntax files can be provided on request.

Sample

The study was planned as part of a student project at the University of Bonn, and the students recruited the participants among their friends and relatives with precise instructions as to what they could (not) disclosure about the study. Due to the low statistical power of the original study ($1 - \beta = .47$ for a possible true effect of $\eta_p^2 = 0.04$ for the interaction effect between time and condition on delinquency, $N = 87$), we[30] aimed for a substantially larger sample and included only participants who had completed all stages of the study. From an initial sample of 314 participants, 104 dropped out as they did not complete three questionnaires or/and did not answer seven e-mails. With the final sample ($N = 210$), the probability of detecting a possible true effect in the size of the original study ($\eta_p^2 = 0.04$) was 84%.[31] Sample characteristics are listed in Table 8.

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[28] Power calculations for *F*-test, ANOVA: Repeated measures, within-between interaction, "effect size specification as in Cohen (1988) – recommended": $f(V) = 0.2041241$, two groups, two measurements, nonsphericity correction $\varepsilon = 1$, $\alpha = .05$.

[29] Weblink to pre-registration: https://aspredicted.org/r4er4.pdf

[30] As Study 3 was planned as part of a student project at the University of Bonn, I refer to "we" when reporting on Study 3.

[31] Power calculations for *F*-test, ANOVA: Repeated measures, within-between interaction, "effect size specification as in Cohen (1988) – recommended": $f(V) = 0.2041241$, two groups, two measurements, nonsphericity correction $\varepsilon = 1$, $\alpha = .05$.

Table 8

Sample Characteristics of Study 3.

Initial sample	$N = 314$
Dropouts	Did not complete T1: $n = 22$; did not complete T2: $n = 52$; did not complete T3: $n = 40$; did not answer all seven e-mails: $n = 80$
Final sample	$N = 210$
Reward	Raffle of five 20€-Amazon vouchers
Gender	68% female, 32% male
Age (years)	$M = 23.68$ ($SD = 2.80$), range = 18-32
Education	50% university, 48% Abitur (German diploma required for admission to university studies)
Experimental conditions	Past/present ($n = 110$) vs. 20-years-future ($n = 100$)

Note. Actual average completion time: T1 five min, T2 one min, T3 four min.

Design and Procedure

A randomized mixed 2 (past/present condition, future condition) x 2 (measurement time T1, T2 or T1, T3) design was used, with intervals between the measurement times of one week each. Building on the theoretical assumptions and results of van Gelder et al. (2015), we expected 1) a negative correlation between baseline vividness of the 20-years-future self and baseline unhealthy behavior, 2) an increase in vividness of the 20-years-future self after the manipulation in the future condition as compared to the past/present condition *(manipulation check)*, 3) decreases in unhealthy behavior after the manipulation in the future condition as compared to the past/present condition, and 4) change in vividness of the 20-years-future self to mediate the relationship between the experimental conditions and change in unhealthy behavior.

Interested persons first received an information sheet on the study procedure and data protection, including the cover story that the 15-day online study was about "lifestyle and self-perception". Different from the original study in which all participants who had fully participated were rewarded with a €10 cinema voucher, we raffled off five Amazon vouchers of €20 each among the final sample participants. At the end of the last questionnaire, the participants could indicate whether they were interested in further information on the research question and the results of the study. Participants indicating wanting further information were sent a short report with the results of first data analyses several weeks later.

   Manipulation. Instead of the quasi-experimental approach of the original study, participants were randomly assigned to one of the two experimental conditions. For a period of seven days between T1 (baseline, Day 1-3) and T2 (post-manipulation, Day 8-11), they received daily e-mails from the "research team of the University of Bonn" to which they were to reply (instead of communicating with their avatars on Facebook, as in the original study). In case participants had forgotten to answer an e-mail (or a questionnaire at T1, T2, or T3), they were sent a reminder and could answer the e-mail (or complete the questionnaire) up to three days later. In the future condition, the e-mails were designed to

stimulate thinking about the future self, starting with two years in the future and gradually building up to 20 years in the future. We opted for a 20-year (instead of 15-year) interval between the age of the present and the most distant future self as we expected a sample of adults rather than adolescents, and assumed that imagining future selves was easier after entering adulthood (van Gelder et al., 2015, see p. 57 of the present research). In the past/present condition, the messages were on the same topics, but with a focus on the past or present. The topics, such as relationships, work, education, social life, sports, and hobbies, were adapted from the original study. We shortened the questions and minimized differences between the conditions with respect to wording and length.

Measures. At T1 (baseline) and T3 (follow up, Day 15-16), all participants answered 17 items on *health-relevant behavior in the past week*, i.e., smoking (two items), alcohol consumption (two items), substance use (three items), physical activity (two items), diet (seven items), and tanning (one item). Care was taken to only survey behavior that is generally acknowledged to be healthy vs. unhealthy. Nine additional distractor items (e.g., on reading books or using social media in the past week) were intended to conceal that the study was about health behavior in particular rather than "lifestyle" in general. Answers were given on 5-point scales indicating frequencies ("never" to "daily"/"more than 10 times"), and coded so that higher values corresponded to more unhealthy behavior. Regarding alcohol consumption in the past week, participants indicated both the number of days they had drunk, and the total number of standard drink units consumed. They were informed that one standard drink unit is equal to, e.g., 0.33l of beer, 0.25l of wine, or 0.02l of liquor (see Appendix G).

For scale calculations, these answers were linearly transformed onto five-point scales. For the unhealthy behavior *total score* over all 17 items, the internal consistency was $\alpha_{T1} = .69$ and $\alpha_{T3} = .70$; item-total-correlations ranged between $r = .04$ and $r = .60$, with low values ($r < .30$) for the majority of 12 items at T1. We aggregated despite the rather low internal consistency because the items inquire about entirely different unhealthy behaviors that do not necessarily co-occur, and aggregation of such causal indicators can be valid even if internal consistency is low (Bollen & Lennox, 1991; Gabriel et al., 2007). Additionally, three subscales were calculated: *unhealthy diet* (five items, $\alpha_{T1} = .80$, $\alpha_{T3} = .76$),[32] *alcohol* (two items, $\alpha_{T1} = .85$, $\alpha_{T3} = .81$), and *smoking* (two items, $\alpha_{T1} = .84$, $\alpha_{T3} = .87$). From the remaining single items (tanning, prescription or illegal drug abuse, cannabis consumption, not skipping sweets/dessert, drinking not enough water), no meaningful subscales could be calculated. We decided not to assess unhealthy behavior in the past year (as the original study did for delinquency). Due to randomization, baseline differences between the experimental conditions were not to be expected, and it was regarded as sufficient to test the randomization regarding demographics, baseline vividness of the future self (vividness_{20}), and baseline unhealthy behavior in the past week. *Vividness_{20}* was assessed at T1 (baseline, Day 1), T2 (post-manipulation, Day 8-11), and T3 (follow-up, Day 15-

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[32] Two thematically matching items were not included due to low item-total correlations at T1: not skipping sweets/dessert ($r = .29$) and drinking not enough water ($r = .27$); r [.50, .68] for the remaining five items.

16) with five items[33] adopted from the original study ($\alpha_{T1} = .91$, $\alpha_{T2} = .91$, $\alpha_{T3} = .92$). With consideration of the results of Study 2, connectedness with future selves was no longer assessed. Since van Gelder et al. (2015) also assessed a criminal choice vignettes series at T1 and T2, which was not included in the analyses due to low internal consistency and questionable validity and was left out of the present study as well, our questionnaires were considerably shorter than in the original study.

Results

Preliminary analyses indicated that the dropout rate did not differ between conditions ($\chi^2(1) = 1.76$, $\phi = -.08$, $p = .185$, $N = 273$). Participants who had dropped out did not differ from the final sample with respect to age ($t(75.48) = 1.93$, $d = 0.31$, $p = .058$), gender ($\chi^2(1) = 0.47$, $\phi = .04$, $p = .495$), education ($\chi^2(1) = 0.47$, $V = .04$, $p = .817$), baseline vividness$_{20}$ ($t(271) = -.41$, $d = 0.06$, $p = .689$), or baseline unhealthy behavior (*total score: t*(271) = 0.36, *d* = 0.04, *p* = .720; *unhealthy diet: t*(271) = -0.66, *d* = -0.08, *p* = .509; *alcohol: t*(271) = 1.25, *d* = 0.15, *p* = .211; *smoking: t*(271) = 1.01, *d* = 0.12, *p* = .312).

Randomization Check. The randomization check was successful in that the experimental conditions did not differ in terms of age ($t(170.76) = -1.26$, $d = 0.17$, $p = .210$), gender ($\chi^2(1) = 0.39$, $\phi = -.04$, $p = .535$), education ($\chi^2(2) = 4.39$, $V = .15$, $p = .111$), baseline vividness$_{20}$ ($t(208) = 1.48$, $d = 0.21$, $p = .139$), or baseline unhealthy behavior (*total score: t*(189.72) = 0.41, *d* = 0.06, *p* = .686; *unhealthy diet: t*(208) = -0.27, *d* = -0.04, *p* = .791; *alcohol*: *t*(208) = -0.65, *d* = -0.09, *p* = .517; *smoking: t*(208) = -0.14, *d* = -0.02, *p* = .890). Participants in both conditions also wrote comparably long e-mails ($t(208) = 0.04$, $d = 0.01$, $p = .966$) and completed the questionnaires comparably quickly (T1: $t(167.76) = -1.59$, $d = 0.22$, $p = .115$; T2: $t(208) = 0.51$, $d = 0.07$, $p = .612$; T3: $t(208) = -1.22$, $d = 0.17$, $p = .222$).

Manipulation Check: Change in Vividness$_{20}$. To test whether the manipulation was successful, i.e., whether vividness$_{20}$ increased over time in the future condition as compared to the past/present condition, two repeated-measures ANOVAs were conducted with time (T1, T2 or T1, T3) as a within-subjects factor and condition as a between-subjects factor.[34] For both comparisons, there were no significant effects (T1, T2: time: $F(1, 208) = 0.52$, $\eta_p^2 < 0.01$, $p = .471$; time x condition: $F(1, 208) = 1.78$, $\eta_p^2 = 0.01$, $p = .184$;[35] T1, T3: time: $F(1, 208) = 0.90$, $\eta_p^2 < 0.01$, $p = .344$; time x condition: $F(1, 208) = 0.01$, $\eta_p^2 < 0.01$, $p = .945$).[36] From T1 to T2, vividness$_{20}$ changed neither in the past/present condition ($\Delta M = -0.03$, $SD = 0.59$; $t(109) = -0.55$, $d = 0.05$, 95% CI [-0.34, 0.19], $p = .583$, $BF_{10} = 0.11$) nor in the future condition ($\Delta M = 0.10$, $SD = 0.86$; $t(99) = 1.21$, $d = 0.12$, 95% CI [-0.11, 0.45], p

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[33] Translated from Dutch to German; again, the sixth item used in van Gelder et al. (2015) introducing a visual component was omitted as considered unnecessary.

[34] Following the rational of Hall and Fong (2003), two repeated-measures 2 (condition) x 2 (T1, T2 or T1, T3) ANOVAs were conducted rather than a single 2 (condition) x 3 (T1, T2, T3) ANOVA. If the future condition were to show large initial increases in vividness$_{20}$ from T1 to T2 and maintain these changes to T3, the effect of time would be dampened by the uniformity of vividness$_{20}$ for this condition from T2 to T3.

[35] Box's *M*-test of equality of covariance matrices: $p = .001$.

[36] Box's *M*-test of equality of covariance matrices: $p = .031$.

= .231, BF_{10} = 0.25). From T2 to T3, vividness$_{20}$ did not change in the past/present condition (ΔM = -0.02, SD = 0.48; $t(109)$ = -0.43, d = 0.04, 95% CI [-0.32, 0.21], p = .665, BF_{10} = 0.09), and slightly decreased in the future condition (ΔM = -0.15, SD = 0.67; $t(99)$ = 2.22, d = -0.22, 95% CI [-0.59, -0.03], p = .029, BF_{10} = 1.08). Therefore, the manipulation check failed; there was no increase in vividness$_{20}$ in the future condition as compared to the past/present condition.

Change in Unhealthy Behavior. Means and standard deviations, and interaction effects between time and condition for the single items and scales on unhealthy behavior between conditions, are listed in Table 9. The single items on substance use (alcohol, smoking, prescriptive drugs, cannabis, hard drugs) and tanning, with higher values indicating more unhealthy behavior, showed low base rates and restricted variance (M [1.00; 1.20], Mdn = 1.00, SD [0.12, 1.30], at a potential range of 1-5 or with open text fields for numbers). At baseline, 38% of the participants had not drunk any alcoholic beverages at all in the past week, another 29% had drunk alcohol on one day only. A total of 82% of participants reported no smoking, 94% reported no abuse of prescription drugs, and 97% reported no use of cannabis in the past week. Only one participant (in the past/present condition) had consumed hard drugs such as cocaine or heroin one or two times in the past week, at both T1 and T2.

In order to compare the change in unhealthy behavior between conditions, repeated-measures (M)ANOVAs were used with time (T1, T3) as a within-subjects factor and condition as between-subjects factor, expecting an interaction indicating less unhealthy behavior after the manipulation in the future condition, but not in the past/present condition. For all single items and three of the scales, there were no significant effects (unhealthy behavior *total score*: time: $F(1, 208)$ = 0.01, η_p^2 < 0.01, p = .939; time x condition: $F(1, 208)$ = 2.75, η_p^2 = 0.01, p = .099, Figure 9 [left]; *alcohol*: time: $F(1, 208)$ = 1.30, η_p^2 = 0.01, p = .255; time x condition: $F(1, 208)$ = 0.01, η_p^2 < 0.01, p = .924; *smoking*: time: $F(1, 208)$ = 1.51, η_p^2 = 0.01, p = .220; time x condition: $F(1, 208)$ = 0.45, η_p^2 < 0.01, p = .503; Table 9).[37]

Due to the low base rates, exploratory Receiver Operating Characteristic (ROC) curve analyses (Rice & Harris, 2005) were conducted, with results on change in the unhealthy behavior total score (AUC = .57, 95% CI [.49, .65], SE = 0.04, p = .083), change in alcohol consumption (AUC = .53, 95% CI [.45, .61], SE = 0.04, p = .414), and change in smoking (AUC = .49 (95% CI [.41, .57], SE = 0.04, p = .843) speaking against any predictive value of the experimental conditions.

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[37] Box's *M*-test of equality of covariance matrices: p = .041; Levene's test for unhealthy behavior total score at T1: p = .024.

Table 9

Means and Standard Deviations in the Experimental Conditions at T1 and T3, and Interaction Effects Between Time and Condition for the Single Items and Scales on Unhealthy Behavior in Study 3.

	Future condition (*n* = 110)					Past/present condition (*n* = 100)					Time x condition		
	T1		T3		T3-T1	T1		T3		T3-T1			
	M	*SD*	*M*	*SD*	Δ*M*	*M*	*SD*	*M*	*SD*	Δ*M*	*F*(1, 208)	η_p^2	*p*
Alcohol	1.66	0.67	1.71	0.66	0.05	1.60	0.76	1.65	0.71	0.05	0.01	< 0.01	.924
Alcohol days[a]	1.26	1.27	1.34	1.22	-0.08	1.14	1.34	1.23	1.29	0.09	0.01	< 0.01	.945
Alcohol units[b]	3.63	4.37	4.07	4.56	0.44	3.62	6.80	3.77	5.17	0.15	0.16	< 0.01	.689
Cigarettes	1.26	0.77	1.25	0.80	-0.01	1.24	0.70	1.20	0.62	-0.04	0.45	< 0.01	.503
Smoking overall	1.37	1.01	1.33	0.97	-0.04	1.37	0.95	1.32	0.83	-0.05	0.04	< 0.01	.836
Smoking per day	1.14	0.57	1.17	0.67	0.03	1.11	0.51	1.09	0.48	-0.02	1.02	0.01	.314
Unhealthy diet	**2.78**	**0.76**	**2.72**	**0.64**	**-0.06**	**2.76**	**0.65**	**2.82**	**0.66**	**0.06**	**4.43**	**0.02**	**.031**
Junk food	1.90	0.72	1.89	0.58	-0.01	1.73	0.56	1.76	0.61	0.03	0.27	< 0.01	.604
No fruit	2.91	1.08	2.89	0.96	-0.02	2.97	0.90	3.03	0.94	0.06	0.47	< 0.01	.492
No vegetables	2.76	0.83	2.69	0.80	-0.07	2.73	0.86	2.83	0.91	0.10	3.48	0.02	.063
Unbalanced diet	2.81	1.14	2.75	1.04	-0.06	2.85	0.98	2.95	1.03	0.10	2.46	0.01	.119
Unhealthier meal option	3.54	1.19	3.39	1.09	-0.15	3.52	1.03	3.55	1.02	0.03	2.23	< 0.01	.137
Further single items													
No sports	4.03	0.74	3.93	0.84	-0.10	3.85	0.87	3.93	0.81	0.08	3.07	0.02	.081
Not physically active	3.64	1.11	3.45	1.05	-0.19	3.77	0.95	3.79	0.89	0.02	2.76	0.01	.098
Sweets or dessert	3.80	1.33	3.79	1.13	-0.01	3.69	1.18	3.75	1.15	0.06	0.27	< 0.01	.601
Not enough water (≥ 2l)	2.14	1.28	2.25	1.32	0.11	2.77	1.39	2.68	1.47	-0.09	3.52	0.02	.062
Abuse prescr. drugs	1.06	0.42	1.02	0.14	-0.04	1.20	0.74	1.15	0.56	-0.05	< 0.01	< 0.01	.951
Cannabis	1.03	0.17	1.02	0.14	-0.01	1.05	0.25	1.05	0.30	0.00	0.66	< 0.01	.416
Hard drugs	1.01	0.10	1.01	0.10	0.00	1.00	0.00	1.00	0.00	0.00	--	--	--
Tanning	1.01	0.10	1.04	0.24	0.03	1.02	0.13	1.03	0.16	0.01	0.81	< 0.01	.370
Unhealthy behavior total score	2.20	0.39	2.18	0.37	-0.02	2.22	0.31	2.25	0.32	0.03	2.75	0.01	.099

Note. Higher values indicate more frequent unhealthy behavior; [a] potential range = 0-7; [b] indicated in standard drink units: 1 unit ~ 0.33l of beer, 0.25l of wine, 0.02l of liquor; all other variables: potential range = 1-5.

Figure 9

Non-Significant Interaction Between Time and Condition in Unhealthy Behavior Total Scores (Left),
and Significant Interaction Between Time and Condition in Unhealthy Diet (Right) in Study 3.
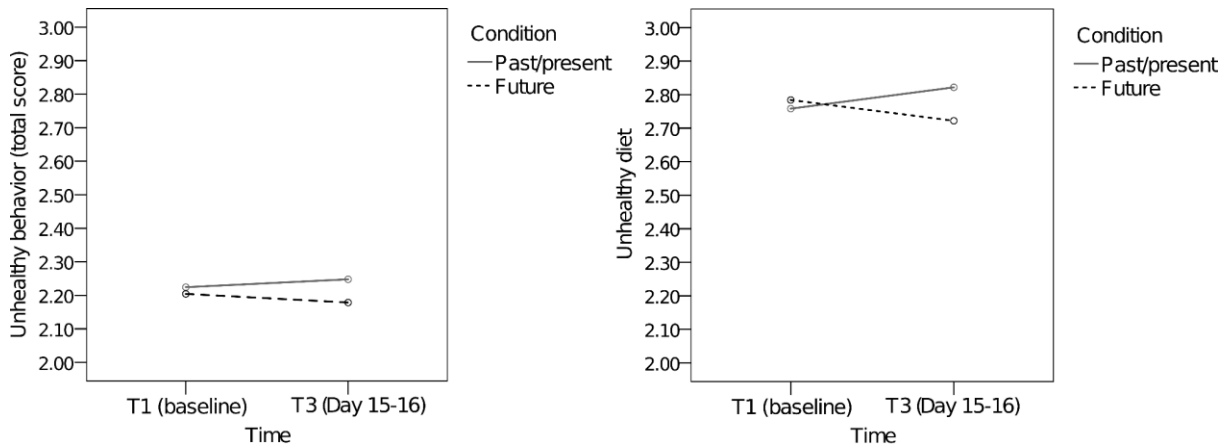
Note. Scale units for the y-axis were chosen with consideration of the small effect sizes, and to ensure comparability with results in Study 4; potential range = 1-5, $N = 210$.

For the *unhealthy diet* subscale, there was a significant interaction effect between time and condition ($F(1, 208) = 4.73$, $\eta_p^2 = 0.02$, 90% CI [< 0.01, 0.07], 95% CI [< 0.01, 0.08], $p = .031$; time: $F(1, 208) < 0.01$, $\eta_p^2 < 0.01$, $p = .977$; Figure 9 (right)]. In Bayesian analysis on the basis of an independent-samples *t*-test on change in unhealthy diet ($t(208) = 2.18$, $d = 0.29$, 90% CI [0.07, 0.53], 95% CI [0.03, 0.57], $p = .031$), the H_1 was $BF_{10} = 1.36$ times more likely than the H_0. The *AUC* was significant at .59 (95% CI [.51, .67], $SE = 0.04$, $p = .025$). In exploratory hierarchical moderated regression analysis with baseline unhealthy diet (centered; Step 1), condition (dichotomous; Step 2), and their interaction (Step 3) as predictors of T3 unhealthy diet, only baseline unhealthy diet accounted for a significant amount of variance in T3 unhealthy diet (Table 10).

Table 10

Multiple Linear Regression with Unhealthy Diet at T3 as Criterium in Study 3.

Predictor	ΔR^2	B	SE_B	β	t	p
Step 1	.62					
(Constant)		2.77	0.03		112.51	< .001
T1 unhealthy diet		**0.72**	**0.04**	**.79**	**20.27**	**< .001**
Step 2	< .01					
(Constant)		2.88	0.08		37.28	< .001
T1 unhealthy diet		**0.72**	**0.04**	**.79**	**20.34**	**< .001**
Condition		-0.07	0.05	-.06	-1.46	.145
Step 3	< .01					
(Constant)		2.88	0.08		37.38	< .001
T1 unhealthy diet		**0.88**	**0.12**	**.97**	**7.59**	**< .001**
Condition		-0.07	0.05	-.06	-1.47	.144
T1 unhealthy diet x condition		-0.10	0.07	-.19	-1.46	.147

Note. N = 210.

Table 11

Measures of Association (Spearman or Phi/Cramer's V) and Internal Consistencies of All Study 3 Measures.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. **Experimental condition**	--													
2. **T1 Vividness$_{20}$**	-.11	$\alpha = .91$												
3. **T2 Vividness$_{20}$**	-.04	**.72****	$\alpha = .91$											
4. **T3 Vividness$_{20}$**	-.09	**.73****	**.84****	$\alpha = .92$										
Measures of unhealthy behavior														
5. **T1 Alcohol**	.08	.09	**.16***	**.15***	$\alpha = .85$									
6. **T3 Alcohol**	.07	.01	.09	.05	**.60****	$\alpha = .81$								
7. **T1 Smoking**	-.03	.07	**.18****	**.16***	**.28****	**.21****	$\alpha = .84$							
8. **T3 Smoking**	-.05	-.05	.05	.01	**.21****	**.24****	**.74****	$\alpha = .87$						
9. **T1 Unhealthy diet**	.02	-.11	.01	-.06	.10	**.19****	**.14***	.10	$\alpha = .80$					
10. **T3 Unhealthy diet**	-.07	<-.01	.02	-.05	.04	**.17***	.07	.10	**.80****	$\alpha = .76$				
11. **T1 Unhealthy total**	-.05	-.07	.06	-.02	**.36****	**.31****	**.34****	**.27****	**.84****	**.70****	$\alpha = .69$			
12. **T3 Unhealthy total**	-.11	.03	.07	-.01	**.23****	**.38****	**.24****	**.30****	**.68****	**.82****	**.78****	$\alpha = .70$		
Demographics														
13. **Age**	.03	.01	.01	-.01	**.16***	**.18****	**.16***	**.16***	.07	.05	.11	.10	--	
14. **Gender**	*-.04*	-.02	-.11	**-.16***	**-.15***	**-.16***	-.10	-.10	**-.28****	**-.14***	**-.22****	-.07	-.09	--
15. **Education**	*.15*	-.06	-.08	-.10	.01	.04	-.01	.04	-.07	-.06	-.04	<-.01	**.36****	*.14*

Note. **1. Experimental condition:** 1 = past/present, 2 = future; **14. Gender:** 1 = male, 2 = female; **15. Education:** actual range = 3-5; 3 = "Realschulabschluss", 4 = "Abitur", 5 = "Hochschulabschluss"; all other variables: higher values indicate higher manifestations; **13. Age:** actual range = 18-32; *for **1., 14., 15.:** Phi/Cramer's V*; all other coefficients: Spearman; $N = 210$; * $p < .05$, ** $p < .01$.

Correlations across Conditions. Spearman correlations or Phi/Cramer's *V* coefficients for all scale measures of Study 3 are shown in Table 11. Contrary to expectations, vividness$_{20}$ measures were negatively associated neither with scale measures nor with single items assessing unhealthy behavior ($r(210)$ [-.13, .08], p [.054, .957]). For information on the statistical analyses, see also Appendix E.

Discussion

According to van Gelder et al. (2015), writing to one's distant future self over the course of one week can be used as an intervention to increase the vividness of that distant future self, and thus to reduce delinquent behavior in adolescents. In an attempt to conceptually replicate these findings for unhealthy behavior in young adults, with almost 2.5 times the original sample size, the hypotheses largely could not be confirmed. A small effect of the intervention was observed for diet behavior, i.e., participants who had contemplated future experiences reported healthier eating in the week after the manipulation as compared to participants who had reflected on recent or past events. However, the intervention failed to increase vividness of the future self, and vividness$_{20}$ was not negatively associated with any unhealthy behaviors, thus there was no indication of the expected mediating effect of change in vividness$_{20}$.

Overall, the potential of the intervention to improve health outcomes, or the relevance of future self-continuity to predict health outcomes on a differential level, can hardly be assessed on the basis of these data. Due to low base rates and variance restrictions, it was not even possible to reduce unhealthy behaviors for the most part. Besides possible impacts of socially desirable responding, these figures match sample characteristics, as higher educational level has been shown to improve several health-related behaviors such as drinking habits (Li & Powdthavee, 2015). Additionally, the mere fact that the participants had successfully completed the extensive intervention, i.e., answered e-mails every day for over a week, suggests a certain degree of conscientiousness, or self-control. In contrast to the original study, we did not find that participants with more self-control-related problem behavior at baseline were more likely to drop out, but such persons might not have been motivated to participate from the start due to the scope and overall duration of the study.

Therefore, the small effect on diet behavior *could* be interpreted as the intervention showing promising results in the only domain where the sample had potential for improvement. However, the effect sizes in the 90% and 95% confidence intervals ranged from close to zero to medium, and Bayesian analysis indicated that the H$_1$ and the H$_0$ were almost equally likely. There also were no substantial changes in diet behavior within the single experimental conditions, thus the results are not particularly promising.

Even if the intervention had a small but replicable true effect on diet behavior, the findings in Study 3 speak against future self-continuity as the underlying process. Calling into question its predictive value, vividness of the future self was not substantially correlated with diet behavior, and independent from outcome measures, the manipulation check failed: Participants who had contemplated future

experiences did not have a more vivid picture of their future selves than participants who had reflected on present or past experiences.

The results of van Gelder et al. (2015) and Study 2, however, indicated that vividness of the future self can be altered by writing tasks, and that such changes can be depicted on the self-report scale used. Therefore, it is quite possible that deviations from the original study account for the failed manipulation. First, regarding sample characteristics, our sample did not consist of teenagers, but of young adults who had already finished school or even university and were about six years older than the participants in van Gelder et al. (2015). Younger people generally view time intervals into the future as more distant than older people, as these intervals represent larger proportions of their previous lifetime (Barbot & Hunter, 2012). Also, several aspects of future orientation have been found to increase with age, particularly from the age of 15 or 16 years (e.g., anticipation of future consequences, planning ahead; Steinberg et al., 2009). Therefore, it can be assumed that it is also more difficult for younger people to imagine their future selves (van Gelder et al., 2015), which should be particularly true for future selves in different life stages (e.g., adolescence, school vs. adulthood, work life). In order to take this into account with our older sample, we increased the imagined distance to the future self from 15 to 20 years. It is questionable, however, whether imagining one's 42-year-old self when one is 22 (as in Study 3) is as comparably difficult as imagining one's 31-year-old self when one is 16 (as in van Gelder et al., 2015). Compared to adults, in teenagers the vividness of any adult future self might be increased more easily by specific questions. In Study 2, however, the expected manipulation effects on measures of future self-continuity emerged in adults, speaking against such age-related boundary conditions (see also Bartels & Urminsky, 2011, Study 4).

Second, regarding instructions, the messages sent to the participants were shorter and differences in length between conditions were smaller than in the original study. What might be more important is that the participants in Study 3 did not communicate with avatars of their age-morphed or current selves via an online social network site, but via e-mail with the "research team of the University of Bonn". These settings were unfavorable particularly in view of the letter content analysis in Study 1 (but not Study 2): Addressing distant/near future selves personally ("Dear…," "you") was associated with increased connectedness to distant future selves in the distant future condition, but with decreased connectedness in the nearer-future conditions (see p. 34). In Study 3, e-mail communication in general might have led the participants to contemplate their (future) selves less intensely or less honestly. The official salutation and closing formula in the e-mails could have constantly reminded them that they "had to" deal with the questions only for the purpose of the study, to do their friends or relatives a favor by participating, and/or to take part in the voucher raffle. The visual and personal component in van Gelder et al.'s (2015) intervention might be crucial for effects on vividness of the future self.

Eventually, Study 3 provided no evidence that future self-continuity could be altered via writing tasks on future selves – though the intervention was designed more extensively as compared to the original letter task. However, the informative value of the results was limited due to methodological problems. The final study of the present research draws back to the idea of a minimal intervention: The letter task paradigm from Study 1 and 2 was applied to health-related outcomes that were assumed to be relevant to more people, and in order to systematically examine possible mediating factors in another longitudinal design.

Study 4: Future Self-Continuity, Self-Affirmation, and Unhealthy Behavior

In Study 3, an e-mail writing task over the course of one week had hardly any effects on health behavior, but the informative value of the results was limited due to low base rates. The intervention also failed to increase vividness of the future self, whereby unfavorable intervention characteristics might have played a role. Content analyses in Study 1 and 2 indicated that writing letters to distant future selves encourages contemplating personal values in terms of a self-affirmation strategy (e.g., being married with kids, having a fulfilling job, living in a nice place, travelling, as compared to referring to daily routines when writing to near-future or present selves; see p. 46). According to the framework of self-affirmation interventions (e.g., McQueen & Klein, 2006), self-esteem can be strengthened by directly querying self-relevant values independent of a temporal reference (see p. 21). With interventions on future self-continuity – still assuming they can actually work – such self-affirmation processes might substantially contribute to effects on intertemporal decisions. Also, self-affirmation interventions might interact beneficially with elements targeting future orientation. The objective of Study 4 was to disentangle future self-continuity from self-affirmation in order to further elucidate possible underlying mechanisms and boundary conditions of the letter task paradigm. Therefore, a task that explicitly combines elements to "affirm the self"/enhance self-esteem, i.e., contemplating personal values, with elements to enhance future orientation, i.e., contemplating one's distant future self (SF), was tested for its effectiveness compared to a classical self-affirmation task (S), a letter task on future orientation (F), i.e., without explicit value activation, and an "other-affirmation" control task (C) containing neither future orientation nor self-affirmation elements (e.g., Napper et al., 2009).

As dependent variables, alcohol consumption, (un)healthy diet, and physical (in)activity were chosen because the least variance restrictions were to be expected for these domains of unhealthy behavior in a non-clinical sample. In order to provoke problem awareness among the participants, a common component of self-affirmation interventions was adopted for all experimental conditions: Participants were exposed to a *health message* that provided information about the health risks associated with consuming alcohol, eating unhealthily, and lack of exercise. In terms of an alternative underlying process, the interventions might promote health message acceptance (e.g., Epton et al., 2015), i.e., they might help participants to deal more constructively with such threatening information. On the one

hand, the delivery of the health message made the subject of the study less subtle than in Study 1-3, but on the other hand, the intervention itself was still not recognizable as such.

The scope of the interventions was significantly reduced as compared to Study 3. Instead of answering an e-mail every day for a week, the participants in Study 4 completed one out of four one-off tasks that took less than five minutes. At the same time, the follow-up interval was increased to four weeks. Taking into consideration the previous results of the present research, this was rather optimistic. However, the informative value of the previous three studies was limited due to questionable outcome measures (Study 1 & 2), or low base rates (Study 3), and positive effects on health behavior have been achieved with subtle, one-off self-affirmation interventions in comparable settings (e.g., Armitage et al., 2011; Epton et al., 2015). As in the previous studies, possible mediators (in Study 4: response to health-related information, vividness of the 10-years-future self, self-esteem) were assessed along with related trait constructs (self-control, future time perspective) by way of comparison. Prior to data collection, the study was approved by the ethics committee of the Department of Psychology at the University of Bonn, and pre-registered in the OSF[38] (see Appendix H). Deviations from the pre-registration are indicated in the following sections. All materials are available in Appendix I, data sets and syntax files can be provided on request.

Sample

Participants were recruited from the ProA participant pool, with prescreening filters to achieve the best possible data quality (i.e., experienced ProA members only, who had taken part in more than 10 previous studies, with approved participation rates above 50%). Since alcohol consumption was surveyed again, the minimum age was set at 21 years, consistent with the highest legal drinking age in international comparison. A priori power analysis indicated a necessary sample size of $N = 126$ to detect a medium true effect of $\eta_p^2 = 0.06$, or a necessary sample size of $N = 256$ to detect a small true effect of $\eta_p^2 = 0.03$.[39] The objective was to have 260 participants at T1 (65 per experimental condition). Again, due to settings in ProA, the initial sample was slightly larger than pre-registered. From 269 participants at T1, 58 (27%) dropped out, thus the final sample was $N = 211$. Sample characteristics are listed in Table 12.

Design and Procedure

A randomized block mixed 2 (self-affirmation [S] given, not given) x 2 (future orientation [F] given, not given) x 2 (measurement time T1, T2) design was used. The time interval between T1 and T2 was four to five weeks, and the hypotheses were 1) more constructive direct reactions to information on

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[38] Weblink to pre-registration: https://osf.io/k49n2

[39] Power calculations for F-test, ANOVA: Repeated measures, within-between interaction, "effect size specification as in Cohen (1988) – recommended": $f(V) = 0.1758631$ or 0.2526456, two groups, two measurements, $\alpha = .05$, $1 - \beta = .80$. Power calculations differ from the pre-registration (Appendix H) as two factors were compared rather than four experimental conditions, and results of ANOVAs were considered rather than of MANOVAS. The result of the pre-registered power analysis ($N = 179$) was descriptively between the values reported here.

health risks in the experimental conditions (SF, S, F) than in the control condition (C; *Manipulation Check 1*), 2) increases in vividness of the 10-years-future self after the manipulation in the F conditions (SF, F; as compared to S, C; *Manipulation Check 2a*), and, vice versa, 3) increases in self-esteem after the manipulation in the S conditions (SF, S; as compared to F, C; *Manipulation Check 2b*),[40] as well as 4) effects on health behavior, i.e., decreases in alcohol consumption, unhealthy diet, and physical inactivity in the experimental conditions (SF, S, F) as compared to the control condition (C), with stronger effects in the combined experimental condition (SF) as compared to the single experimental conditions (S, F).

Table 12

Sample Characteristics of Study 4.

Initial sample (T1)	$N = 269$
Final sample (T2)	$N = 211$
Reward	£2.43 (~ $2.05)[a]
Gender	58% female, 42% male
Age (years)	$M = 34.92$ ($SD = 12.00$), range = 21-76
Education	74% college/university, 23% high school
Place of residence	52% United Kingdom, 11% Portugal, 7% Italy, 7% United States
Native language	56% English, 11% Portuguese, 6% Italian, 6% Spanish
Socioeconomic status[b]	$M = 2.82$ ($SD = 0.64$), actual range = 1-4 (potential range = 1-5)
Experimental conditions	SF ($n = 54$) vs. S ($n = 47$) vs. F ($n = 59$) vs. C ($n = 51$)

Note. [a] Reward per hour T1: £5.16, T2: £5.34; estimated completion time: T1 20 min, T2 10 min (actual completion time: T1 12 min, T2 six min); [b] self-rated; Experimental conditions: SF = self-affirmation & future orientation, S = self-affirmation, F = future orientation, C = control.

ProA members were first presented the cover story that the study was about "lifestyle and self-perception," followed by information regarding consent, ethics, and instructions for completing the study. If they agreed, they were forwarded to the T1 questionnaire (baseline, Day 1). After stating demographics and baseline data, the participants were randomly assigned to the experimental conditions, completed one of the four writing tasks, and were then all exposed to an identical health message, i.e., an information sheet on health risks, followed by eight final items to assess their understanding of, and their emotional reactions to, the health message. At T2 (Day 29-36), the participants filled out a short version of the T1 questionnaire for follow-up measures of health behavior, self-esteem, vividness of the 10-years-future self (vividness$_{10}$), self-control, and future time perspective, within one week.

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[40] Pre-registered hypotheses regarding self-control and future time perspective measures (see Appendix H) are not listed as based on findings from Study 2, it did not seem reasonable to expect effects of the intervention with the scales used (e.g., Hall, 2001). Results on self-control and future time perspective are presented in comparison with possible mediating constructs (i.e., self-esteem, vividness) in *Manipulation Check 2*.

Manipulation. In the condition combining *self-affirmation and future self-continuity (SF)*, the participants were instructed to rank common values such as family, hobbies, and religion according to their subjective importance. Subsequently, they were to think about their future selves in 10 years' time, and to briefly describe why and when the personal value ranked most important would be helpful to them in the future. In the *self-affirmation condition (S)*, participants also ranked common values according to their subjective importance, but without any reference to the future or future selves. Instead, they were instructed to describe when and why their most important value had been helpful to them (Napper et al., 2009). In the *future orientation condition (F)*, participants completed the letter task. They were asked to think about their future in 10 years' time, and then to write a letter to their future selves. In contrast to instructions in previous studies (Monroe et al., 2017; Rutchick et al., 2018; van Gelder et al., 2013; Study 1 & 2 of the present research), the instruction was not to write about self-relevant values ("topics that will be important and dear to your future self"), but was formulated as openly and neutrally as possible instead (e.g., "What would you like to ask [your future self]?"). In the *control condition (C)*, participants ranked common values, again, but according to their presumed significance to other people, and then described when and why a value of medium rank might be helpful to other people. This task is commonly used for controls in self-affirmation experiments (e.g., Napper et al., 2009). After the manipulation, all participants were presented the same *health message* listing the numbers of annual deaths and illnesses associated with alcohol consumption, unhealthy diet, and physical inactivity in that order, each together with behavioral recommendations to keep health risks as low as possible (see Appendix I). In order to avoid reactance effects, there was no minimum time for the health message to be displayed.

Unhealthy Behavior Measures. *Alcohol consumption during the past week* was assessed at T1 (baseline, Day 1) and T2 (follow up, Day 29-36) with a modified version of the Timeline Followback Technique (e.g., Armitage et al., 2011; Sobell & Sobell, 1992). Participants entered the number of alcohol units they had consumed per day in a calendar of the past seven days. They were informed that one standard drink unit (one shot) is equal to, e.g., half a pint of beer (10 oz/300 ml), one glass of wine (at 9% alc/vol; 4 oz/125 ml), or one shot of hard liquor or spirits (0.8 oz/25 ml). Two sum scores were calculated ($\alpha_{T1} = .79$, $\alpha_{T2} = .80$). *(Un-)healthy diet in the past week* and *physical (in)activity in the past week* were assessed at T1 and T2 with six or three items, respectively. The items were largely adopted from Study 3 and translated into English; formulations that were considered unsuitable were modified.[41] Again, the items on unhealthy behavior were presented together with four distractor items (e.g., on reading books or magazines in the past week) – due to the health message, however, the actual subject of the study presumably became apparent at the end of T1. For scale calculations, the

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[41] Upon analysis of Study 3, two items were considered unsuitable to assess behavioral change. "How often have you avoided sweets or desserts in the last week?" presupposes that you are constantly offered sweets or desserts. Likewise, "How often have you been physically active [apart from sports] in the last week (climbing stairs, gardening, etc.)?" presupposes choices regarding physical activity in everyday life. However, it cannot be taken for granted that every person has the opportunity to, e.g., do gardening somewhere.

answers to the items on diet and physical activity were coded so that higher values correspond to higher frequencies of unhealthy behavior. Regarding the *unhealthy diet* subscale, an item on having sweets or a dessert (though modified as compared to Study 3) was not included due to item-total correlations close to zero ($r_{T1} < -.01$, $r_{T2} = .03$). For the remaining five items, the internal consistency was $\alpha_{T1} = .68$ and $\alpha_{T2} = .69$. For the *physical inactivity* subscale, the internal consistency was $\alpha_{T1} = .44$ and $\alpha_{T2} = .46$.[42] As in Study 3, aggregation was considered appropriate despite of rather low internal consistencies, as different causal indicators of (un)healthy diet or physical (in)activity do not need to co-occur (see Bollen & Lennox, 1991; Gabriel et al., 2007).

Manipulation Check Variables. *Reactions to the health message* were assessed at the end of T1 with eight items adopted from Armitage et al. (2011), e.g., "Did you think [the information you just read] was persuasive?", "How much of the article did you read?", to rate on seven- or six-point scales. Two items were aggregated to a measure of *perceived threat* ($\alpha = .90$). Regarding the other items, no meaningful subscales could be calculated, even if only those 83 participants who had spent the estimated minimum time (i.e., 50 seconds) required to read the entire health message on the health message were included. The time spent on the health message was additionally examined in terms of a reaction to the health message in *Manipulation Check 1*.

Self-esteem was assessed at T1 and T2 with two items (i.e., "I have high self-esteem," Robins et al., 2001; "On the whole, I am satisfied with myself," Rosenberg, 1965), each rated on a five-point scale, with higher values reflecting higher self-esteem ($\alpha_{T1} = .87$, $\alpha_{T2} = .85$). *Vividness$_{10}$* was assessed at T1 and T2 with five items adopted from van Gelder et al. (2015). The items were (re-)coded so that higher values reflect stronger vividness of the future self ($\alpha_{T1} = .93$, $\alpha_{T2} = .92$). The 10-year interval between the age of the present self and the future self was chosen as the manipulation of vividness of the future self had only been successful with using this interval in the present research (Study 2).

Moderators and Control Variables. To indicate *risky vs. non-risky alcohol intake,* baseline alcohol consumption was dummy coded according to current United Kingdom governmental recommendations (i.e., less than three or four units/day for women or men, and less than 14 units/week; Alcohol Policy Team, Department of Health, 2016), as the majority of the participants were from the United Kingdom. The dichotomous "risky intake" variable was used as a quasi-experimental between-subjects factor in repeated-measures ANOVAs on alcohol consumption. To gain an impression of the participants' overall *health status,* height and weight were queried to calculate the BMI,[43] along with two items on the subjective health status to rate on a five-point scale. This information was aggregated into a dummy variable coded as *risky* if two out of three criteria were

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[42] For the pre-registered combined scale on diet and physical activity, the internal consistency was sufficient ($\alpha_{T1} = .69$, $\alpha_{T2} = .69$); however, it seemed more reasonable to use behavior-specific scales, particularly as it turned out that the majority of participants had not read the health message completely, thus had not read information on each unhealthy behavior.

[43] Due to a programming error, height and weight were not recorded correctly at T1. As no (substantial) changes were to be expected over four weeks, height and weight were queried again at T2 and offset against the baseline items on health status.

met: BMI ≥ 30, self-rated "poor overall health", self-rated as "not at all athletic." The health status variable was used as a quasi-experimental between-subjects factor in repeated-measures MANOVAs on unhealthy diet and physical inactivity.

Self-control was assessed at T1 and T2 with the Brief Self-Control Scale (Tangney et al., 2004). Participants indicated their agreement with 13 items (e.g., "I am good at resisting temptation") on a five-point scale. Items were (re-)coded so that higher values reflect higher trait self-control ($\alpha_{T1} = .75$, $\alpha_{T2} = .84$). *Future time perspective* was assessed at T1 and T2 with 13 items of the TPQ (Fong & Hall, 2003; $\alpha_{T1} = .86$, $\alpha_{T2} = .87$), rated on a seven-point scale, with higher values indicating a more future-oriented time perspective. These constructs were examined in comparison to self-esteem and vividness[10]. At T1, participants also stated their age, gender, highest level of education, place of residence, native language, and rated their socioeconomic status (SES). Demographics were tested for group differences in the randomization check.

Results

In preliminary analyses, the data were checked for extreme values, i.e., values more than three interquartile ranges (IQRs) below the 25th percentile or above the 75th percentile. No unrealistic or otherwise questionable values were found. On the one hand, extreme values were identified that indicated longer display times for specific pages of the online questionnaire. On the other hand, the participants reported such low alcohol consumption that for five out of the days queried at T1 and T2, respectively, one unit was already a statistical extreme value. By far the highest extreme value on a single day was at 20 units of alcohol; this was considered a lot though not unrealistic, also on account of the specific participant's BMI (30.86, obese). Therefore, no extreme values were excluded in the following analyses.

Randomization Check. The randomization check was largely successful. There were hardly any differences in baseline measures and demographics between conditions with/without an S or F component (see Appendix J). Differences were found only in that there were slightly fewer participants with a risky health status at baseline in conditions with an F component (SF, F: 15:98 vs. S, C: 24:74; $\chi^2(1) = 4.38$, $\phi = -.14$, $p = .036$), and in that self-rated SES was slightly higher in conditions with an S component (SF, S: $M = 2.92$, $SD = 0.60$; F, C: $M = 2.73$, $SD = 0.68$; $F(1, 208) = 4.89$, $\eta_p^2 = 0.02$, $p = .028$).

Manipulation Check 1: Response to Health Message. Regarding possible mechanisms behind the interventions, it was assumed that all three forms of intervention (SF, S, F) would help participants to deal with the health message more constructively (e.g., less avoidant) as compared to participants in the control condition (C; *Manipulation Check 1*). In an exploratory check on the time (minutes) spent on the intervention tasks, the were no differences between conditions with/without an S component ($F(1, 208) = 1.18$, $\eta_p^2 = 0.01$, $p = .278$). In conditions with an F component, in which participants were to write about (SF), or to (F) their future selves, the intervention took slightly longer as compared to

the writing tasks in the S and C conditions (SF, F: $M = 3.60$, $SD = 2.42$; S, C: $M = 2.97$, $SD = 1.66$; $F(1, 208) = 4.63$, $\eta_p^2 = 0.02$, $p = .033$).[44] The time (seconds) spent on the second part of the intervention, reading the health message, varied widely ($Mdn = 38.00$, $M = 48.12$, $SD = 41.05$, observed range = 3-219), and was moderately associated with self-reports on how much of the health message had been read ($r = .41$, $p < .001$). Only 83 participants (39%) had spent at least 50 seconds on the health message, which was considered the minimum time to read the whole text after several speed tests with persons who were not involved in the study. Therefore, the time spent on the health message was examined in terms of an additional measure of response to the health message.

Differences in time spent on the health message were found between conditions with/without an S component ($F(1, 208) = 4.25$, $\eta_p^2 = 0.02$, $p = .040$). In particular, participants in the SF ($M = 40.30$, $SD = 34.61$) and S condition ($M = 44.21$, $SD = 39.79$) spent 21 ($SE = 7.93$, $p = .009$) or 17 ($SE = 8.21$, $p = .041$) seconds less on the health message than participants in the C condition ($M = 61.12$, $SD = 50.37$), with the F condition descriptively in between ($M = 47.17$, $SD = 36.68$; $SE = 7.76$, $p = .074$). There were no differences between conditions with/without an F component ($F(1, 208) = 2.67$, $\eta_p^2 = 0.01$, $p = .104$).

Regarding the items on response to the health message, there were no differences between conditions (SF, S vs. F, C: $F(1, 208)$ [0.18, 3.04], $\eta_p^2 \leq 0.01$, p [.983, .672]; SF, F vs. S, C: $F(1, 208)$ [0.13, 1.91], $\eta_p^2 \leq 0.01$, p [.104, .715]), except that participants in the F and C conditions ($M = 4.52$, $SD = 1.53$) stated more willingness to reconsider their health behavior than participants in the SF and S conditions ($M = 4.06$, $SD = 1.58$; $F(1, 208) = 4.53$, $\eta_p^2 = 0.02$, $p = .034$).[45] Simple contrasts indicated no differences between single conditions ($p \geq .074$). The only significant results thus contradicted the hypothesis so that *Manipulation Check 1* failed, no form of intervention led to a more constructive evaluation or processing of the health message.

Manipulation Check 2: Change in Self-Esteem and Vividness$_{10}$. In *Manipulation Check 2*, increases in vividness$_{10}$ in the future conditions (SF, F) were expected as compared to the S and C conditions, and increases in self-esteem were expected in the self-affirmation conditions (SF, S) as compared to the F and C conditions. However, there were no significant changes in vividness$_{10}$ or self-esteem, thus *Manipulation Check 2* failed as well. By comparison, the interventions also had no impact on the trait measures of self-control and future time perspective (Table 13).

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[44] Levene's test for time spent on the intervention: $p = .010$

[45] If only those participants who had spent at least 50 seconds on the health message ($n = 83$) were considered, there was no indication of differences in response to the health message (SF, S vs. F, C: $F(1, 80)$ [0.05, 1.52], $\eta_p^2 \leq 0.02$, p [.222, .832]; SF, F vs. S, C: $F(1, 80)$ [0.07, 0.91], $\eta_p^2 \leq 0.01$, p [.344, .793]).

Table 13

Repeated-Measures ANOVA with S (Given, Not Given) and F (Given, Not Given) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects Factor, on Vividness$_{10}$ and Related Constructs in Study 4 (Manipulation Check 2).

	$F(1, 207)$	η_p^2	p		$F(1, 207)$	η_p^2	p
Vividness$_{10}$				**Self-esteem**			
Time	2.40	0.01	.123	Time	2.00	0.01	.159
S	0.24	< 0.01	.622	S	3.62	0.02	.059
F	1.34	0.01	.249	F	0.04	< 0.01	.839
S x F	1.22	0.01	.271	S x F	1.43	0.01	.233
Time x S	0.32	< 0.01	.574	Time x S	0.39	< 0.01	.535
Time x F	0.06	< 0.01	.802	Time x F	1.52	0.01	.220
Time x S x F	0.12	< 0.01	.730	Time x S x F	< 0.01	< 0.01	.999
Self-control				**Future time perspective**			
Time	0.67	< 0.01	.413	Time	0.30	< 0.01	.587
S	0.70	< 0.01	.404	S	0.04	< 0.01	.835
F	1.34	0.01	.249	F	0.03	< 0.01	.854
S x F	1.02	0.01	.315	S x F	5.95	0.03	.016
Time x S	0.76	< 0.01	.386	Time x S	0.95	0.01	.330
Time x F	0.03	< 0.01	.861	Time x F	0.27	< 0.01	.603
Time x S x F	0.04	< 0.01	.948	Time x S x F	0.42	< 0.01	.516

Note. N = 211.

Change in Unhealthy Behavior. In the main hypotheses, decreases in alcohol consumption, unhealthy diet, and physical inactivity, were expected in the experimental conditions (SF, S, F) as compared to the control condition (C), with strongest effects in the SF condition. These hypotheses were tested using a series of ANOVAs as well as exploratory hierarchical moderated regression analyses, ROC analyses (Rice & Harris, 2005), and Bayesian analyses (e.g., Rouder et al., 2009). The analyses were additionally conducted for subgroups of participants who had spent enough time on the health message to read the information on the respective topic, assuming participants would read the information in the order presented (alcohol only: ≥ 17 seconds, alcohol and diet: ≥ 25 seconds, alcohol, diet, and physical activity: ≥ 50 seconds). As including only these participants had no systematic impact, the results presented in the following sections refer to the whole sample. Means and standard deviations of unhealthy behavior measures for the whole sample and subgroups, and detailed test results, are listed in Appendix K.

Alcohol Consumption. Overall alcohol consumption was relatively low. The median of the summed units of alcohol consumed in the respective past week was at $Mdn_{T1} = 1.00$ or $Mdn_{T2} = 2.00$, and 42.% (T1) or 45% (T2) of the participants stated that they had not drunk any alcoholic beverages in the past week. An alcohol intake to be classified as risky according to current recommendations (Alcohol Policy Team, Department of Health, 2016) was reported by 20.4% (T1) or 22.3% (T2) of the participants (Table K1). A repeated-measures ANOVA with S (given, not given) and F (given, not given) as between-subjects factors, and time (T1, T2) as a within-subjects factor indicated no significant effects (p [.113, .819], $\eta_p^2 \le 0.01$; Table K2).

Exploratory ROC analyses also indicated no predictive value of S or F for change in alcohol consumption (S: $AUC = .53$, 95% CI [.45, .61], $SE = 0.04$, $p = .418$; F: $AUC = .53$, 95% CI [.45, .61], $SE = 0.04$, $p = .466$).[46] In exploratory hierarchical moderated regression analysis, the continuous variable of baseline alcohol consumption (centered; Step 1), S and F (dichotomous; Step 2), and the respective interactions (Step 3-5) were used as predictors of T2 alcohol consumption. Baseline alcohol consumption accounted for 60% of variance in T2 alcohol consumption, and was its only significant predictor (Step 1-4: (β [.65, .77], $p \leq .002$; Step 5: $\beta = .73$, $p = .098$; all other $\Delta R^2 < .01$; Table K3). When the dichotomous variable of risky vs. not risky alcohol intake was added as a quasi-experimental between-subjects factor in repeated-measures ANOVA, there were significant main effects of time ($\eta_p^2 = 0.03$, $p = .015$), of S ($\eta_p^2 = 0.03$, $p = .017$), and of alcohol intake ($\eta_p^2 = 0.52$, $p < .001$); the two-way interactions between time and alcohol intake ($\eta_p^2 = 0.03$, $p = .019$), and between S and alcohol intake ($\eta_p^2 = 0.04$, $p = .005$), were also statistically significant. However, the hypothesis-relevant interactions among time and S and/or F, and among time, S and/or F, and alcohol intake, were not statistically significant ($\eta_p^2 \leq 0.01$, p [.090, .843]; Table K4).

In Bayesian analyses for independent-samples t-tests on change in alcohol consumption, including only participants with risky alcohol intake at T1 ($n = 43$), the H_0 was $BF_{01} = 1/0.19 = 5.26$ times more likely than an effect of S ($t(41) = 0.02$, $d < -0.01$, 90% CI [-0.50, 0.51], 95% CI [-0.60, 0.61], $p = .986$, $BF_{10} = 0.19$), and $1/0.16 = 6.25$ times more likely than an effect of F ($t(41) = 0.26$, $d = 0.08$, 90% CI [-0.43, 0.59], 95% CI [-0.53, 0.69], $p = .798$, $BF_{10} = 0.16$). In separate repeated-measures ANOVAs for the four conditions, a significant main effect of risky vs. not risky alcohol intake was found for each condition (η_p^2 [0.46, 0.60], $p < .001$). The effect sizes of the non-significant interactions between time and alcohol intake were small to medium in the SF, S, and F conditions (η_p^2 [0.04, 0.05], p [.105, .204]), and close to zero in the C condition ($\eta_p^2 < 0.01$, $p = .518$). Standard deviations were large, and subgroup sample sizes were unequal and particularly small for the risky baseline alcohol consumption subgroups (n [8, 17]; Table K1), so that the statistical power was particularly low (Table K5). Descriptively, for "non-risky" participants, alcohol consumption remained constant or slightly increased from T1 to T2 in all conditions (average increase by 0.96 units/week; Figure 10 [left]; Table K1). For "risky" participants, alcohol consumption decreased in the SF, S, and F conditions (average decrease by 1.95 units/week), but increased in the C condition (average increase by 0.22 units/week; Figure 10 [right]; Table K1). Therefore, though the hypothesis on alcohol consumption (decrease in the SF, S, and F conditions as compared to the C condition) was generally not supported, there were indications that all intervention forms might be successful for participants with risky levels of alcohol intake.

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[46] ROC analyses on change in alcohol consumption, including only participants who had spent at least 17 seconds on the health message ($n = 159$): S: $AUC = .56$, 95% CI [.47, .65], $SE = 0.05$, $p = .231$; F: $AUC = .55$, 95% CI [.46, .64], $SE = 0.05$, $p = .288$

Figure 10

Interactions Between Time and Condition in Alcohol Consumption for Participants with Non-Risky (Left; n = 168), or Risky (Right, n = 43) Alcohol Consumption at Baseline in Study 4.
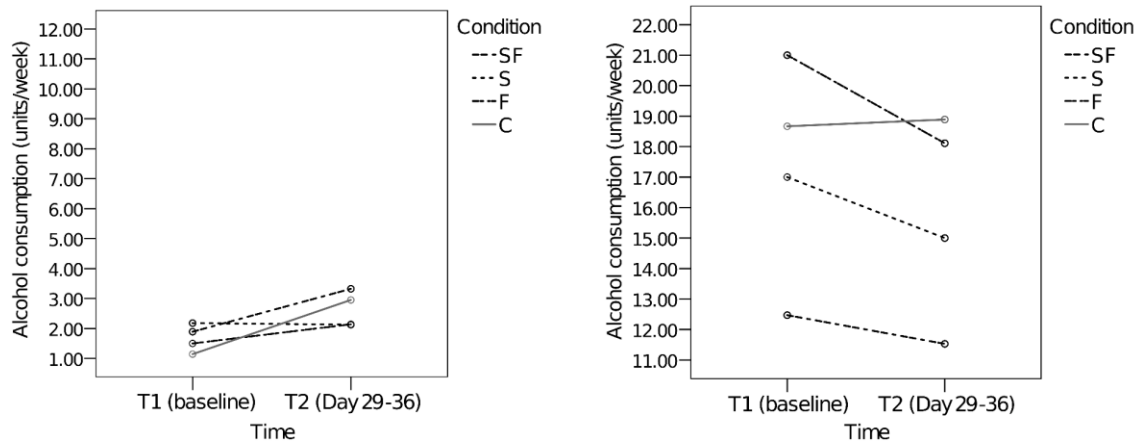
Note. Experimental conditions: SF = self-affirmation & future orientation, S = self-affirmation, F = future orientation, C = control; alcohol: 1 standard drink unit ~ 0.33l of beer, 0.25l of wine, 0.02l of liquor.

Unhealthy Diet and Physical Inactivity. The self-report measures on unhealthy diet (Mdn_{T1} = 2.37 or Mdn_{T2} = 2.43) and physical inactivity ($Mdn_{T1, T2}$ = 3.67) were almost normally distributed (potential range: 1-5, with higher values indicating higher frequency of unhealthy behaviors). The overall health status was coded as "risky" in 18.5% of the cases, i.e., these 39 participants met at least two of the criteria BMI ≥ 30, self-rated "poor overall health," and self-rated as "not at all athletic."

Regarding diet, in a repeated-measures ANOVAs with S (given, not given) and F (given, not given) as between-subjects factors, and time (T1, T2) as a within-subjects factor, there were no significant effects ($\eta_p^2 \leq 0.02$, p [.065, .819]; Table K6). ROC analyses also indicated no predictive value of S or F for change in unhealthy diet (S: AUC = .52, 95% CI [.44, .60], SE = 0.04, p = .571; F: AUC = .50, 95% CI [.43, .58], SE = 0.04, p = .917).[47] When the continuous variable of baseline unhealthy diet (centered; Step 1), S and F (dichotomous; Step 2), and the respective interactions (Step 3-5) were entered in exploratory hierarchical moderated regression analysis, only baseline unhealthy diet accounted for variance (64%) in unhealthy diet at T2 (β [0.80, 1.16], $p \leq$ .006); all other $\Delta R^2 <$ .01; Table K7). When baseline health status (risky vs. non-risky) was added as a quasi-experimental between-subjects factor in repeated-measures ANOVA on unhealthy diet, only its main effect was significant (η_p^2 = 0.55, p = .001), with all other effect sizes close to zero ($\eta_p^2 \leq$ 0.02, p [.052, 929]; Table K8). As baseline health status (risky vs. not risky) did not interact with time, S, or F, it was not considered in subsequent analyses.

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[47] ROC analyses on change in unhealthy diet, including only participants who had spent at least 25 seconds on the health message (n = 135): S: AUC = .53, 95% CI [.44, .63], SE = 0.05, p = .507; F: AUC = .46, 95% CI [.36, .56], SE = 0.05, p = .409

In Bayesian analyses for independent-samples t-tests on change in unhealthy diet, the H_0 was $BF_{01} = 1/0.19 = 5.26$ times more likely than an effect of S ($t(209) = 0.74$, $d = 0.09$, 90% CI [-0.12, 0.33, [-0.17, 0.37], $p = .458$, $BF_{10} = 0.19$), and $1/0.16 = 6.25$ times more likely than an effect of F ($t(209) = -0.38$, $d = -0.04$, 90% CI [-0.23, 0.17], 95% CI [-0.32, 0.22], $p = .702$, $BF_{10} = 0.16$). Separate repeated-measures ANOVAs for the four conditions also yielded no significant results ($\eta_p^2 \leq 0.04$, p [.147, .821]; Table K9). Also descriptively, no hypothesis-consistent pattern could be identified. Unhealthy eating behavior remained constant or tended to increase in all conditions (Table K1; Figure 11 [left]). There was thus no support for the hypothesis that any form of intervention used would reduce unhealthy eating behavior.

Regarding physical inactivity, a repeated-measures ANOVAs with S (given, not given) and F (given, not given) as between-subjects factors, and time (T1, T2) as a within-subjects factor yielded a significant interaction between time and S ($\eta_p^2 = 0.04$, $p = .005$; Table K10). ROC analyses indicated predictive value of S ($AUC = .59$, 95% CI [.52, .67], $SE = 0.04$, $p = .021$), but not of F ($AUC = .47$, 95% CI [.40, .55], $SE = 0.04$, $p = .515$).[48] In regression analysis, baseline physical inactivity (continuous, centered) was the only significant predictor of physical inactivity at T2 (Step 1-4: β [0.57, 0.72], p [<.001, .014]); all other $\Delta R^2 \leq .01$; Table K11). With baseline health status (risky vs. not risky) as a quasi-experimental between-subjects factor in repeated-measures ANOVA on physical inactivity, only its main effect was significant ($\eta_p^2 = 0.04$, $p = .005$; with all other $\eta_p^2 \leq 0.01$, p [.115, .780]; Table K12). Again, as baseline health status thus did also not affect changes in physical inactivity, it was not further considered.

In Bayesian analyses for independent-samples t-tests on change in physical inactivity, an effect of S was $BF_{10} = 6.09$ times more likely than the H_0 ($t(209) = 2.83$, $d = 0.34$, 90% CI [0.17, 0.62], 95% CI [0.12, 0.66], $p = .005$), and the H_0 was $BF_{01} = 1/0.24 = 4.17$ times more likely than an effect of F ($t(209) = -1.00$, $d = -0.14$, 90% CI [-0.37, 0.09], 95% CI [-0.41, 0.13], $p = .320$, $BF_{10} = 0.24$). Separate repeated-measures ANOVAs for the four conditions indicated a significant effect of time in the S condition only ($\eta_p^2 = 0.15$, $p = .006$; Table K13). Descriptively, physical inactivity decreased in both the SF and the S condition, but slightly increased in the F and C conditions (Table K1; Figure 11 [right]). The hypothesis of a decrease in physical inactivity was thus largely supported for the S component, but not for the F component of the interventions. In exploratory moderation analyses (Hayes, 2018), trait self-control had a significant impact on the relationship between S and change in physical inactivity (overall model: $F(3, 207) = 2.91$, $R^2 = .04$, $p = .035$; interaction: $t(207) = 2.04$, $b = 0.13$, $p = .043$; $F(1, 207) = 4.14$, $\Delta R^2 = .02$). The higher baseline levels of self-control, the more effective the self-affirmation interventions were in reducing physical inactivity.

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[48] ROC analyses on change in physical inactivity, including only participants who had spent at least 50 seconds on the health message ($n = 83$): S: $AUC = .56$, 95% CI [.44, .69], $SE = 0.06$, $p = .335$; F: $AUC = .60$, 95% CI [.47, .72], $SE = 0.06$, $p = .131$.

Figure 11

Interactions Between Time and Condition for Unhealthy Diet (Left), and Physical Inactivity (Right) in Study 4.
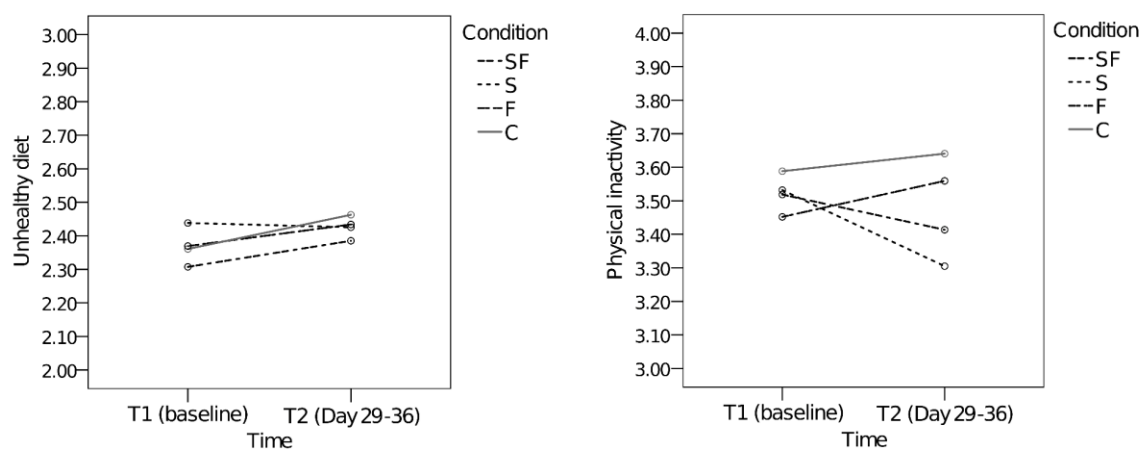
Note. Experimental conditions: SF = self-affirmation & future orientation, S = self-affirmation, F = future orientation, C = control; potential range = 1-5, $N = 211$.

Trait future time perspective had no significant impact (overall model: $F(3, 207) = 0.54$, $R^2 = .01$, $p = .654$; interaction: $t(207) = -0.96$, $b = -0.23$, $p = .338$; $F(1, 207) = 0.92$, $\Delta R^2 < .01$). Considering baseline differences in SES, it was also checked whether SES moderated the relationship between S and change in physical inactivity, which was not the case (overall model: $F(3, 207) = 2.79$, $R^2 = .04$, $p = .042$; interaction: $t(207) = -0.59$, $b = -0.07$, $p = .558$; $F(1, 207) = 0.34$, $\Delta R^2 < .01$).

Self-control, future time perspective, and SES, each had no impact on the relationships between S and change in unhealthy diet, and between S and change in alcohol consumption (overall model: $F(3, 207)$ [0.23, 1.94], R^2 [< .01, .03], p [.125, .875]; interaction: $t(207)$ [-1.15, 1.95], b [-0.08, 2.39], p [.053, .907]; $F(1, 207)$ [0.01, 3.78], ΔR^2 [< .01, .02]). The same was true for any relationship between F and any measure of unhealthy behavior (overall model: $F(3, 207)$ [0.14, 2.19], R^2 [.001, .024], p [.090, .939]; interaction: $t(207)$ [-0.44, 1.63], b [-0.44, 1.69], p [.105, .841]; $F(1, 207)$ [0.04, 2.65], ΔR^2 [< .01, .02]).

Correlations across Conditions. Spearman correlations or Phi/Cramer's V coefficients for all measures in Study 4 are shown in Table 14. The S component of the intervention was weakly and negatively associated only with physical inactivity at T2. The F component was not substantially associated with any outcome measure. Regarding vividness$_{10}$, there was only a weak negative correlation with unhealthy diet at T1. Higher self-esteem tended to go along with less physical inactivity and a less unhealthy diet, more self-control with a less unhealthy diet, and a future time perspective with less alcohol consumption (Table 14; for detailed information on the statistical analyses, see also Appendix E).

Table 14

Measures of Association (Spearman or Phi/Cramer's V) and Internal Consistencies of All Study 4 Measures.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
Between-subjects factors																			
1. **Self-affirmation**	--																		
2. **Future orient.**	*<.01*	--																	
Manipulation check variables																			
3. **T1 self-esteem**	.12	.01	*α=.87*																
4. **T2 self-esteem**	.10	-.04	**.84****	*α=.85*															
5. **T1 vividness$_{10}$**	<.01	.09	**.45****	**.42****	*α=.93*														
6. **T2 vividness$_{10}$**	.04	.07	**.39****	**.38****	**.78****	*α=.92*													
Further trait variables																			
7. **T1 self-control**	-.01	.08	**.44****	**.42****	**.31****	**.35****	*α=.75*												
8. **T2 self-control**	.06	.09	**.41****	**.44****	**.27****	**.31****	**.83****	*α=.84*											
9. **T1 time persp.**	<.001	.05	**.25****	**.30****	**.43****	**.46****	**.33****	**.33****	*α=.86*										
10. **T2 time persp.**	.02	.04	**.31****	**.30****	**.39****	**.46****	**.33****	**.34****	**.78****	*α=.87*									
Measures of unhealthy behavior																			
11. **T1 alcohol**	**.15***	.07	.02	.04	-.02	-.07	-.06	-.04	**-.19****	**-.23****	*α=.79*								
12. **T2 alcohol**	.05	<.01	<-.01	-.03	-.09	-.11	-.07	-.07	-.08	**-.14***	**.72****	*α=.80*							
13. **T1 unhealthy diet**	.01	-.03	**-.20****	**-.16***	**-.14***	-.12	**-.15***	-.11	-.11	**-.13***	.09	.09	*α=.68*						
14. **T2 unhealthy diet**	-.02	-.01	**-.22****	**-.21****	-.09	-.11	**-.23****	**-.19***	-.11	-.12	.06	.08	**.79****	*α=.69*					
15. **T1 inactivity**	<.01	-.04	**-.22****	**-.19****	-.05	-.01	-.10	-.11	-.04	-.02	-.04	.01	**.37****	**.32****	*α=.44*				
16. **T2 inactivity**	**-.15***	<.01	**-.26****	**-.25****	-.06	-.06	-.12	-.14	-.14	-.13	-.09	-.04	**.29****	**.31****	**.69****	*α=.46*			
Demographics																			
17. **Age**	<-.01	-.11	-.03	.01	-.04	-.01	**.16***	.12	-.06	-.08	.06	.09	-.07	-.05	.08	**.14***	--		
18. **Gender**	*-.03*	*-.01*	-.09	-.11	.02	.09	-.06	-.05	-.07	-.04	**-.15***	**-.18***	-.07	-.06	.10	.10	.09	--	
19. **Education**	*.04*	*.13*	.12	.11	.12	.07	<.01	.03	**.17***	**.25****	-.01	-.02	**-.14***	-.10	-.09	**-.16***	<.001	*.04*	--
20. **SES**	**.14***	.11	**.44****	**.43****	**.29****	**.37****	**.28****	**.24****	**.22****	**.27****	.03	-.04	-.12	**-.19****	**-.16***	**-.16***	-.04	.02	.05

Note. **1. Self-affirmation, 2. Future orientation:** 1 = not given, 2 = given; **18. Gender:** 1 = male, 2 = female; **19. Education:** 1 = no degree, 2 = high school, 3 = college/university; all other variables: higher values indicate higher manifestations; **17. Age:** range = 21-76; *for **1., 2., 18., 19.:** Phi/Cramer's V;* all other coefficients: Spearman; $N = 211$; * $p < .05$, ** $p < .01$.

Discussion

In Study 4, it was examined whether brief writing tasks with elements to enhance future orientation or self-affirmation can have positive effects regarding alcohol consumption, diet, or physical activity three to five weeks later, and whether the effectiveness of such minimal interventions can be increased if combined, i.e., contemplating personal values with regard to a distant future self. Again, the hypotheses were largely not confirmed; as the only significant result, self-affirmation (but not future orientation) tasks had a small effect on physical activity. Regarding presumed mediating processes, i.e., more constructive reactions to health-risk information, increases in vividness of the future self and/or self-esteem, however, the interventions did not work as intended, and correlational results again speak against the basic assumption that vividness of the future self is relevant in predicting health-related decisions.

In a considered response to the low base rates for most unhealthy behaviors measured in Study 3, Study 4 focused on three unhealthy behaviors that are generally highly prevalent (e.g., Candari et al., 2017; World Health Organization, 2018). Nevertheless, regarding alcohol consumption there again was a base rate problem, as more than 40% of the participants could not reduce their alcohol intake from baseline because they did not consume alcohol at baseline. The proportion of participants with risky alcohol consumption, i.e., above recommended limits (Alcohol Policy Team, Department of Health, 2016), was about 20% and thus 10% less than in a similar study (Armitage et al., 2011) in which alcohol intake was reduced by more than one unit per day on average after self-affirmation interventions (η_p^2 [0.36, 0.38], $p < .01$), but not in a control group ($\eta_p^2 < 0.01$, $p = .84$, $N = 278$). When considering descriptive scores for such "risky drinkers" only, the present results would be quite promising: In the intervention conditions, alcohol intake was reduced by 0.95 (self-affirmation and future orientation), 2.00 (self-affirmation), or 2.89 units per week (future orientation), corresponding to an average decrease of 0.28 units per day, but slightly increased in the control condition (by 0.22 units per week, or 0.03 units per day). However, standard deviations were large, and since the "risky drinker" subgroup sample sizes of eight to 17 participants were particularly small, no significant effects were observed.

Regarding unhealthy diet, there were no variance restrictions, but no impact of the interventions was discernible. An intervention effect was observed only regarding physical activity – in participants who had completed the classic self-affirmation task, and tendentially also in participants who had completed the combined task. Bayesian analyses indicated moderate evidence for a self-affirmation effect on change in physical activity, and effect sizes in the 90% confidence intervals ranged from small to moderate. Although the follow-up interval of four weeks was rather short in relation to common conventions for testing maintenance of change in physical activity (e.g., Hall & Fong, 2003), it was still considerably larger than in comparable studies that successfully applied self-affirmation interventions in this outcome domain (e.g., Cooke et al., 2014, for a one-week follow-up: $p < .001$, $d =$

1.06, $N = 80$). Considering the minimal costs and effort, self-affirmation tasks can be repeated at short intervals and easily be integrated into everyday life. Therefore, the observed effect is promising – self-affirmation could indeed contribute to promoting physical activity. Further research on the robustness of the effect might also consider the current finding that level of trait self-control seems to interact with intervention effects, supporting the view that individuals with more resources might benefit more from self-affirmation interventions (e.g., G. L. Cohen & Sherman, 2014). In addition, it would be worth checking whether self-affirmation effects also occur when control tasks other than the "other-affirmation" task (Napper et al., 2009) are used. However, Study 4 yielded no evidence that the effectiveness of self-affirmation interventions could be increased by focusing on future selves, or that interventions on future orientation that do not explicitly address personal values might be effective at all.

As in Study 3, and contrary to Study 1 and 2, there was no indication of limited validity of the outcome measures. Assessing alcohol intake via calendar measures such as the Timeline Followback Technique (Sobell & Sobell, 1992), for example, has shown up to 97% agreement with biological markers (Armitage et al., 2011), and self-reports of exercise behavior have been cited as fairly accurate and hardly biased by social desirability (Rutchick et al., 2018). Epton et al. (2015) found in meta-analysis that it was not relevant for the effectiveness of self-affirmation interventions whether self-reports or objective measures of health behavior were used. In order to increase comparability with other study results, it would still have been advantageous to use established measures also for eating behavior and physical activity. The Godin Leisure-Time Physical Activity Questionnaire (LTPAQ; e.g., Amireault & Godin, 2015), for example, correlates with objective fitness measures such as body fat percentage and can be used to classify people as fit vs. unfit (Cooke et al., 2014).

Regarding vividness of the distant future self, and self-esteem as assumed mediators, no post-intervention measures were taken, and at the four-weeks follow-up, no intervention effects were found. The design was unfavorable since theoretically, immediate changes in such constructs can have delayed effects on behavioral decisions, and do not necessarily persist at follow-up (e.g., van Gelder et al., 2015). Regarding self-esteem, it may be principally questionable whether predicted effects of any minimal intervention can be shown on responses to classical trait items (e.g., "I have high self-esteem," Robins et al., 2001), which are likely driven by a lifetime experience observing oneself (Hall, 2001). However, Armitage et al. (2011), for example, assessed self-esteem via this one item, but directly after their interventions, and found increased scores after self-affirmation tasks as compared to a control task ($\eta_p^2 = 0.38$, $p < .01$, $N = 278$). Likewise, scores on vividness of the future self have been observed to be altered when assessed directly after writing tasks (Study 2; van Gelder et al., 2015).

As in Study 1-3, however, vividness of the future self was hardly associated with outcome measures. In contrast, related trait measures were each more clearly associated with certain unhealthy behaviors. The predictive power of these measures was reasonable, as correlations between general self-report

measures of personality and unhealthy behaviors rarely exceed .20 (Fong & Hall, 2003). Since self-esteem, self-control, and also higher valuation of long-term goals are generally regarded as favorable characteristics, it is conceivable that these correlations are more strongly driven by socially desirable responding as compared to correlations between vividness of the future self and unhealthy behaviors. As the results in Rutchick et al. (2018, Study 1) and van Gelder et al. (2015) suggest, measures of future self-continuity might be associated with more general behavioral indicators rather than with concrete recent behaviors.

Besides vividness of the future self and self-esteem, a mediating effect was also assumed for reactions to potentially threatening information on health risks. On the basis of self-affirmation research, it was hypothesized that both future self-continuity and self-affirmation tasks could help individuals to deal with such information in a less avoidant, more constructive way. However, a main limitation in Study 4 was that about 60% of the participants did not read the health message completely, as indicated by display times. Therefore, item scores on reactions to the health message were not informative. The design of the health message (see Appendix I) was in fact unfavorable. Instead of pure text, pictures and/or graphics probably would have been more suitable to attract the attention and interest of the participants (e.g., Armitage et al., 2011; Hershfield & Bartels, 2018). In addition, it would have been helpful to focus on only one domain of unhealthy behavior, but querying alcohol consumption, unhealthy diet, and physical inactivity increased the chance that each participant would encounter at least one topic of personal relevance (or area in which the participant could improve). Eventually, regarding the main results, no systematic impact became apparent if only those participants were considered who had spent enough time on the health message so that they could have read the information on the respective topic.

Overall, regarding the main research questions, Study 4 provided no evidence that brief writing tasks could be effective in enhancing future self-continuity and thus promote more healthy behavior in the longer term. If interventions that aimed to increase future self-continuity indeed have true effects on self-control-related decisions (e.g., Rutchick et al., 2018; van Gelder et al., 2015), such findings might be driven by group differences in contemplating self-relevant values rather than differences in the temporal focus.

General Discussion

After two non-significant direct replication attempts (Study 1 & 2), further results on variations of the letter task with regard to health behavior in Study 3 and 4 did not meet expectations – there were no indications that the tasks could decrease unhealthy behaviors or increase future self-continuity. How do these findings fit into the state of research on future self-continuity, or, more generally, future orientation? At the starting point of the present research, it was assumed that brief writing tasks that address future selves might be used as a "wise intervention" (Walton, 2014) to mitigate self-control

failures. Theoretical accounts suggest that if people could be made to perceive more continuity between their present and future selves, in terms of sharing important psychological properties (Bartels & Urminsky, 2011), this perception of continuity might help them to recognize temporal trade-offs, which in turn could encourage decisions with more favorable long-term consequences under various circumstances (e.g., Hershfield & Bartels, 2018). Several experimental findings in laboratory and field studies have found support for this view in that they used straightforward manipulations and observed positive effects on behaviors that imply temporal trade-offs, such as financial, delinquent, academic, and health-related decisions (e.g., Duckworth et al., 2018; Urminsky, 2017).

In four pre-registered studies, the present research examined, on the one hand, whether writing letters or online text messages, to/about future selves does actually have replicable effects on decisions that would be of practical relevance in different domains of self-control. In a second step, it was examined whether these writing tasks can actually alter future self-continuity, i.e., whether they were adequate to induce a more vivid picture of future selves, and/or more perceived connectedness and similarity to future selves, which was expected to mediate relationships between the manipulation and outcome measures. These questions were considered independently. Both with regard to assumed mediator and outcome variables, it is theoretically possible that the measures used may not be valid or sensitive enough to reflect actual changes. Moreover, even if assumptions about mediators were genuinely incorrect, observed effects of the interventions on outcome variables would still be of interest, and would stimulate new hypotheses about possible mediators. Conversely, it would also be of interest if manipulation checks supported hypotheses about cognitive processes – increases in future self-continuity in particular or future orientation in general – even if assumptions about susceptible outcome domains were incorrect. In short, however, the present research did not yield promising results in any of these respects.

Can Brief Writing Tasks on Future Selves Reduce Risky Decisions?

As discussed in the Interim Conclusion, two high-powered direct replication attempts on delinquent and risky investment decisions, using sample sizes 2.5 times as the size of those in the original studies, dampened expectations in the letter task (Study 1 & 2). It cannot be ruled out that the divergent results of the original and replication studies are based on the same true effects; if such effects exist, however, they are at least considerably smaller than the original studies suggest, and thus likely not relevant in practice (for implications regarding replicability as a quality feature of studies, see p. 44). Beyond comparisons with the original studies, analyses of the letter content did not provide any evidence that subtle differences in instructions, or in completing the task, could explain the results. Correlation analyses also raised doubts about the validity of the outcome measures, since even level of trait self-control, which was assessed as an established correlate of risky behavior (e.g., Zuckerman & Kuhlman, 2000), was not related to responses to the hypothetical risky decisions measure (Study 2).

In two longitudinal studies, the paradigm was then applied to health behavior – in order to query actual rather than hypothetical behavior, and assuming that this outcome domain is more relevant to more people in random online samples. Study 3 was an attempt at a conceptual replication of van Gelder et al.'s (2015) one-week intervention that had been claimed as promising in terms of reducing delinquent behavior. Study 4 drew back to the letter task paradigm from Study 1 and 2 in order to disentangle and compare presumed mediating factors from self-affirmation (e.g., G. L. Cohen & Sherman, 2014) and future self-continuity intervention approaches. The sample sizes were sufficient to detect possible small true intervention effects with adequate statistical power, and the self-report measures used are commonly considered valid proxies for actual health behaviors (e.g., Armitage et al., 2011; Rutchick et al., 2018; see p. 72 of the present research). However, base rates for several unhealthy behaviors, especially for addictive behaviors, were so low that conclusions about the effectiveness of the interventions were hardly possible. Regarding unhealthy diet and physical inactivity, i.e., unhealthy behaviors in which the current samples had potential for improvement, Study 3 found a statistically significant intervention effect on diet behavior one week after the last writing task, but large confidence intervals and a Bayes factor close to one indicated that this effect was not of substantial value. Study 4 also yielded no significant effects of future self-continuity interventions but suggested that self-affirmation interventions can successfully promote physical activity.

With a closer look at previous research, these present findings are not particularly surprising – the robustness of reported effects has been questionable right from the start. A *p*-curve analysis of $k = 14$ studies that aimed to manipulate future self-continuity in order to decrease short-sighted, risky behaviors indicated evidential value to be inadequate or absent, i.e., the reported effects are likely false positives, or at least overestimate true effects (Simonsohn et al., 2017; see p. 23 of the present research). However, the present research is relevant for just this reason. Due to rather small samples in previous studies, their statistical power was mostly insufficient to reliably detect a possible small true effect – even though a small effect size is all that could be expected from a minimal intervention. As is evident in the analyses of the original studies behind the direct replication attempts (Study 1 & 2, see p. 30 & p. 39), and the intervention effect on unhealthy diet in Study 3 (see p. 54), statistically significant findings are hardly meaningful in the case of insufficient statistical power, as 90% or 95% confidence intervals include almost every possible result and thus also include effects that are practically zero. A rather superficial look easily gives a biased impression of the actual state of research if underpowered or "marginally significant" (e.g., van Gelder et al., 2015, p. 169), i.e., non-significant results are published, cited, and promoted uncritically, partly without stating statistical parameters (e.g., Duckworth et al., 2018; Hershfield et al., 2018). For meta-analysis, but also for *p*-curve analysis, however, which both allow for inferences about a possible true effect, a sufficient number of comparable studies has to be available first, and the interpretability of such tools is easily limited due to heterogeneity between studies regarding, for example, manipulations, sample characteristics, outcome measures, and time frames. The results of the *p*-curve analysis on

manipulations of future self-continuity and risky behavior at least suggest that overall, attempts at replication of previous studies with the same sample sizes would likely have produced non-significant results and may not have been published. Such "failed" studies in file drawers can exert a markedly larger biasing impact on meta-analytic effect estimates than does *p*-hacking (Friese & Frankenbach, 2019). The potential of the letter task and similar manipulations is thus not easy to assess, especially since, given the minimal costs and effort, and the broad conceivable field of application, even small true effects could be of practical relevance. However, practical relevance would presuppose that such effects would be shown consistently with larger sample sizes. Therefore, the present research provides informative evidence to substantiate doubts about the relevance of such manipulation approaches: The results clearly suggest that tasks such as writing letters, or online text messages to/about future selves, are not adequate to reliably alter self-control-related decisions with the outcome domains and/or samples characteristics examined. This finding is made even stronger by the examination of possible underlying processes in the present research.

Can Brief Writing Tasks Promote Continuity with Future Selves?

A central assumption of the four studies was that future self-continuity is more easily manipulable than related constructs such as future time perspective, and therefore particularly interesting for applied interventions to increase self-control (e.g., Duckworth et al., 2018). Several previous studies, however, only assumed their manipulations to be effective through changes in perceived continuity with distant future selves but did not apply manipulation checks. As the most important factor in wise interventions is a precise understanding of the psychological process at hand (Walton, 2014), the present research examined various constructs in terms of mediators, i.e., vividness of the future self (Study 1-4), connectedness with the future self, self-affirmation strategies expressed in the writing tasks (Study 1 & 2), similarity to the future self (Study 1), general future thinking (Study 2), and self-esteem (Study 4), as well as related trait measures by way of comparison (i.e., self-control and future time perspective; Study 2 & 4).

In order to demonstrate that effects on outcome variables were driven by considerations regarding the *distant* rather than *any* future self, some previous studies used near-future (i.e., three months) conditions as controls (e.g., Rutchick et al., 2018, Study 2; van Gelder et al., 2013, Study 1) in comparison to distant-future (i.e., 10 to 20 years) conditions. Adding a very-near-future (i.e., one week) condition in Study 1 raised doubts about this assumption, as participants who had contemplated their distant future selves did not indicate more continuity with these distant future selves than did participants who had contemplated their very near future selves. In Study 2, however, with the less conservative comparison between *present* and *distant* future conditions, the manipulation check was successful: Participants who had contemplated their future selves in 10 years' time tended to feel more connected to them, and specifically had a more vivid picture of these distant future selves than did participants who had contemplated their present selves. The manipulation did not affect general future

thinking, trait self-control, and trait future time perspective. Therefore, the direct replication studies overall suggest that manipulating continuity with distant future selves may not be as simple as assumed but can work under certain circumstances, and that the vividness self-report measure used is generally sensitive enough to depict such changes.

The more extensive intervention in Study 3, however, in which the participants answered e-mails concerning their future or present selves once a day over one week, did not increase vividness of the future self, neither directly after the last part of the intervention nor one week later. Age-related boundary conditions were considered rather unlikely (e.g., Bartels & Urminsky, 2011, Study 4; Study 2 of the present research; see also p. 57), but features of the task might have been unfavorable: Contrary to the successful intervention in van Gelder et al. (2015), the participants in Study 3 wrote about, but did not communicate *with*, their future/present selves. Analyses of the content of the letters in Study 1, however, indicated larger group differences in future self-continuity for participants who had addressed their future/present selves personally. Also contrary to van Gelder et al. (2015), the participants in Study 3 did not see (age-morphed) avatars of their future/present selves, and the vividness measure did not contain a visual component. In any case, Study 3 did not support the view that future self-continuity can be increased through straightforward writing tasks.

In Study 4, future self-continuity was not assessed directly after the intervention, thus the failed manipulation check regarding a four-week follow-up was hardly informative. However, the comparison of self-affirmation and future self-continuity interventions suggested that if comparable tasks do find effects on decision making, self-affirmation processes rather than changes in aspects of future orientation might be crucial. Building on similarities between these intervention approaches, letter content analyses in Study 1 and 2 provided evidence that contemplating future selves promoted contemplating self-relevant goals and values (e.g., being married with kids, having a fulfilling job, living in a nice place, travelling), but contemplating near-future or present selves promoted thinking about daily routines. Therefore, it was assumed that self-affirmation processes (i.e., reflection of core values, increased self-esteem) might also play a mediating role in common manipulations of future self-continuity. Eventually in Study 4, only interventions that explicitly encouraged thinking about self-relevant values had an impact on physical inactivity, and the idea that the effectiveness of interventions could be increased by combining elements of future self-continuity and self-affirmation was not supported.

Overall, the fact that most manipulation checks failed might suggest that online samples, ProA samples in particular, were not suitable for the present research. Basically, all samples were homogenous in terms of a high educational level (i.e., 69 to 74% had a college or university degree), which restricts the generalizability of all present findings (Bulley et al., 2019). However, it may be that the letter task manipulation in particular requires a certain willingness for introspection that is not to be expected in this context, e.g., if people participate for financial rewards (or to do friends a favor,

as was probably often the case in Study 3). The content analyses of the letters in Study 1 and 2 indicated that the participants generally followed the instructions and produced texts consistent with the manipulation. The relatively low numbers of written words (M [111.16, 152.81], SD [47.68, 59.90]), however, might suggest that they were not very motivated to contemplate themselves, or their future selves. The fact that about 60% of the participants did not completely read the health-related information presented in Study 4 generally speaks against their being particularly motivated in the course of the studies. Several previous studies, including the original studies behind the direct replication attempts (i.e., Monroe et al., 2017, Study 1; van Gelder et al., 2013, Study 1), successfully applied minimal interventions on future orientation in MTurk samples (see also Hershfield et al., 2011, Study 3B, or Sjåstad, 2019). As compared to MTurk samples, ProA samples have been shown to be more naive, less dishonest, and more diverse (Peer et al., 2017). It is possible that problems discussed regarding MTurk, particularly slowing rates of population replenishment, and growing participant non-naivety, now also exist in ProA, but there is no indication of comparatively poorer data quality in ProA. Future studies could examine the extent to which data quality on commercial platforms, in comparison to conventional survey practices, might depend on requirements that different methods impose on participants and e.g., compare self-report scales with reading and writing tasks or reaction-time measurements, or compare one-off assessments with repeated measurements.

Is Future Self-Continuity Even Relevant in Temporal Decisions?

What might point to a more fundamental problem of the present research is that level of future self-continuity also did not predict delinquent, risky, or unhealthy decisions at a differential level. On the one hand, the interpretability of the non-significant and low correlations of vividness of the future self (and connectedness with and similarity to the future self) with outcome measures was limited due to the questionable ecological validity of the hypothetical dilemma situations (Study 1 & 2), or due to low base rates and variance restrictions in unhealthy behaviors (Study 3 & 4). On the other hand, however, scores on related trait measures (i.e., self-esteem, self-control, future time perspective) showed more consistent relationships with certain unhealthy behaviors than did scores on vividness of the future self in Study 4. These results confirm doubts about the "the more, the better" principle that was supposed to apply to future self-continuity.

In Study 1 it was initially assumed that vividness of, connectedness with, and similarity to distant future selves each constitute aspects of future self-continuity for which higher manifestations would be associated with less risky decisions. Intercorrelations among these constructs were stronger between vividness and connectedness than with similarity, and similarity was not further assessed mainly because it appeared to be least plausible – as this concept in particular hardly allows for personal development. It is certainly possible that a future self has very different needs than the present self (e.g., less nightlife and more sleep, in case you expect your future self to be a parent), thus this future self may not feel similar then. Nevertheless, you could still feel connected to him or her

(e.g., in case you are sure you want to start a family), and you can still have a vivid picture of him or her (e.g., as you might envision your parent future self with dark circles under the eyes, wearing a more practical style of clothing). High perceived similarity to distant future selves, in contrast, could easily result in incorrect forecasts and risky behavior. For example, if you imagine your future self in 10 years' time to be fit and healthy in a way similar to your present self, you might just continue the same level of health-related activities instead of trying to make better choices, thus high perceived similarity would not be particularly motivating to stop smoking, or to do sports. Therefore, it was assumed from Study 2 that feeling connected to one's future self, and particularly having a vivid picture of one's future self, would be decisive in order to act for the sake of this future self, in terms of making sacrifices or efforts in the present. Also regarding these constructs, however, it should be questioned how intertemporal choice might be affected if people predict more constancy in their selves than actually obtained (Hershfield & Bartels, 2018). Having a very vivid picture of one's distant future self, and feeling highly connected to it, may also imply that you overweigh the extent to which your current self's interests extend to the future. It is quite plausible that such exaggerated expectations of continuity can result in more risky decisions (e.g., "The meaning of the tattoo I am about to get will always be important to me"; Hershfield & Bartels, 2018, p. 104) – just as has been predicted for the opposite, i.e., low manifestations of future self-continuity. In this sense, *low* perceived future self-continuity could also be associated with *lower* risk tolerance. For example, if you are seriously dissatisfied with your current situation, you could hope your future self would be different, and work towards such changes by making decisions driven by long-term plans or visions. It is therefore conceivable that level of future self-continuity can predict risky behavior only with careful consideration of specific sample characteristics.

Under What Circumstances Might Future Orientation Interventions Work?

Also independent from the concept of future self-continuity, writing or thinking tasks that focus on future orientation might have opposite effects depending on participants' general degree of realism in future expectations. Realistic positive expectations have predicted better future outcomes (Oettingen & Mayer, 2002). Also, experimentally inducing people to think of a positive future has been shown to encourage goal pursuit (Taylor et al., 1998), which, according to Monroe et al. (2017), could go along with lower risk tolerance. Then again, people tend to hold unrealistically promising expectations about their futures (e.g., Shepperd et al., 2013; Stankevicius et al., 2014), in particular when strong current needs are unmet (Kappes, Schwörer, & Oettingen, 2012). Chronically thinking of positive futures is associated with higher risk tolerance (Moore & Small, 2007), and idealized future fantasies have been found to predict worse future outcomes in various domains such as academic performance, job pursuit, romantic relationships, and mental health (e.g., Kappes & Oettingen, 2011; Kappes, Oettingen, & Mayer, 2012; Oettingen, 2012; Oettingen & Mayer, 2002; Oettingen et al., 2016; Oettingen & Wadden, 1991; though not from independent sources).

Basically, the question arises, for whom could it even be helpful to increase future orientation in order to reduce risk tolerance? Eventually, any (wise) intervention will be effective only if the process it targets matters in the setting at hand (Walton, 2014). As discussed in the Interim Conclusion, changes in hypothetical delinquent or financial decisions are not to be expected without any actual need for change apparent in everyday delinquency or financial management. As with several unhealthy behaviors assessed in Study 3 and 4, there obviously is no reason to assume that after any intervention, people will consume less alcohol, smoke less cigarettes, reduce drug use, or go to the tanning salon less often if they barely engaged in these behaviors prior to the intervention. But even if overall scores on outcome measures indicate potential for improvement, as was the case with diet and physical activity, the actual need for change is unclear if participants do not state their motivation, and if there is no objective assessment of risk status.

This basic problem is consistent with what Loewenstein (2018) refers to as "Calvinist" (p. 98) or "puritanical" (p. 99) bias in psychological self-control research: It is largely neglected that self-control problems, in the sense of deliberation vs. affect, are not always linked to a lack of future orientation, but often instead go along with *hyperopia*, i.e., excessive far-sightedness (e.g., Kivetz & Simonson, 2002). Satisfaction with life is also considerably restricted if decisions are too strongly oriented towards sometime in the future and current needs are chronically neglected. Regarding the outcome domains examined, problems in abiding by laws or norms, in financial investing, or in living healthily, may well be myopia-related. However, reverse self-control problems are also conceivable, such as obedience to authority, "tightwaddism" (Loewenstein, 2018, p. 98), asceticism, ortho-/anorexia, or hypochondria. In these cases, people might be more likely to benefit from a "here-and-now orientation intervention" (van Gelder et al., 2015, p. 174) to become more focused on the present.

Generally, the functionality of delaying gratification is dependent on the availability of resources and stability of the environment (Dual Component Theory of Inhibition Regulation, Reynolds & McCrea, 2017). If the future is highly uncertain, a focus on the present and immediate rewards can be considerably more reasonable than waiting to capitalize on delayed rewards that may or may not come to be (e.g., Barndt & Johnson, 1955; Hill et al., 1997; Jachimowicz et al., 2017; Kidd et al., 2013). Therefore, decision-making profiles that have been labelled "impulsive" or "risky" can actually be adaptive under some circumstances, and might have been generated by careful deliberation (Bulley et al., 2019) – in case of negotiations, a distant future self might then also acknowledge that it would be the overall better choice to "live wild and dangerous" (translated from Bünger, 2019).

It might thus be assumed that minimal interventions to enhance future orientation could be useful in samples with concrete, myopia-related problems. In several experimental studies such as on EFT or possible selves, care was taken to ensure that the participants had specific deficits regarding the outcome domain examined. For example, they were included only if they had confirmed insufficient physical activity (Murru & Martin Ginis, 2010), intentions to control food intake (Daniel et al., 2013), or to lose weight (Kuo et al., 2016), or if they exceeded a certain BMI (Sze et al., 2017). Risk level has been found to moderate effects of self-affirmation interventions in that persons at higher risk benefit more (e.g., Harris et al., 2007). Such interactions could also be reflected in the tendentially promising, but vastly underpowered results on risky alcohol consumption in Study 4 of the present research. Conversely, Study 4 also suggested that persons with more trait self-control might benefit more, and principally, positive effects are not to be expected from such subtle interventions if the basic resources needed to change patterns of thought and thus behavior are significantly limited (e.g., G. L. Cohen & Sherman, 2014). Depressive symptoms, for example, which are common with more pronounced self-control problems, have been an exclusion criterion in comparable studies (e.g., Sze et al., 2017). However, even if such minimal interventions were to reliably function as intended in cases of, e.g., serious addiction or chronic delinquency, they could be of interest at best as a supplement to extensive therapeutic measures.

Within the scope of the present research project, a pilot study was conducted at a withdrawal treatment facility in order to examine the minimal intervention combining elements of self-affirmation and future self-continuity from Study 4 in substance-dependent patients, regarding overall and addiction-specific well-being, as well as pro-criminal attitudes. Considering the unsteady and complicated life circumstances of the participants, it seemed inadequate to use 10- to 20-year intervals into the future as have commonly been used in other studies. Instead, the task was to imagine one's future self in two years' time, but still, during the paper-and-pencil surveys, several participants expressed uncertainties about how to handle the task and found it rather difficult. Half of the 60 participants dropped out before follow-up, thus it was not possible to draw conclusions on the effectiveness of the intervention (Esser, 2018; Rupp, 2018; Weckemann, 2018).

With research and also socio-political measures for high-risk samples, it should generally be noted that a focus on supposed individual deficiencies easily distracts attention from more fundamental situational causes of social problems, such as income inequality (Loewenstein, 2018). It is much easier to save for retirement, or desist from crime, if your income meets basic needs, and it is also much easier to stay physically fit if you can afford healthy food and time for exercise. This is also evident in findings that future orientation increases as SES increases (e.g., Crockett et al., 2009; Study 4 of the present research). In terms of Maslow's (1943, 1970) pyramid, needs for self-actualization (in the future) are more likely to be triggered when basic needs are met (for a contemporary hierarchy of fundamental human motives, see Kenrick et al., 2010).

Conclusion

Of course, subtle, non-specific minimal interventions that are effective in any random online samples, and with regard to various outcomes that contain temporal trade-offs, would be particularly efficient and desirable. However, the present results likely illustrate that any intervention can be successful only if situational factors are adequately considered. In psychotherapy and particularly in offender treatment, for example, increasing future orientation, or future self-continuity, has in principle long been used as a therapeutic tool in terms of developing perspectives, plans and goals. Such practices are tailored to individual needs, directly guided, and supervised (e.g., Andrews et al., 2011). Future research on future orientation interventions should thus focus not on what is easiest to apply and might help as many people and problems as possible, but on evidence as to what could be most helpful with specific characteristics of certain samples.

If actual needs of the study participants are given more attention, task that are more directive and less subtle could provide more informative tests of causal effects of future orientation on decision making. In further studies by Monroe et al. (2017), for example, participants were told to reflect the meaning of 14 future- or 14 present-oriented statements (e.g., "I find myself sometimes thinking about…" "…how my life might be in the future" vs. "…what is going on in my life right now"), and to rewrite them in their own words, which apparently produced robust effects on how strongly the participants were thinking about the future (p [.015, .01], d [0.37, 0.63], N [69, 173]; Monroe et al., 2017, Study 2 & 3).[49] Moreover, recent pre-registered and high-powered studies have yielded evidence that manipulations in which future/present considerations are more directly related to the outcome domain of interest can effectively alter general temporal perspectives, and produce robust effects on decisions that imply temporal trade-offs (e.g., Bulley et al., 2019; Sjåstad, 2019; see p. 19 & 20 of the present research). Such tasks might presuppose that people are at least somewhat motivated to deal with problem behavior, but the results presented in this thesis suggest that otherwise, intervention attempts are generally rather presumptuous. Moreover, these manipulations are still less directive and more flexible than teachings about possible future consequences (e.g., Fong & Hall, 2003), and may thus be more successful in bringing about intrinsically motivated changes in behavior. In this respect, it seems principally advisable to assess whether participants are aware of the goal of the study, and to examine how demand or reactance effects might play a role in certain samples, manipulations, and outcomes (Bulley et al., 2019).

Lastly, stronger manipulations are warranted not only to create variation in outcome measures, but also to informatively examine possible underlying mechanisms. Therefore, pre-registered research that a priori defines how and in which contexts manipulations are expected to be effective, and how exactly these assumptions will be tested, is needed. This implies that it would not be useful to discuss

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[49] The results of Monroe et al (2017, Study 2 & 3) were not entered into the p-curve, because the outcome variables, i.e., interpersonal trust and moral judgments of blame, did not meet the inclusion criterion regarding risk-taking/self-control/temporal trade-offs. All inclusion criteria and detailed results on the studies included are provided in Appendix A.

which temporal orientation, future or present, is more desirable in general terms. Also for research at the group level, it should rather be considered that for (psychologically) healthy functioning, it is crucial to be able to switch between temporal orientations, depending on situational demands, personal needs, and values (e.g., Barber et al., 2009). Such a balanced time perspective (Zimbardo & Boyd, 1999) requires a conscious, mindful attitude towards one's own thoughts, feelings, and environmental influences (e.g., Stolarski et al., 2016).

This perspective has already been taken in ancient times. According to Aristotle's (384–322 BC) *Nicomachean Ethics,* ethical virtue, i.e., having appropriate feelings, exists as a mean state between the insidious extremes of deficiency and excess, such as courage stands between cowardice and rashness (Kraut, 2018). Virtue cannot be learned through obeying universal rules, but through reflection on personal experiences. Therefore, virtue implies finding an individual mean path between pleasures and duties, in order to enjoy the present and look optimistically into the future.

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Table A1

Calculations for Each Test Entered into the p-Curve.

Study	N	Test entered	p-value	pp-values[a] Full p-curve Right skew	pp-values[a] Full p-curve 1-β = 33%	pp-values[a] Half p-curve Right skew	pp-values[a] Half p-curve 1-β = 33%	Z scores[b] Full p-curve Right skew	Z scores[b] Full p-curve 1-β = 33%	Z scores[b] Half p-curve Right skew	Z scores[b] Half p-curve 1-β = 33%
– Bartels & Urminsky (2011, Study 1)	141	$F(1,134) = 5.89$	.017	.331	.426	.662	.731	-0.44	-0.19	0.42	0.62
– Bartels & Urminsky (2011, Study 2)	118	$F(1,114) = 5.85$	.017	.343	.416	.686	.726	-0.40	-0.21	0.49	0.60
– Bartels & Urminsky (2011, Study 3)	97	$F(1,94) = 8.70$	.004	.080	.742	.161	.879	-1.40	0.65	-0.99	1.17
– Bartels & Urminsky (2011, Study 4)	71	$t(69) = 2.67$	.009	.189	.582	.378	.803	-0.88	0.21	-0.31	0.85
– Hershfield et al. (2012, Study 5)	86	$t(84) = 2.03$	.046	.910	.044	NA	NA	1.34	-1.71	NA	NA
– (Hershfield et al. [2011, Study 1])[c]	50	$t(48) = 1.83$	.073	NA	NA	NA	NA	NA	NA	NA	NA
– Hershfield et al. (2011, Study 3A)	40	$t(38) = 2.38$	.022	.448	.336	.897	.685	-0.13	-0.42	1.27	0.48
– Hershfield et al. (2011, Study 3B)	38	$t(36) = 2.28$	.029	.573	.245	NA	NA	0.18	-0.69	NA	NA
– Monroe et al. (2017, Study 1)	187	$t(185) = 2.06$	.041	.816	.093	NA	NA	0.90	-1.33	NA	NA
– Nurra & Oyserman (2018, Study 3)	111	$t(108) = 2.39$[d]	.019	.372	.391	.743	.714	-0.33	-0.28	0.65	0.57
– Nurra & Oyserman (2018, Study 4)	165	$t(163) = 2.03$	.044	.880	.059	NA	NA	1.17	-1.56	NA	NA
– Rutchick et al. (2018, Study 2)	498	$Z = 2.28$	.023	.452	.321	.904	.683	-0.12	-0.46	1.31	0.48
– Sheldon & Fishbach (2015, Study 2)	75	$t(73) = 2.52$	.014	.279	.481	.557	.756	-0.59	-0.05	0.14	0.69
– van Gelder et al. (2013, Study 2)	67	$\chi^2(1) = 4.03$	.045	.894	.051	NA	NA	1.25	-1.63	NA	NA
– van Gelder et al. (2013, Study 1)	111	$t(109) = 2.01$	.047	.938	.030	NA	NA	1.54	-1.88	NA	NA
– (van Gelder et al. [2015])[c]	87	$F(1, 85) = 3.60$	.061	NA	NA	NA	NA	NA	NA	NA	NA
Sum of Z scores in column, dividing by sqrt(N of tests) Z scores reported in p-curve (Figure 2) →								1.44	-3.07	1.69	1.27

Note. Calculations via http://www.p-curve.com/app4/ (Simonsohn et al., 2017); [a] *pp*-values: probability of at least as extreme a significant *p*-value; [b] negative *Z*-values indicate deviation in the direction of the alternative hypothesis (e.g., more right skewed than flat); [c] study not included in *p*-curve as $p \geq .05$ (two-tailed); [d] Controlling for age.

Inclusion criteria: 1) The outcome variable is related to self-control/risk-taking/temporal trade-offs. 2) The manipulation tasks differ between the experimental conditions only in their temporal reference, i.e., they address the distant future as compared to the present or near future, or high as compared to low connections between future and present selves. Thus, effects on outcome variables can be attributed to changes in temporal trade-offs rather than, e.g., domain-specific reinforcement. 3) The tasks directly address personal identity, i.e. in the future conditions, they require projecting oneself into the future rather than general future thinking. 4) The tasks are unspecific in that they are not related to the outcome domain, so that the manipulation is particularly subtle with low risks of demand effects, or vice versa, reactance effects.

Appendix B: Pre-Registrations of the Replication Studies (Study 1 & 2)

Study 1: https://osf.io/x8exr/

1) What's the main question being asked or hypothesis being tested in this study?

We aim to replicate Study 1 of van Gelder et al. (2013)[1] with an additional experimental condition and additional variables concerning 1) the vividness of the future self, 2) the perception of the future self and 3) the connectedness with the future self.

In line with van Gelder et al. (2013) we expect: "Increasing the vividness of the future self should motivate individuals to act in a more future-oriented way and should therefore reduce delinquent involvement." (p. 2)
In particular, we hypothesize that the manipulation (writing a letter to the future self) increases the vividness of the future self, resulting in a monotonic decrease in the individual tendency to make delinquent choices over the three conditions, from the 1-week condition over the 3-month condition to the 20-years condition.

Manipulation check: The 20-years future self should be more vivid in the 20-years condition than in the other conditions.

2) Describe the key dependent variable(s) specifying how they will be measured.

Dependent variable: Individual tendency to make delinquent choices
Measurement: Five delinquent-choice scenarios (dilemmas), concerning theft, insurance fraud, illegal downloading and buying stolen goods; 7-point Likert scale (1 = very unlikely, 7 = very likely); averaged (over the 5 scenarios) to calculate the individual delinquent-choice scores.

3) How many and which conditions will participants be assigned to?

Participants are asked to write a 200-300-word letter to their future self; they are randomly assigned to three conditions which specify the temporal distance of the future self: 20 years vs. 3 months vs. 1 week.

4) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

- Control for group differences (e.g., the average number of words, age, gender etc. [ANOVA & post hoc tests])
- Main hypothesis: difference between groups concerning the individual delinquency score (ANOVA & post hoc tests, trend analysis)

5) Any secondary analyses?

- Mediation model: direct and indirect effects of condition on the tendency to make delinquent choices, vividness of the 20-years-future self as mediator
- Exploratory analyses: connectedness to and perception of the 20-years future self as mediators or moderators
- Item analyses

6) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

We want to augment the original study's sample size (van Gelder et al., 2013; Study 1; $N = 114$) and aim for 300 participants, 100 in each condition.
Data will be collected using the Prolific Academic subject pool; data collection will stop when 300 people have participated*

7) Anything else you would like to pre-register? (e.g., data exclusions, variables collected for exploratory purposes, unusual analyses planned?)

Additional variables:
- Vividness of the future self: 5 items retrieved from van Gelder et al. (2015)
- Connectedness with the future self: 8 items on the extent to which participants feel connected to their future self
- Perception of the future self: 3 items on the extent to which participants perceive their future self as one and the same person or as two different people

8) Have any data been collected for this study already?

No.

Additional data collection
Following the recommendation by Simonsohn (2015), we aim at 2.5 times the original sample size (van Gelder et al., 2013: n/condition = 57). As we added a third experimental condition this means 3 x 2.5 x 57 = 428 participants.

Data collected so far: $n = 300$
Data to be collected: $n = 136$ (128 + 8 to prevent a reduction of the sample size due to possible cases of invalid data)

Study 2: https://osf.io/q7yuv

Have any data been collected for this study already?

No, no data have been collected for this study yet

What's the main question being asked or hypothesis being tested in this study?

We aim to replicate experiment 1 of Monroe et al. (2017) with additional variables concerning 1) the vividness of the future self, 2) the connectedness with the future self, 3) self-control (trait) and self-control variability and 4) time perspective. In line with Monroe et al. (2017) we expect participants to favor less risky, lower payoff investments after writing a letter to their future selves (EG) as compared to participants writing to their present selves (CG). Manipulation check: Participants in the EG should report stronger future-oriented thinking (state) as compared to participants in the CG.
Describe the key dependent variable(s) specifying how they will be measured.
Dependent variable: Individual tendency to make high-risk, high-payoff financial decisions.
Measurement: 4 questions assessing the preference for different types of investment, each ranging from low-risk and low-payoff to high-risk and high-payoff, retrieved from Monroe et al. (2017).

How many and which conditions will participants be assigned to?

Participants are asked to write a 100-300-word letter to their self either 10 years from now (future-orientation condition, EG) or in the present (present-orientation condition, CG); subjects are randomly assigned to one of the conditions.

Specify exactly which analyses you will conduct to examine the main question/hypothesis.

- Sample description including degree of risk aversion within each group (*t*-tests against the scale midpoint)
- *t*-tests to control for group differences between EG and CG, e.g., the average number of words, age, gender, current emotional state, etc.
- Manipulation check: *t*-test to compare the groups with respect to the degree of future-orientated [sic] thinking
- Main hypothesis: *t*-test for group difference concerning the tendency to make high-risk, high-payoff decisions

Any secondary analyses?
- Item analyses
- Exploratory analyses on vividness of the future self, connectedness with the future self, self-control (trait), self-control variability and time perspective: correlations; if applicable mediation and moderation analyses

How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

Data will be collected using the Prolific Academic subject pool. Following the recommendation by Simonsohn (2015), we aim at 2.5 times the original sample size ($N = 178$ x 2.5 = 445). To prevent a reduction of the sample size due to possible cases of invalid data, data collection will stop when 455 subjects have participated.

Anything else you would like to pre-register? (e.g., data exclusions, variables collected for exploratory purposes, unusual analyses planned?)

Scales:
- Vividness of the future self: 5 items retrieved from van Gelder et al. (2015)
- Connectedness with the future self: 8 items on the extent to which participants feel connected to their future selves
- Self-control (trait): Brief Self-Control measure (Tangney et al., 2004); 13 items
- Self-control variability: individual standard deviations of the Brief Self-Control measure (for a detailed explanation see Pratt, 2014)
- Time Perspective Questionnaire (TPQ; Fong & Hall, 2003); 13 items
- Attitudes towards living in the here and now: 9 worldly-wisdom-items; 1 additional item on future vs. present orientation in general [accidently listed in the pre-registration. We did not collect any data concerning these two measures in the replication attempt.]

Appendix C: Instructions and Measures of the Replication Studies (Study 1 & 2)

Study 1 (direct and extended attempt at replication of van Gelder et al., 2013, Study 1)

– Programming via https://www.soscisurvey.de/

– Data collection via https://www.prolific.co/; study title: "Self-perception and decision making (2)"

– Reward: £1.20; average completion time: 8.15 min; survey time frame: 02/15/2017 – 02/17/2017; 08/03/2017

Survey section	Text[a]	Response format
ProA participant ID	Please enter your Participant ID:	Text field
Original study instructions and measures		
General instruction (van Gelder et al., 2013, Study 1)	This is a study on **self-perception**, or in other words, how people see themselves. In particular, we are interested in how you see yourself in the future.	--
Letter task instruction 1a): very near future condition	We first want to ask you to think about yourself **1 week** from now. Try to imagine this "future self" as vividly as possible. For example, what do you look like then? What are you doing? Where will you be? What goals do you pursue? etc. Then, write in the space below a short **200-300 words** letter to your future self, so the person you will be in **1 week** from now. Write in your letter about who you are now, what things are important to you now, what you are doing, etc. Use the space below for the letter and take about five minutes to write it.	Text field
Letter task instruction 1b): near future condition (van Gelder et al., 2013, Study 1)	We first want to ask you to think about yourself **3 months** from now. Try to imagine this "future self" as vividly as possible. For example, what do you look like then? What are you doing? Where will you be? What goals do you pursue? etc. Then, write in the space below a short **200-300 words** letter to your future self, so the person you will be in **3 months** from now. Write in your letter about who you are now, what things are important to you now, what you are doing, etc. Use the space below for the letter and take about five minutes to write it.	Text field
Letter task instruction 1c): distant future condition (van Gelder et al., 2013, Study 1)	We first want to ask you to think about yourself **20 years** from now. Try to imagine this "future self" as vividly as possible. For example, what do you look like then? What are you doing? Where will you be? What goals do you pursue? etc. Then, write in the space below a short **200-300 words** letter to your future self, so the person you will be in **20 years** from now. Write in your letter about who you are now, what things are important to you now, what you are doing, etc. Use the space below for the letter and take about five minutes to write it.	Text field
General instruction (van Gelder et al., 2013, Study 1)	Thank you for completing the first of two studies. Please click 'Next' to continue with the second study.	--
Delinquent decisions instruction (van Gelder et al., 2013, Study 1)	In this survey you will be presented 5 short **dilemmas**. We are interested in how people experience these dilemmas and what they would do in such a situation. Try to imagine each dilemma as best as you can. Good luck!	--
Delinquent decisions items (van Gelder et al., 2013, Study 1)	1. (Theft 1) 2. (Theft 2) 3. (Insurance fraud) 4. (Buying stolen goods) 5. You need a new computer but you are short on cash. A fellow student tells you about an acquaintance of his who sells laptops that have 'fallen off a truck'. The laptops meet your requirements and are very attractively priced. How likely is it that you would buy this potentially stolen laptop? 6. (Illegal downloading)	Seven-point scale: 1. very unlikely *to* 7. very likely

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Survey section	Text[a]	Response format
Additional instructions and measures		
General instruction	Thank you for completing the second study. Please click 'Next' to continue with some additional questions on self-perception.	--
Similarity	Now please think about yourself 20 years from now, [again,][b] and rate how you perceive you and your 20-years-future self in general. 1. I perceive me and my future self as one and the same person. 2. I perceive me and my future self as two different people.	Seven-point scale: 1. not at all *to* 7. very much
	Please use the slider to rate how you perceive you and your future self in general. I perceive me and my future self as...	Slider: "one and the same person" – "two different persons"
Vividness (van Gelder et al., 2015)	Now please indicate for each item to what extent you agree or disagree with it by ticking the answer that best reflects your opinion. e.g., I find it easy to imagine myself 20 years from now. → *5 items*	Five-point scale: 1. disagree completely *to* 5. agree completely
Connectedness	Again, please indicate for each item to what extent you agree or disagree with it by ticking the answer that best reflects your opinion. 1. I feel connected to myself 20 years from now. 2. What I do now does not really affect myself 20 years from now. 3. I feel quite distant from myself 20 years from now. 4. I do not feel very connected to myself 20 years from now. 5. What I do now matters to myself 20 years from now. 6. I am very concerned about myself 20 years from now 7. What I do now has little to do with myself 20 years from now. 8. I feel responsible for myself 20 years from now.	Five-point scale: 1. disagree completely *to* 5. agree completely
Demographics	Please choose your gender.	o male o female o other
	How old are you?	Text field
	Please indicate the highest level of education you have completed.	o none o High School o College/University o other
General instruction	Thank you very much for your participation! Please click on this completion URL to show that you have finished the study: *[URL]*	--
General instruction	Thank you for completing this questionnaire! We would like to thank you very much for helping us. Your answers were transmitted, you may close the browser window or tab now.	--

Note. [a] Each row within the "Text" column indicates a separate page in the online questionnaire. Item list numbers were not displayed in the online questionnaire. [b] Displayed in the distant future condition only.

Study 2 (direct and extended attempt at replication of Monroe et al., 2017, Study 1)

– Programming via https://www.soscisurvey.de/

– Data collection via https://www.prolific.co/; study title: "Self-Perception and Financial Decisions"

– Reward: £1.25; completion time: 11.73 min; survey time frame: 08/09/2017

Survey section	Text[a]	Response format
ProA participant ID	Please enter your Participant ID:	Text field
Original study instructions and measures		
General instruction	Thank you for participating in our research. In the current experiment, you will be asked to write a short essay, to make a series of financial decisions, and to complete personality questionnaires.	--
Letter task instruction (1) (Monroe et al., 2017, Study 1)	This part of the experiment focuses on a task that examines how people think about themselves. On the next page you'll be asked to spend about 5 minutes writing a 100-300-word letter to yourself.	--
Letter task instruction 2a): present condition (Monroe et al., 2017, Study 1)	Write about the person you are now, and which topics are important and dear to you. When you write the letter to yourself, think about the events of the day today. Write about what you've done and what's happened to you today.	Text field
Letter task instruction 2b): distant future condition (Monroe et al., 2017, Study 1)	Write about the person you will be in 10 years and which topics will be important and dear to your future self. When you write the letter to your future self, think about the events that will happen 10 years from today. Write about what your future self will do and what happens to you then.	Text field
Brief Mood Introspection Scale (Mayer & Gaschke, 1988)	*(Adjective rating)*	Four-point scale: 1. definitely do not feel *to* 4. definitely feel
	Overall, my mood is:	Slider: "very unpleasant" – "very pleasant"
State future thinking (Manipulation Check 1; (Monroe et al., 2017, Study 1)	I am currently thinking about the future.	Slider: "strongly disagree" – "strongly agree"
Risky investment decisions instruction (Monroe et al., 2017, Study 1)	In a moment you're going to be asked to a series of financial decisions. There are no right or wrong answers. Please just answer honestly.	--
Risky investment decisions items (Monroe et al., 2017, Study 1)	1. ($50,000 to invest in a mutual fund)	Five-point scale: 1. Extremely conservative *to* 5. Extremely aggressive
	2. ($50,000 to invest in a company)	10-point scale: 1. $47,500 – $52,500 *to* 10. $25,000 – $75,000
	3. ($50,000 to invest for a year)	Six-point scale: 1. No risk little reward *to* 6. High risk high reward
	4. (Bonds vs. stocks)	11-point scale: 1. 0% Stocks (100% Bonds) *to* 11. 100% Stocks (0% Bonds)

Survey section	Textᵃ	Response format
Additional instructions and measures		
Vividness (van Gelder et al., 2015)	Next, please indicate for each item to what extent you agree or disagree with it by ticking the answer that best reflects your opinion. e.g., I find it easy to imagine myself 20 years from now. → *5 items*	Five-point scale: 1. disagree completely *to* 5. agree completely
Connectedness	1. I feel connected to myself 20 years from now. 2. What I do now does not really affect myself 20 years from now. 3. I feel quite distant from myself 20 years from now. 4. I do not feel very connected to myself 20 years from now. 5. What I do now matters to myself 20 years from now. 6. I am very concerned about myself 20 years from now. 7. What I do now has little to do with myself 20 years from now. 8. I feel responsible for myself 20 years from now.	
General instruction	In the last part of the study, please answer some questions about your personality and your daily routine.	--
Brief Self-Control Scale (Tangney et al., 2004)	Using the scale provided, please indicate how much each of the following statements reflects how you typically are. e.g., I am good at resisting temptation. → *13 items*	Five-point scale: 1. not at all *to* 5. very much
Time Perspective Questionnaire (Fong & Hall, 2003)	Almost done! Now once again, for each of the statements below, indicate your level of agreement or disagreement. e.g., Short-term goals are more important to me than long-term goals. → *13 items*	Seven-point scale: 1. disagree very strongly *to* 7. agree very strongly
Demographics	Please choose your gender.	o male o female o other
	How old are you?	Text field
	Please indicate the highest level of education you have completed.	o none o High School o College/University o other
General instruction	Thank you very much for your participation! Please click on this completion URL to show that you have finished the study: *[URL]*	--
General instruction	Thank you for completing this questionnaire! We would like to thank you very much for helping us. Your answers were transmitted, you may close the browser window or tab now.	--

Note. ᵃ Each row within the "Text" column indicates a separate page in the online questionnaire. Item list numbers were not displayed in the online questionnaire.

Appendix D: Letter Content Analyses for the Replication Studies (Study 1 & 2)

Coded variables:

Written seriously: Dummy coding whether the letter task had been processed seriously, in terms of producing a somehow meaningful text according to the instructions.

Personal address: Dummy coding whether the participants addressed their present/future self personally (i.e., "Dear [future] self," "you"). A personal address might strengthen (future) self-continuity, i.e., the connection to (future) selves, but on the other hand might enhance the distance to (future) selves in terms of different persons. In both cases, impacts on the respective relationships between the experimental conditions and the dependent variables are conceivable.

Temporal focus: Coding whether the participants wrote about their present selves/lives only, about both present and future, or about the future only, as the instructions of the letter task slightly differ between the original studies. In Monroe et al. (2017, Study 1), the participants were explicitly instructed not only to address, but also to actually write about their present or future selves, depending on the experimental condition: ("[…] Write about the person you *are now/will be in 10 years* and which topics *are/will be* important and dear to *yourself/your future self* […]"). However, in van Gelder et al. (2013, Study 1) and Rutchick et al. (2018, Study 2), after briefing the participants to imagine their three-months- or 20-years-future selves ("Try to imagine this 'future self' as vividly as possible […]"), the instruction in both conditions read: "Write in your letter about who you are *now*, what things are important to you *now*, what you *are doing*, etc. […]". It was thus not clear whether one should describe to one's three-months-/20-years-future self what the present was like, or how one imagined the future. Therefore, rather than the experimental conditions, differences in the actual temporal focus referred to in the letters might be crucial for the task's effectiveness. The temporal focus was rated independently from the experimental conditions; it was not relevant which present/future self was addressed in the salutation, but which time was referred to in the overall letter.

Self-affirmation and values: Coding to what extent self-affirmation strategies and self-relevant topics were addressed in the letters, as – independent from letter task version and condition – participants were instructed to write about self-relevant values ("topics that are/will be important and dear to you/your future self"). Criteria for rating positive and negative self-affirmation strategies are presented in Table D1. Categories for dummy coding certain topics were initially based on the Source of Validation Scale (G. L. Cohen et al., 2000) and were then adapted and extended according to the actual content of the letters: Family, friends, romance, (mental) health, physical attractiveness, education/job, finances/wealth, spirituality/religion, politics/world affairs, and hobbies (e.g., arts, music, sports, travelling, pets).

Table D1

Criteria of the Negative and Positive Self-Affirmation Categories with Example Letters.

	Negative	Positive
Self-affirmation criteria	– Self-concept includes a lack of ability to shape and control behavior adequately and effectively – Meaningfulness and significance of own actions, thoughts and feelings is denied – Low importance of individual values – No agreement between individual value system/moral conceptions and own acting, thoughts, and feelings – Denial of own competences/resources in personally important areas	– Self-concept includes the ability to shape and control adequately and effectively – Own actions, thoughts and feelings are experienced as meaningful – Emphasis on the importance of individual values – Agreement between individual value system/moral concepts and own actions, thoughts, and feelings – Focus on competencies and resources in areas of personal importance
Example	"Hi, future self. Currently I'm unemployed and not doing much of anything other than applying for jobs. Other than that I walk the dog and spend some time thinking about how unfulfilling my present lifestyle is. My sister is expecting a baby boy but currently she's just pregnant so it has almost no impact on my life. I read a bit, I listen to music a lot, but as I previously said, my life at present could not honestly be described as eventful. Nothing is particularly important to me at the moment. Who I am right now is essentially a diluted version of who I used to be and I get the feeling that the longer I continue to do nothing, the more diluted I will become."	"This is where it all changed so I could be the success I am when I am reading this 20 years from now. I am self-focused, I realise now that I am responsible for the way I feel and I can have all the good in my life if I want it. I am overcoming the struggle to eat right. I am beginning to see the greatness in all. I am empowered. University has been a long drag but I am demonstrating great willpower to get to the finish line, when my heart isn't in it at all. Where is my heart? Still I feel heartbreak and sorrow for the failures of the relationship with my first and only true love, but I am in the process of deep healing and I will be able to love much more strongly than ever before. I love myself and I always will."

Note. Letters containing either positive and negative aspects in equal proportions or no self-affirmation criteria at all, were rated as "ambivalent/neutral". Further coding variables for example letters: both positive and negative rated as written seriously, "present" temporal focus; example letter 1: future self addressed personally, topics: family, education/job, music, pets; example letter 2: future self not addressed personally, topics: romance, health, education/job.

Procedure:

A total of 936 letters over both replication studies were divided among six independent raters. A sample of 240 letters (26%) were rated twice, thus each rater had 80 letters that were also rated by one other rater (Table D2). Cases of disagreement were discussed and resolved by consensus. The rating variables were tested for differences between conditions, and regarding relationships with other variables to obtain a more comprehensive picture of possible moderators and mediators of the letter task effect.

Table D2

Cohen's Ks Between Raters for All Coding Variables.

Rater / Coding variable	R6, R1	R1, R2	R2, R3	R3, R4	R4, R5	R5, R6
Written seriously	-- [a]	-- [a]	-- [a]	1.00	1.00	-- [a]
Personal address	1.00	1.00	.88	.95	.95	1.00
Temporal focus	.89	.88	.71	.73	.89	.62
Self-affirmation	.85	.78	.74	.78	.76	1.00
Family	.94	.95	.83	.90	.84	.88
Friends	.88	1.00	1.00	.72	.61	.77
Romance	.88	1.00	.89	.87	.80	.95
Health	.83	.89	.80	.95	.64	.80
Education, job	.80	.83	.64	.89	.84	.79
Finances, property	.82	.84	.95	.74	.80	.85
Attractiveness	.79	1.00	.92	1.00	.64	1.00
Religion, spirituality	1.00	1.00	-- [a]	1.00	-- [a]	1.00
Politics, world	1.00	1.00	1.00	1.00	.77	1.00
Arts, creativity	.84	1.00	1.00	.77	.67	.79
Music	1.00	1.00	.88	.79	1.00	-- [a]
Sports	.93	.87	.82	1.00	.84	.77
Travelling	1.00	.83	.94	.84	.61	.93
Pets, animals	1.00	1.00	1.00	1.00	.83	1.00
Other hobbies	.78	.73	.80	.77	.77	1.00

Note. [a] No measures of association were computed since at least one of the variables is a constant; $n = 240$ letters, $n/K = 40$ letters.

Appendix E: Statistical Analyses (Study 1-4)

Calculations with SPSS Statistics (version 23.0; IBM Corp., 2015):

- Cohen's K as measure of agreement between raters in the letter content analysis (Study 1 & 2)
- Linear transformations onto seven-point (Study 1), 10-point (Study 2), or five-point scales (Study 3)
- Internal consistencies (Cronbach's α) and descriptive statistics
- Boxplots to check for extreme values (Study 4)
- χ^2-tests and Phi/Cramer's V coefficients with dichotomous/multicategorial variables, t-tests on ordinal and scale variables
- (Repeated-measures) (M)AN(C)OVA (with simple contrasts) on ordinal and scale variables; unless stated otherwise, the following preconditions were met: Homogeneity of variances between groups (Levene's test; in case of violation: Welch's test), homogeneity of the variance-covariance matrices across groups (Box's M-test)
- Spearman correlation coefficients
- Exploratory Receiver Operating Characteristic (ROC) curve analyses (Rice & Harris, 2005; Study 3 & 4)
- Exploratory hierarchical moderated regression analysis (Study 3 & 4)
- Exploratory moderation analyses with the SPSS PROCESS macro version 3.3 (Study 1 & 2; bootstrap $n = 5,000$; for multicategorial variables as independent variables or moderators, Helmert coding was used, which allows for the comparison of group j to all groups ordinally higher on the categorial variable; Hayes, 2018)

Calculations with R Statistical Software (version 3.6.2; R Core Team, 2019) using the R packages pwr (Champely, 2020), haven (Wickham & Miller, 2019), dplyr (Wickham et al., 2020), and BayesFactor (Morey & Rouder, 2018);

- Statistical parameters of cited studies that are not specified in the respective publications (exact p-value, Cohen's d effect sizes, 90% and 95% confidence intervals, observed 1 - β)
- For sample sizes of studies entered into the p-curve: *Mdn, M, SD*
- 1 - β of van Gelder et al. (2013, Study 1; $N = 111$) and Monroe et al. (2017, Study 1; $N = 187$) and the replication studies (Study 1: $N = 314$: Study 2: $N = 463$) to detect a small true effect of $d = 0.30$ (independent-samples t-tests, two-sided, α = .05)

- Statistical parameters of main results (independent-samples t-tests):
    - Cohen's d effect sizes, 90% and 95% confidence intervals
    - Bayes factors: BF_{10} = probability that the data occurred under H_1 as compared to H_0; BF_{01} = $1/BF_{10}$ = probability that the data occurred under H_0 as compared to H_1; see, e.g., Rouder et al., 2009)
- "Small telescope" parameters (Simonsohn, 2015) to test whether the replication effect sizes are larger than small effects that could have been detected with the respective original sample size (Study 1 & 2):
    - $d_{33\%}$ = small effect that would have been detected with the original sample in one third of the cases, i.e., that would have led to a significant result with 33% power and the original sample size
    - $ncp(d_{33\%})$ = sqrt($n_1 * n_2/(n_1 + n_2)$) * $d_{33\%}$ = noncentrality parameter of the replication study
    - p-value for H_0: $d_{\text{Replication}} = d_{33\%}$ and H_1: $d_{\text{Replication}} < d_{33\%}$ based on the non-central t-distribution = probability that an effect that is equal to or smaller than the effect in the replication study would occur with a true effect of $d_{33\%}$ and the sample size of the replication study; if H_0 is rejected, the sampling error alone is an unlikely explanation for the smaller replication effect size, as the studied effect is too small to have been detectable with the original sample size (Simonsohn, 2015)
- Bayesian replication test parameters (Verhagen & Wagenmakers, 2014), using the additional R packages R2WinBUGS (Sturtz et al., 2005), MCMCpack (Martin et al., 2011), polspline (Kooperberg, 2019), to test whether the replication effect sizes are comparable or not comparable to the respective original effect size, or whether they are not different from zero (Study 1 & 2):
    - H_0: $d = 0$; H_r: $d \sim$ posterior distribution from the original study
    - The larger BF_{r0}, the more likely it is that the data occurred under H_r as compared to H_0
- Z-values and 95% confidence intervals to compare correlation coefficients (Study 1)

Calculations with G*Power (version 3.1.9.4; Faul et al., 2007):

- $1 - \beta$ of van Gelder et al. (2015; $N = 87$) and Study 3 ($N = 210$) to detect a possible true effect in the size of the effect found original study ($\eta_p^2 = 0.04$; F-test, ANOVA: Repeated measures, within-between interaction, "effect size specification as in Cohen (1988) – recommended": $f(V) = 0.2041241$, two groups, two measurements, nonsphericity correction $\varepsilon = 1$, $\alpha = .05$).
- A priori power analysis for Study 4 to detect a possible true effect of $\eta_p^2 = 0.06$ or $\eta_p^2 = 0.03$ (F-test, ANOVA: Repeated measures, within-between interaction, "effect size specification as in Cohen (1988) – recommended": $f(V) = 0.1758631$ or 0.2526456, two groups, two measurements, $\alpha = .05$, $1 - \beta = .80$)

Appendix F: Pre-Registration of Study 3

https://aspredicted.org/r4er4.pdf

1) What's the main question being asked or hypothesis being tested in this study?

Based on the article by Jean-Louis van Gelder and colleagues (Van Gelder, J.-L., Luciano, E. C., Weulen Kranenberg, M., & Hershfield, H. E. (2015). Friends with my Future Self: Longitudinal Vividness Intervention Reduces Delinquency. Criminology 53 (2), 158-179), we aim to study the influence of vividness of the future self on health behavior. After a 1-week-manipulation we expect healthier behavior from people whose future is made more salient by questions concerning their future self as compared to people who answer questions concerning their current or past self.)

2) Describe the key dependent variable(s) specifying how they will be measured.

Dependent variable (DV): Individual health behavior

Measurement: 16 items on health-relevant issues in the past week, namely smoking (1 item), drugs/medicine (3 items), alcohol (2 items), physical activity (2 items), eating behavior (7 items) and tanning (1 item); 5-point Likert scale (2 times of measurement: baseline, follow up after 1 week)

Additional variable: Vividness of the future self

Measurement: 5 items on the ability to imagine / describe oneself in the future; 5-point Likert scale (3 times of measurement: baseline, after manipulation follow up after 1 week)

3) How many and which conditions will participants be assigned to?

Participants answer one question on each day for seven days, randomly assigned to 2 conditions: control group (CG): questions on current and past life; experimental group (EG): questions on future life starting with 2 years from now and gradually building up to 20 years from now

4) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

- Bivariate correlations between baseline vividness of the future self and baseline health behavior. We expect a positive correlation.
- Repeated-measures ANOVA with time as within-subjects factor and condition as between-subjects factor. We expect an interaction indicating healthier behavior after the manipulation in the EG, but not in the CG. DVs: whole scale and subscales health behavior
- Mediation analysis. We expect vividness of the future self to mediate the relationship between the experimental manipulation and health behavior.

5) Any secondary analyses?

- (Dropouts, baseline differences, manipulation checks)
- Stability of future orientation/salience: bivariate correlations between the three times of measurement

6) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

We recruit as many participants as possible within the scope of the project's resources: $N = 315$. We expect high dropout rates and aim at a substantially larger sample than in the original study (Van Gelder et al., 2015: $N = 87$).

7) Anything else you would like to pre-register? (e.g., data exclusions, variables collected for exploratory purposes, unusual analyses planned?)

Exploratory analyses on possible influences of age, gender, and education

8) Have any data been collected for this study already?

No, no data have been collected for this study yet

Appendix G: Instructions and Measures of Study 3

Attempt at conceptual replication of van Gelder et al. (2015)

– Programming via https://www.soscisurvey.de/

– Data collection by psychology students at the University of Bonn (D1 2017/18)

– Study title: "Lifestyle und Selbstwahrnehmung"

– Reward: Raffle of 5 Amazon vouchers of 20€ each

– Survey time frame: T1 (baseline, Day 1-3): 01/19/2017 – 01/21/2017; manipulation (Day 2-8): 01/20/2017 – 01/26/2017; T2 (post-manipulation, Day 8-11): 01/26/2017 – 01/29/2017; T3 (follow-up, Day 15-16): 02/02/17 – 02/03/2017

Survey section	Text[a]	Response format
Intro (per e-mail)	Liebe/r Studienteilnehmer/in, vielen Dank, dass Sie sich dazu entschieden haben, an unserer Studie zum Thema „Lifestyle und Selbstwahrnehmung" teilzunehmen. Hier vorab eine kurze Übersicht, was Sie erwartet: Die Studie wird in einer Woche (19.01.2017) mit einem kurzen Fragebogen beginnen. Danach werden Sie eine Woche lang täglich gebeten, eine kurze Nachricht per E-Mail zu beantworten (20.-26.01.2017). Zum Abschluss werden wir Ihnen eine Woche nach der letzten Nachricht (also am 02.02.2017) einen weiteren Fragebogen zuschicken. Ihre Daten werden dabei absolut vertraulich behandelt und nicht an Dritte weitergegeben. Die Teilnahme an dieser Studie ist freiwillig. Sie können Ihr Einverständnis ohne Angabe von Gründen und ohne Nachteile wieder zurückziehen, indem Sie die Fragen/E-Mails nicht mehr beantworten. Zur Erinnerung: Durch die vollständige Teilnahme an der Studie können Sie einen von fünf Amazon-Gutscheinen à 20 € gewinnen! Bis dahin viele Grüße Ihr Studienteam der Uni Bonn	--
T1 Intro (per e-mail)	Liebe/r Studienteilnehmer/in, wir freuen uns, dass Sie an unserer Studie zum Thema „Lifestyle und Selbstwahrnehmung" teilnehmen. Zunächst bitten wir Sie um die Bearbeitung eines kurzen Fragebogens, den Sie unter dem unten stehenden Link abrufen können. Bitte füllen Sie diesen noch heute aus. Ab morgen werden wir Ihnen dann täglich eine Frage per E-Mail schicken. Und nochmal zur Erinnerung: Als Dankeschön für die vollständige Teilnahme können Sie einen von fünf Amazon-Gutscheinen im Wert von je 20 € gewinnen! Um zum heutigen Fragebogen zu kommen, folgen Sie bitte diesem Link und geben das Passwort «TNCode» ein. https://www.soscisurvey.de/lifestyle_selbstwahrnehmung/?q=base Vielen Dank und bis morgen, Ihr Studienteam der Uni Bonn	--
T1 (baseline, Day 1-3)		
T1 Participant code	Bitte geben Sie das Passwort ein:	Open text field, 4 numbers/letters
T1 Instruction	*Bitte beantworten Sie nun einige Fragen zum Thema „Lifestyle".*	--
T1 (Un)healthy behavior (1)	1. Wie oft haben Sie in der letzten Woche auswärts gegessen? 2. Wie oft haben Sie in der letzten Woche Fastfood gegessen (z.B. Burger, Pizza, Pommes Frites, etc.)? 3. Wie oft haben Sie in der letzten Woche ferngesehen? 4. Wie oft waren Sie in der letzten Woche auf der Sonnenbank? 5. An wie vielen Tagen haben Sie in der letzten Woche Alkohol getrunken?	Item 1-4: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter Item 5: Text field for number 0-7, otherwise error message: *Bitte geben Sie eine Zahl zwischen 0 und 7 ein.*

Survey section	Text[a]	Response format
T1 (Un)healthy behavior (2)	6. Wie oft haben Sie in der letzten Woche Sport getrieben (Fitnessstudio, Joggen, etc.)? 7. Wie oft waren Sie in der letzten Woche darüber hinaus körperlich aktiv (Treppensteigen, Gartenarbeit etc.)? 8. Wie oft haben Sie in der letzten Woche Bücher oder Zeitschriften gelesen? 9. Wie oft haben Sie in der letzten Woche Obst gegessen? 10. Wie oft haben Sie in der letzten Woche Gemüse gegessen?	Item 6-10: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter
T1 (Un)healthy behavior (3)	11. Wie oft haben Sie in der letzten Woche insgesamt geraucht? 12. Wie oft haben Sie in der letzten Woche am Tag geraucht? 13. Wie oft haben Sie sich in der letzten Woche mit Freunden getroffen? 14. Wie oft haben Sie in der letzten Woche verschreibungspflichtige Medikamente ohne medizinische Notwendigkeit eingenommen? 15. Wie oft haben Sie in der letzten Woche ausreichend Flüssigkeit (mind. 2l täglich) zu sich genommen? 16. Wie oft waren Sie in der letzten Woche shoppen?	Item 11-13, 15, 16: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter Item 14: 5-point scale: nie -- ein- bis zweimal -- drei- bis viermal -- fünf- bis sechsmal -- täglich
T1 (Un)healthy behavior (4)	17. Wie oft haben Sie in der letzten Woche bei Ihren Malzeiten bewusst eine gesunde Alternative bevorzugt? 18. Wie oft haben Sie in der letzten Woche Radio gehört? 19. Wie viele Einheiten Alkohol (1 Einheit = 0,33l Bier, 0,25l Wein, 0,02l Spirituosen) haben Sie in der letzten Woche konsumiert? 20. Wie oft haben Sie in der letzten Woche auf Süßigkeiten oder Desserts verzichtet? 21. Wie viel Zeit haben Sie in der letzten Woche in sozialen Netzwerken verbracht? (Stunden)	Item 17, 18, 20: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter Item 19, 21: Text field for number
T1 (Un)healthy behavior (5)	22. Wie oft haben Sie sich in der letzten Woche ausgewogen ernährt? 23. Wie oft haben Sie in der letzten Woche Videospiele gespielt? 24. Wie oft haben Sie in der letzten Woche Cannabis konsumiert? 25. Wie oft haben Sie in der letzten Woche andere Drogen (z.B. Kokain, Ecstasy, (Meth-)Amphetamin, Heroin, etc.) konsumiert? 26. Wie oft haben Sie in der letzten Woche gemalt oder gezeichnet?	Item 22: 5-point scale: nie -- ein- bis zweimal -- drei- bis viermal -- fünf- bis sechsmal -- täglich Item 23-26: 5-point scale: ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter
T1 Instruction	*Bitte beantworten Sie nun einige Fragen zum Thema „Selbstwahrnehmung."*	--
T1 Instruction	*Geben Sie an, inwiefern Sie den folgenden Aussagen zustimmen.*	--
T1 Vividness (van Gelder et al., 2015)	e.g., Ich habe ein klares Bild von mir selbst in 20 Jahren. → 5 items	5-point scale: 1. stimme nicht zu -- 5. stimme voll und ganz zu
T1 Demographics	*Bitte machen Sie zum Abschluss folgende Angaben zu Ihrer Person:*	
	Geschlecht	o männlich o weiblich o anders
	Alter	Text field
	Höchster Bildungsabschluss	o kein Abschluss o Hauptschulabschluss o Realschulabschluss o Abitur o Hochschulabschluss
T1 Outro	*Vielen Dank!* *Morgen erhalten Sie eine weitere E-Mail von uns.* *Herzliche Grüße! Das Studienteam der Uni Bonn*	--
Manipulation (Day 2-8)		
Future condition e-mail 1	Liebe/r Studienteilnehmer/in, in dieser Woche (bis nächsten Donnerstag) ist es Ihre Aufgabe, auf die in den E-Mails gestellten Fragen noch am selben Tag per E-Mail (an psychologie@uni-bonn.de) zu antworten. Ihre Angaben werden natürlich absolut vertraulich behandelt. Nachricht 1 (von 7) *Bitte antworten Sie in wenigen Sätzen auf folgende Nachricht:*	E-mail

Survey section	Text[a]	Response format
	Was machen Sie wohl an einem Tag wie heute in zwei Jahren, also im Januar 2019? Beschreiben Sie so realistisch wie möglich, wo Sie dann sind und was Sie vermutlich machen. Herzliche Grüße und bis morgen! Ihr Studienteam der Uni Bonn	
Present condition e-mail 1	Liebe/r Studienteilnehmer/in, in dieser Woche (bis nächsten Donnerstag) ist es Ihre Aufgabe, auf die in den E-Mails gestellten Fragen noch am selben Tag per E-Mail (an psychologie@uni-bonn.de) zu antworten. Ihre Angaben werden natürlich absolut vertraulich behandelt. Nachricht 1 (von 7) *Bitte antworten Sie in wenigen Sätzen auf folgende Nachricht: Schreiben Sie so realistisch wie möglich über ein Ereignis aus dem letzten Monat, z.B. über etwas, das Sie erlebt haben oder bei dem Sie mitgemacht haben.* Herzliche Grüße und bis morgen! Ihr Studienteam der Uni Bonn	E-mail
Future condition e-mail 2	Liebe/r Studienteilnehmer/in, weiter geht's mit Nachricht 2 (von 7). Bitte antworten Sie wieder in wenigen Sätzen: *Heute gehen wir etwas weiter in der Zeit. Stellen Sie sich vor, was Sie an einem Tag wie heute in fünf Jahren machen. Denken Sie an Ihre Aktivitäten an diesem Tag, wen Sie treffen, Ihre Arbeit, Familie, Sport, Hobbies, etc. Schreiben Sie wieder so realistisch wie möglich.* Danke und bis morgen, Ihr Studienteam der Uni Bonn	E-mail
Present condition e-mail 2	Liebe/r Studienteilnehmer/in, weiter geht's mit Nachricht 2 (von 7). Bitte antworten Sie wieder in wenigen Sätzen: *Beschreiben Sie, was Sie gestern gemacht haben. Denken Sie dabei an Ihre Aktivitäten, wen Sie getroffen haben, Ihre Arbeit, Familie, Sport, Hobbies, etc.* Danke und bis morgen, Ihr Studienteam der Uni Bonn	E-mail
Future condition e-mail 3	Liebe/r Studienteilnehmer/in, auch heute haben wir wieder eine Frage für Sie. Frage 3 (von 7) Bitte antworten Sie wieder in wenigen Sätzen auf folgende Nachricht: *Stellen Sie sich vor, dass Sie sich in zehn Jahren auf eine neue Stelle bewerben. Möglicherweise haben Sie dann eine Ausbildung oder ein Studium beendet, oder Sie arbeiten schon und möchten sich beruflich verändern. Beschreiben Sie in Ihrer Antwort heute, was diese zukünftige Laufbahn beinhalten könnte, welche Ausbildung und (Arbeits-) Erfahrung dafür nötig ist und warum Sie für die Stelle geeignet sind.* Viele Grüße und bis morgen, Ihr Studienteam der Uni Bonn	E-mail
Present condition e-mail 3	Liebe/r Studienteilnehmer/in, auch heute haben wir wieder eine Frage für Sie. Frage 3 (von 7) Bitte antworten Sie wieder in wenigen Sätzen auf folgende Nachricht: *Stellen Sie sich vor, dass Sie sich morgen auf einen neuen interessanten Nebenjob oder eine neue interessante Stelle bewerben. Beschreiben Sie in Ihrer Antwort, was diese Stelle beinhaltet, ob eine bestimmte (Arbeits-) Erfahrung dafür nötig ist und warum Sie für diese Stelle geeignet sind.* Viele Grüße und bis morgen, Ihr Studienteam der Uni Bonn	E-mail
Future condition e-mail 4	Liebe/r Studienteilnehmer/in, vielen Dank für's Dranbleiben. Heute kommt schon die vierte Nachricht (von 7). Bitte antworten Sie wieder in wenigen Sätzen. *Nachdem Sie gestern über die Stelle geschrieben haben, auf die Sie sich in zehn Jahren bewerben werden, geht es heute um Stärken und Schwächen, die in diesem Bewerbungsgespräch abgefragt werden könnten. Bitte beschreiben Sie je eine Stärke und Schwäche, mit je einem kurzen Beispiel, wie sich diese Eigenschaften bei Ihnen zeigen. Es kann sich auch um Eigenschaften handeln, die Sie momentan noch nicht haben und erst in Zukunft entwickeln werden.* Bis morgen, Ihr Studienteam der Uni Bonn	E-mail

Survey section	Text[a]	Response format
Present condition e-mail 4	Liebe/r Studienteilnehmer/in, vielen Dank für's Dranbleiben. Heute kommt schon die vierte Nachricht (von 7). Bitte antworten Sie wieder in wenigen Sätzen. *Nachdem Sie gestern über eine neue (Neben-)Tätigkeit geschrieben haben, die Sie aktuell interessiert, geht es heute um Stärken und Schwächen, die im Bewerbungsgespräch abgefragt werden könnten. Bitte beschreiben Sie je eine Stärke und Schwäche und geben Sie je ein kurzes Beispiel, wie sich diese Eigenschaften bei Ihnen zeigen.* Bis morgen, Ihr Studienteam der Uni Bonn	E-mail
Future condition e-mail 5	Liebe/r Studienteilnehmer/in, da sind wir wieder, mit Nachricht 5 (von 7). Bitte antworten Sie wieder in wenigen Sätzen. *Stellen Sie sich vor, Sie treffen heute in 14 Jahren zufällig einen Freund oder eine Freundin wieder, den / die Sie in der Zwischenzeit aus den Augen verloren haben. Welche Veränderungen sieht er / sie bei Ihnen? Wie haben Sie sich über die 14 Jahre verändert im Vergleich zu der Person, die Sie heute sind?* Vielen Dank und bis morgen, Ihr Studienteam der Uni Bonn	E-mail
Present condition e-mail 5	Liebe/r Studienteilnehmer/in, da sind wir wieder, mit Nachricht 5 (von 7). Bitte antworten Sie wieder in wenigen Sätzen. *Stellen Sie sich vor, Sie treffen morgen zufällig einen Freund oder eine Freundin aus der Grundschule wieder, den / die Sie seitdem nicht mehr gesehen haben. Welche Veränderungen sieht er / sie bei Ihnen? Wie haben Sie sich über die Jahre verändert im Vergleich zu der Person, die Sie damals waren?* Vielen Dank und bis morgen, Ihr Studienteam der Uni Bonn	E-mail
Future condition e-mail 6	Liebe/r Studienteilnehmer/in, heute schon die vorletzte Frage, fast geschafft! Frage 6 (von 7) *Bitte antworten Sie wieder in wenigen Sätzen auf folgende Frage: Was machen Sie an einem Tag wie heute in 17 Jahren? Denken Sie dabei an Ihre soziale Situation: Sind Sie dann wohl Single oder in einer Beziehung? Sind Sie dann verheiratet (schon, noch oder wieder)? Mit wem haben Sie dann Kontakt? Wie wohnen Sie und mit wem?* Danke, herzliche Grüße und bis morgen! Ihr Studienteam der Uni Bonn	E-mail
Present condition e-mail 6	Liebe/r Studienteilnehmer/in, heute schon die vorletzte Frage, fast geschafft! Frage 6 (von 7) *Bitte antworten Sie wieder in wenigen Sätzen auf folgende Frage: Beschreiben Sie Ihre aktuelle soziale Situation: Sind Sie Single oder in einer Beziehung? Sind Sie verheiratet? Mit wem haben Sie Kontakt? Wie wohnen Sie und mit wem?* Danke, herzliche Grüße und bis morgen! Ihr Studienteam der Uni Bonn	E-mail
Future condition e-mail 7 T2 Intro (per e-mail)	Liebe/r Studienteilnehmer/in, vielen Dank für die Ausdauer bei der Bearbeitung der bisherigen Aufgaben. Heute erhalten Sie eine letzte Frage. Bitte beantworten Sie diese zuerst und folgen Sie anschließend dem untenstehenden Link zu einem kurzen Fragebogen. In einer Woche (also am 02.02.17) bekommen Sie die letzte E-Mail mit einem abschließenden Fragebogen. Frage 7 (von 7) Bitte antworten Sie wieder in wenigen Sätzen. *Stellen Sie sich vor, wir schreiben das Jahr 2037. Sie sind Ihr 20 Jahre älteres Selbst und blicken von da aus zurück auf Ihr heutiges Selbst. Was müssen Sie z.B. tun oder nicht tun, um dahin zu kommen, wo Sie in 20 Jahren sein wollen? Worauf sollten Sie achten? Gibt es Dinge, von denen Sie Ihrem heutigen Selbst abraten würden, oder Dinge, zu denen Sie Ihrem heutigen Selbst raten würden?*	E-mail

Survey section	Text[a]	Response format
	Nachdem Sie die Frage beantwortet haben, folgen Sie bitte diesem Link und geben das Passwort «TNCode» ein, um den Fragebogen bearbeiten zu können. https://www.soscisurvey.de/lifestyle_selbstwahrnehmung/?q=FB2 Herzliche Grüße und bis nächste Woche, Ihr Studienteam der Uni Bonn	
Future condition e-mail 7 T2 Intro (per e-mail)	Liebe/r Studienteilnehmer/in, vielen Dank für die Ausdauer bei der Bearbeitung der bisherigen Aufgaben. Heute erhalten Sie eine letzte Frage. Bitte beantworten Sie diese zuerst und folgen Sie anschließend dem untenstehenden Link zu einem kurzen Fragebogen. In einer Woche (also am 02.02.17) bekommen Sie die letzte E-Mail mit einem abschließenden Fragebogen. Frage 7 (von 7) Bitte antworten Sie wieder in wenigen Sätzen. *Blicken Sie zurück auf Ihre letzten zehn Lebensjahre und denken Sie an die Person, die Sie vor zehn Jahren waren. Was für Ratschläge würden Sie ihrem damaligen Selbst geben? Gibt es Dinge, von denen Sie besonders abraten würden, oder Dinge, zu denen Sie Ihrem damaligen Selbst raten würden?* Nachdem Sie die Frage beantwortet haben, folgen Sie bitte diesem Link und geben das Passwort «TNCode» ein, um den Fragebogen bearbeiten zu können. https://www.soscisurvey.de/lifestyle_selbstwahrnehmung/?q=FB2 Herzliche Grüße und bis nächste Woche, Ihr Studienteam der Uni Bonn	E-mail
T2 (post-manipulation, Day 8-11)		
T2 Intro	Liebe/r Studienteilnehmer/in, bitte füllen Sie diesen Fragebogen zum Thema „Selbstwahrnehmung" erst aus, nachdem Sie die letzte Frage (Frage 7 von 7) per E-Mail beantwortet haben. Wenn Sie dies bereits getan haben, klicken Sie bitte auf „weiter".	
T2 Participant code	Bitte geben Sie das Passwort ein:	Open text field, 4 numbers/letters
T2 Instruction	*Geben Sie an, inwiefern Sie den folgenden Aussagen zustimmen.*	
T2 Vividness (van Gelder et al., 2015)	e.g., Ich habe ein klares Bild von mir selbst in 20 Jahren. → 5 items	5-point scale: 1. stimme nicht zu -- 5. stimme voll und ganz zu
T2 Outro	Vielen Dank! In einer Woche erhalten Sie eine weitere Mail von uns. Herzliche Grüße, das Studienteam der Uni Bonn	
T3 Intro (per e-mail)	Liebe/r Studienteilnehmer/in, wie angekündigt bitten wir Sie nun, folgenden Fragebogen innerhalb der nächsten 24 Stunden zu bearbeiten. Damit ist Ihre Teilnahme an der Studie beendet. Die Gewinner der Amazon-Gutscheine werden in den nächsten 2 Wochen ausgelost und per E-Mail benachrichtigt. Hier geht's zum Fragebogen, bitte geben Sie wieder das Passwort «TNCode» ein. https://www.soscisurvey.de/lifestyle_selbstwahrnehmung/?q=FB03 Vielen Dank für Ihre Teilnahme! Ihr Studienteam der Uni Bonn	--
T3 (follow-up, Day 15-16)		
T3 Participant code	Bitte geben Sie das Passwort ein:	Open text field, 4 numbers/letters
T3 Instruction	*Auch diese Woche interessieren wir uns für Ihren Lifestyle. Bitte beantworten Sie dazu folgende Fragen:*	--
T3 (Un)healthy behavior (1)	1. Wie oft haben Sie in der letzten Woche auswärts gegessen? 2. Wie oft haben Sie in der letzten Woche Fastfood gegessen (z.B. Burger, Pizza, Pommes Frites, etc.)? 3. Wie oft haben Sie in der letzten Woche ferngesehen? 4. Wie oft waren Sie in der letzten Woche auf der Sonnenbank? 5. An wie vielen Tagen haben Sie in der letzten Woche Alkohol getrunken?	Item 1-4: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal --öfter Item 5: Text field for number 0-7, otherwise error message

Survey section	Text[a]	Response format
T3 (Un)healthy behavior (2)	6. Wie oft haben Sie in der letzten Woche Sport getrieben (Fitnessstudio, Joggen, etc.)? 7. Wie oft waren Sie in der letzten Woche darüber hinaus körperlich aktiv (Treppensteigen, Gartenarbeit etc.)? 8. Wie oft haben Sie in der letzten Woche Bücher oder Zeitschriften gelesen? 9. Wie oft haben Sie in der letzten Woche Obst gegessen? 10. Wie oft haben Sie in der letzten Woche Gemüse gegessen?	Item 1-4: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal --öfter
T3 (Un)healthy behavior (3)	11. Wie oft haben Sie in der letzten Woche insgesamt geraucht? 12. Wie oft haben Sie in der letzten Woche am Tag geraucht? 13. Wie oft haben Sie sich in der letzten Woche mit Freunden getroffen? 14. Wie oft haben Sie in der letzten Woche verschreibungspflichtige Medikamente ohne medizinische Notwendigkeit eingenommen? 15. Wie oft haben Sie in der letzten Woche ausreichend Flüssigkeit (mind. 2l täglich) zu sich genommen? 16. Wie oft waren Sie in der letzten Woche shoppen?	Item 11-13, 15, 16: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter Item 14: 5-point scale: nie -- ein- bis zweimal -- drei- bis viermal -- fünf- bis sechsmal -- täglich
T3 (Un)healthy behavior (4)	17. Wie oft haben Sie in der letzten Woche bei Ihren Malzeiten bewusst eine gesunde Alternative bevorzugt? 18. Wie oft haben Sie in der letzten Woche Radio gehört? 19. Wie viele Einheiten Alkohol (1 Einheit = 0,33l Bier, 0,25l Wein, 0,02l Spirituosen) haben Sie in der letzten Woche konsumiert? 20. Wie oft haben Sie in der letzten Woche auf Süßigkeiten oder Desserts verzichtet? 21. Wie viel Zeit haben Sie in der letzten Woche in sozialen Netzwerken verbracht? (Stunden)	Item 17, 18, 20: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter Item 19, 21: Text field for number
T3 (Un)healthy behavior (5)	22. Wie oft haben Sie sich in der letzten Woche ausgewogen ernährt? 23. Wie oft haben Sie in der letzten Woche Videospiele gespielt? 24. Wie oft haben Sie in der letzten Woche Cannabis konsumiert? 25. Wie oft haben Sie in der letzten Woche andere Drogen (z.B. Kokain, Ecstasy, (Meth-)Amphetamin, Heroin, etc.) konsumiert? 26. Wie oft haben Sie in der letzten Woche gemalt oder gezeichnet?	Item 14: 5-point scale: nie -- ein- bis zweimal -- drei- bis viermal -- fünf- bis sechsmal -- täglich Item 23-26: 5-point scale: nie -- ein- bis zweimal -- drei- bis fünfmal -- sechs- bis 10mal -- öfter
T3 Instruction	*Bitte beantworten Sie nun einige Fragen zum Thema "Selbstwahrnehmung."*	--
T3 Instruction	*Geben Sie an, inwiefern Sie den folgenden Aussagen zustimmen.*	--
T3 Vividness (van Gelder et al., 2015)	e.g., I find it easy to imagine myself 20 years from now. → 5 items	5-point scale: 1. stimme nicht zu -- 5. stimme voll und ganz zu
T3 Outro T3 Interest in results	Herzlichen Glückwunsch, Sie haben es geschafft! Möchten Sie über die Gesamtergebnisse der Studie informiert werden? Wenn Sie "ja" anklicken, werden wir Ihre E-Mail-Adresse erst löschen, nachdem Sie den Bericht von uns erhalten haben. Wenn Sie „nein" anklicken, werden wir Ihre E-Mail-Adresse unmittelbar nach Verlosung der Amazon-Gutscheine löschen. Vielen Dank für Ihren Beitrag zu unserer Studie! Herzliche Grüße Das Studienteam der Uni Bonn	Ja -- Nein

Note. [a] Each row within the "Text" column indicates a separate page in the online questionnaire. Item list numbers were not displayed in the online questionnaire.

Appendix H: Pre-Registration of Study 4

Research Questions

Positive effects on health behavior are reported for both self-affirmation (SA) and temporal orientation (TO) interventions (cf. e.g. meta-analyses by Epton, Harris, Kane & van Koningsbruggen, 2015, and Sweeney & Culcea, 2017). In our study a minimum intervention (less than five minutes) as a combination of these two approaches will be tested for its effectiveness on a non-clinical sample

• with regard to alcohol consumption, nutrition and physical activity, self-esteem, temporal orientation and self-control and
• in comparison to a classical SA intervention, a pure TO intervention (without value activation) and a control group (other affirmation [OA] intervention).

Hypotheses

It is predicted that…
1) …all intervention forms (EG1-3) will improve reactions to a health messages (better evaluation, less defensive avoidance, more perceived threat, greater processing) at T1 (manipulation check).
2) …all intervention forms (EG1-3) will reduce alcohol consumption.
3) …all intervention forms (EG1-3) will improve nutrition and physical activity.
4) …the SA and SA-TO interventions will increase self-esteem; the TO and SA-TO interventions will increase self-control, future time perspective, and vividness of the future self.
5) …overall, the combined SA-TO intervention will have the greatest effects; no differences are expected between the pure SA and TO interventions.

Sampling Plan

Existing Data

-

Data collection procedures

Participants will be recruited via the survey platform Prolific Academic.

Inclusion criteria:
• Experienced members of Prolific Academic (who have taken part in more than 10 previous studies on Prolific and those with an approval rate above 50%)
• Motivation to take part in two times of measurement (35 min overall) at a four-week interval
• Minimum age of 21 (consistent with US alcohol licensing laws)

At T1 the estimated time to complete is 20-25 min, participants will be rewarded with £5.16/hr. At T2 the estimated time to complete is 10-15 min, participants will be rewarded with £5.34/hr.

Sample size

An a priori power analysis indicated a necessary sample size of $N = 179$. Considering dropouts we aim at 260 participants at T1 (65 per group).

Sample size rationale

We used the software program G*Power to conduct a power analysis. Our goal was to obtain .80 power to detect a medium effect size of .25 at the standard .05 alpha error probability in a MANOVA with repeated-measures, within-between-interaction, 4 groups, 2 measurements.

Stopping rule

Data collection via Prolific Academic allows full control over the exact sample size.
Variables

Manipulated variables

The subjects will be randomly assigned to the cells of a 2 (TO present, non-existent) x 2 (SA present, non-existent) x 2 (measurement time T1, T2) design.

One experimental group (EG1) will receive a minimum intervention combining SA and TO approaches. General values (family, hobbies, religion, etc.) are to be ranked according to their subjective importance. Subsequently, the participants will be asked to think about their future self (in ten years) and to briefly describe in their own words why and when their most important value will be helpful to them in the future.

EG2 will receive a classic SA intervention in which, again, general values are to be ranked. The TO (future) aspect is omitted here: The participants will not be asked to imagine their future self but to describe when and why the most important value was helpful for them in the past (cf. Napper, Harris & Epton, 2009).

EG3 will receive a pure TO intervention without value activation. The participants will be asked to think about their future self (in ten years) and subsequently write a letter to this future self (c.f. Monroe, Ainsworth, Vohs & Baumeister, 2017; Van Gelder, Hershfield & Nordgren, 2013). The instructions are formulated neutrally, so do not address values directly (e. g.: "What would you like to tell your future self?").

The control group (CG) will receive an OA intervention which is not expected to have any effects. Here again, general values are to be ranked ¬ not according to their significance for one's own person, but for other people. Subsequently, for a value of medium rank, participants are to describe why and when this value is helpful for other people (cf. Napper et al., 2009).

Measured variables

• Health behaviour (eating behavior, physical activity): 11 self-generated items including 4 distractor items
• Alcohol consumption during the past week: modified timeline followback technique (Armitage, Harris & Arden, 2011; Sobell & Sobell, 1992): calendar overview to list the respective number of alcohol units
Further measures:
• Health status: BMI (weight in kg, size in m) and 2 self-generated items
• Self-esteem: 2 Items from Robins, Hendin & Trzesniewski (2001) and Rosenberg (1965)
• Self-control: Brief self-control measure (Tangney, Baumeister & Boone, 2004); 13 items
• Temporal orientation:
    • Time Perspective: Time Perspective Questionnaire (TPQ; Fong & Hall, 2003); 13 items
    • Vividness of the Future Self: 5 items from Van Gelder et al. (2015)
• Dealing with health information: 8 items based on Armitage et al. (2011): evaluation (2), defensive avoidance (2), perceived threat (2), processing (2)
• Demographics: age, gender, highest level of education, socioeconomic status, country, native language

Indices

The alcoholic units that the participants state to have consumed in the past seven days will be summed up for analyses. Additionally, they will be coded as risky vs. not risky according to current UK government recommendations; this dichotomous variable will be used as quasi-experimental between-subjects factor in a repeated-measures ANOVA.

The variable "nutrition/physical activity" will be calculated as mean value of the items on eating behavior and physical activity. Depending on the results of reliability analyses, eating behavior and physical activity will be analyzed as separate scales and at item level.

Participants' "health status" will be coded as "risky" if two of these criteria apply:
• BMI ≥ 30.00
• Self-rated health status "poor"
• Self-rated as "not at all athletic"
Regarding the other constructs scale mean values will be used for analyses.

Design Plan

Study type

Experiment - A researcher randomly assigns treatments to study subjects, this includes field or lab experiments. This is also known as an intervention experiment and includes randomized controlled trials.

Blinding

   For studies that involve human subjects, they will not know the treatment group to which they have been assigned.
   Research personnel who interact directly with the study subjects (either human or non-human subjects) will not be aware of the assigned treatments.

Study design

We have a randomized block mixed 2 (TO manipulation present, non-existent) x 2 (SA manipulation present, non-existent) x 2 (measurement time T1, T2) design (four groups).

Randomization

We will use the SosciSurvey block randomization tool, each participant will be randomly assigned to one of the four equally sized, predetermined blocks.

Analysis Plan

Statistical models

• Reliability analyses (Cronbach's alpha)
For all subsequent analyses, adequate post hoc tests will be chosen based on the recommendations of Field (2011).
• Randomization check: MANOVA with condition as independent variable and demographics and baseline data as dependent variables
In case there are differences between the four groups, the respective variable(s) will be used as covariates in subsequent analyses: (M)ANCOVAs with simple planned contrasts.
• Manipulation check: MANOVA with condition as between-subjects factor and variables on the health information as dependent variables
• Effects of the intervention on alcohol consumption: Repeated-measures ANOVA with condition as between-subjects factor, baseline intake (risky vs. not risky) as quasi-experimental between-subjects factor, time (baseline vs. follow-up) as within-subjects factor and alcohol intake at T2 as dependent variable
If baseline alcohol intake does not influence the results, the sample will be analyzed as a whole in further analyses.
To assess changes in alcohol consumption across time separate repeated-measures ANOVAs will be conducted for the four conditions.
• Effects of the intervention on nutrition / physical activity: Repeated-measures ANOVA with condition as between-subjects factor, baseline health status (risky vs. not risky) as quasi-experimental between-subjects factor, time (baseline vs. follow-up) as within-subjects factor and nutrition / physical activity as dependent variable
If baseline health status does not influence the results, the sample will subsequently be analyzed as a whole.
To assess changes in health behavior across time separate repeated-measures ANOVAs will be conducted for the four conditions.
Depending on the results of reliability analyses, nutrition / physical activity will also be analyzed as separate scales and at item level (repeated-measures MANOVA)
• Effects of the intervention on psychological constructs: Repeated-measures MANOVA with condition as between-subjects factor, time (baseline vs. follow-up) as within-subjects factor and self-esteem, self-control and temporal orientation variables as dependent variables.
• In exploratory tests, self-esteem, self-control, temporal orientation variables and variables concerning the health information (evaluation, defensive avoidance, perceived threat, processing) will be analyzed as possible mediators between condition and health behavior.

Transformations

Inverse items will be recoded; regarding coding of categorical variables, see "indices".

Follow-up analyses

-

Inference criteria

We will use the standard p-smaller-than-.05 criteria for determining if the (M)AN(C)OVAs and post hoc tests suggest that the results are significantly different from those expected if the null hypothesis were correct. For all analyses, adequate post hoc tests will be chosen based on the recommendations of Field (2011).

Data exclusion

Outliers will be excluded only if the data are clearly unrealistic (e.g., 99 units of alcohol per day). Apart from that, if extreme values (greater than 3x interquartile range) are present, the results will be reported both with and without these data.

Missing data

Due to data collection via Prolific Academic, there will be no missing data.

Exploratory analysis

-

Appendix I: Instructions and Measures of Study 4

– Programming via https://www.soscisurvey.de/

– Data collection via https://www.prolific.co/

– Study title on ProA: "Lifestyle & self-perception, part 1/part 2"

– Reward: T1: £1.72, completion time: 12 min; T2: £0.71, completion time: six min

– Survey time frame: T1 (baseline & manipulation, Day 1): 03/15/2018; T2 (follow-up, Day 29-36): 04/12/2018-04/19/2018

– Prescreening: age 22-100, approval rate at least 50%, 10-10,000 previous submissions, T2: only if T1 completed

Survey section	Text[a]	Response format
Intro	This research project of the University of Bonn, Germany, examines to what extent people differ in lifestyle and how they perceive themselves. Among other topics this includes leisure-related issues such as exercise, alcohol consumption, TV, and painting. For our study it is crucial that you take part at two points of measurement, now and in four weeks. This will take approx. 20 min (£5.16/hr) now and approx. 10 min in four weeks (£5.34/hr). As we can only use data from participants who took part in both parts, we kindly ask you to start the survey only if you can participate in four weeks as well. You will receive an E-Mail from Prolific Academic reminding you of the second part of the study.	--
T1 (baseline, Day 1)		
T1 Intro	Please make sure you can take part today and in four weeks! Hi! In this study, we want to learn about how you live and how you perceive yourself. All of your information will be handled with strict confidence and in accordance with the legal provisions for data protection. Collected data will only be saved and published in an anonymous form and will be analyzed on a group level. There will be no way to draw conclusions about your identity or your individual answers. At both times of measurement, we would like you to enter a certain code composed of 6 letters and numbers so that we can correctly assign your data. If you decide to cancel your participation, we can use the participant-ID to identify and delete your data before data collection is completed. After matching the files, the participant IDs will be deleted. By filling out the questionnaires completely you accept the conditions stated above. You can stop participating at any point without providing a reason by closing the relevant tab. After completing the second part of the study, you will be informed about the goals of our research project. You can receive further information on the results at the end of the study in July 2018. If you are interested, please send an e-mail to the examiner (lquinten@uni-bonn.de) with the subject "study lifestyle". Of course, your e-mail-address cannot be linked to your answers and will be deleted after we sent you the results. Thank you very much for participating in this research project. For more information, please contact Laura Quinten: lquinten@uni-bonn.de, 0049-228-73-4114.	--
ProA Participant ID	Please enter your Prolific ID:	Text field
T1 ID[b]	We would like to ask you to create a participant-ID so that we can correctly assign your data from both times of measurement. It is composed of the following 6 letters and numbers: 1. Please state the first two letters of your mother's first name: 2. Please state the first two letters of your father's first name: 3. Please state the first two digits of your mother's birthday (DD, please use two digits, e.g. 02 or 10) Example: • First name mother: **An**na • First name father: **Ma**x • Birthday mother: **27**.08.50 • ID: **ANMA27**	Text fields

Survey section	Text[a]	Response format
T1 Instruction	*To begin with, please answer the following questions about yourself.*	--
T1 Demographics	What is your gender?	o male o female o other
	How old are you?	Text field
	What is your highest level of education?	o None o High School o College/University o Other
	How would you describe yourself in terms of your financial situation?	5-point scale: 1. Very poor *to* 5. Very wealthy
	Where do you live?	Choice options
	What is your native language?	Choice options
T1 Intro (Un)healthy behavior	*We are interested in how you live, what kind of activities, food, etc. you like. Please answer the following questions about your last week as honestly as possible!*	--
T1 (Un)healthy behavior	Last week, how often did you… 1. eat out? 2. have fast food (e.g, Burger, Pizza, Fries)? 3. climb stairs instead of using a escalators or elevators? 4. read books or magazines? 5. eat fruit? 6. eat vegetables? 7. meet friends? 8. have sweets or a dessert? 9. cook using fresh ingredients? 10. drink soft drinks (e.g., Coke, Sprite)? 11. draw or paint? 12. do sports (e.g., fitness, jogging, etc.)? 13. engage in outdoor activities (e.g., going for a walk, gardening)?	Item 1-11: 5-point scale: 1. Never 2. One or two times 3. Three to five times 4. Six to ten times 5. More often Item 12, 13: 5-point scale: 1. Never 2. One or two times 3. Three or four times 4. Five or six times 5. Seven times or more
T1 Health status	1. Now please enter • your weight[c] • your size[c] And how do you actually feel about your health? 2. My current physical health status is... 3. I think I am…	Item 1: Open Item 2: 5-point scale: 1. poor *to* 5. excellent Item 3: 1. not at all athletic *to* 5. very athletic

T1 Alcohol	How much alcohol did you drink in the last 7 days?
	Please enter the number of standard drink units in the calendar.
	1 standard drink unit (one shot) is equal to:
	  – half a pint of BEER (10 oz / 300 ml)
	  – 1 glass of WINE at 9% strength (4 oz / 125 ml)
	  – 1 shot of HARD LIQUOR or SPIRITS (0,8 oz / 25 ml)
	So, if you had 6 beers on a given day, please enter "6".
	If you had 2 beers and 3 glasses of wine on a given day, please enter "5".
	If you had 1 bottle of wine (25 oz/750 ml), please enter "6", again.
	You should enter a digit for every day of the last week. If you did not have any alcohol on a given day, please enter "0".
	Try to be as accurate as possible – if you are not sure that's ok, just give your best guess!
		Calendar over 7 days (past week: *yesterday -- the day before yesterday -- three days ago --...*) with 1 open text field per day for max. 2 numbers

T1 Instruction	*In the next part of the study, please answer some questions about your personality and how you perceive yourself.*	--
T1 Self-esteem (Robins et al., 2001; Rosenberg, 1965)	Using the scale provided, please indicate how much each of the following statements reflects how you typically are. I have high self-esteem. On the whole, I am satisfied with myself.	5-point scale: 1. not at all *to* 5. very much

Survey section	Text[a]	Response format
T1 Brief Self-Control Scale (Tangney et al., 2004)	e.g., I am good at resisting temptation. → *13 items*	5-point scale: 1. not at all *to* 5. very much
T1 Time Perspective Questionnaire (Fong & Hall, 2003)	Now once again, for each of the statements below, indicate your level of agreement or disagreement. e.g., Short-term goals are more important to me than long-term goals. → *13 items*	7-point scale: 1. disagree very strongly *to* 7. agree very strongly
T1 Vividness (van Gelder et al., 2015)	Now please indicate for each item to what extent you agree or disagree with it by ticking the answer that best reflects your opinion. e.g., I find it easy to imagine myself 20 years from now. → *5 items*	5-point scale: 1. disagree completely *to* 5. agree completely
Manipulation		
Self-affirmation – Future-condition (SF)	In the following chart, the left column states aspects which can have different levels of importance to you. **Please put those 8 aspects into an order which reflects their importance to you personally.** Use 1 for the most important aspect, 2 for the second most important aspect, 3 for the third most important aspect and so on until 8 for the least important aspect. **Each number can only be used once.** How important are family/relationships to you? How important are friends to you? How important are politics to you? How important is spirituality/religion to you? How important is humor to you? How important is creativity to you? How important are hobbies to you? How important is school/university or your job to you? Please imagine that ten years have now passed. We are in the year **2028** and you are **ten years older**. Try to imagine your future self right in front of you. What might have changed within the last ten years? What might have happened? We like to ask you to shortly state for your **most important aspect** from the chart above **(importance = 1)**, **why** this aspect is of such importance to you and **in what situation** and in what circumstance it will help you in the future. We are solely interested in your point of view, not in the way you can express yourself.	Text fields for numbers 1-8 Text field for max. 2,000 characters
Self-affirmation-condition (S)	In the following chart, the left column states aspects which can have different levels of importance to you. **Please put those 8 aspects into an order which reflects their importance to you personally.** Use 1 for the most important aspect, 2 for the second most important aspect, 3 for the third most important aspect and so on until 8 for the least important aspect. **Each number can only be used once.** How important are family/relationships to you? How important are friends to you? How important are politics to you? How important is spirituality/religion to you? How important is humor to you? How important is creativity to you? How important are hobbies to you? How important is school/university or your job to you? We like to ask you to shortly state for your **most important aspect** from the chart above **(importance = 1)**, **why** this aspect is of such importance to you and **in what situation** it was helpful to you. We are solely interested in your point of view, not in the way you can express yourself.	Text fields for numbers 1-8 Text field for max. 2,000 characters

Survey section	Text[a]	Response format
Future-condition (F)	We would like to ask you to think about yourself **ten years in the future**. Try to imagine your future self as vividly as possible. How do you look, for example? What are you doing? Where will you be? Please use the free space below to write a short letter (200-300 words) to your future self – **the person you will be in ten years**. What would you like to tell your future self? What would like to ask? What you write is completely up to you.	Text field for max. 2,000 characters
Other-affirmation-condition (C)	In the following chart, the left column states aspects which can have different levels of importance to people. **Please put those 8 aspects into an order which, in your opinion, reflects their importance to people.** Use 1 for the most important aspect, 2 for the second most important aspect, 3 for the third most important aspect and so on until 8 for the least important aspect. **Each number can only be used once.** How important are family/relationships to people? How important are friends to people? How important are politics to people? How important is spirituality/religion to people? How important is humor to people? How important is creativity to people? How important are hobbies to people? How important is school/university or your job to people?	Text fields for numbers 1-8
	We like to ask you to shortly state for your **most important aspect** from the chart above **(importance = 1)**, **why** this aspect might be of such importance to people and **in what situation** it might have been helpful to them. We are solely interested in your point of view, not in the way you can express yourself.	Text field for max. 2,000 characters
Health information	*Now please read the following text carefully.* Every year 3 million people die from the consequences of **heavy drinking**. Heavy drinking increases the risk of falling ill with 200 different diseases most likely concerning the liver, different kinds of cancer and infections (e.g., tuberculosis).[1] The risk of developing a range of serious health problems increases the more you drink on a regular basis. According to the current recommendations, to keep health risks from alcohol to a low level it is safest o For women to consume no more than 2–3 units per day o For men to consume no more than 3–4 units per day o Not to drink more than 14 units a week on a regular basis[2] Please remember: **1 standard drink unit** (one shot) is equal to: o half a pint of BEER (10 oz / 300 ml) o 1 glass of WINE at 9% strength (4 oz / 125 ml) o 1 shot of HARD LIQUOR or SPIRITS (0,8 oz / 25 ml) But it is not only alcohol which is associated with underestimated risks: In 2016, a **poor diet** was a factor for one in five deaths. A diet that is o low in whole grains, fruit, nuts, seeds, fish oils and o high in salt and processed meats o raises the risk of obesity, cancer, heart disease and of having a stroke.[3] **Physical inactivity** also has a major negative health effect worldwide, i.e. promoting coronary heart disease, type 2 diabetes, and different forms of cancer.[4] To reduce health risks, the WHO recommends: o Adults aged 18 to 64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.	

Survey section	Text[a]	Response format
	o Aerobic activity should be performed in bouts of at least 10 minutes duration. o For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity. o Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week.[5] [1] WHO Global status report on alcohol and health 2014. Retrieved 05th November 2017 from: http://apps.who.int/iris/bitstream/10665/112736/1/9789240692763_eng.pdf?ua=1 [2] UK Alcohol Policy Team, Department of Health (2016) How to keep health risks from drinking alcohol to a low level. Government response to the public consultation. Retrieved 30th January 2018 from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/545911/GovResponse2.pdf [3] Global Burden of Disease 2016. Retrieved 05th November 2017 from: http://www.thelancet.com/gbd [4] Retrieved 06th November 2017 from: http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(12)61031-9.pdf [5] Retrieved 06th November 2017 from: http://www.who.int/dietphysicalactivity/factsheet_adults/en/	
T1 Instruction	*After reading this information we would like you to reconsider your answers given before. Are you satisfied concerning your alcohol consumption, your nutrition and your physical fitness due to movement or do you see any potential for improvement?*	--
T1 Response to health information	What did you think about the information you just read? Did you think it was… 1. …overblown? 2. …persuasive?	7-point scale: 1. not at all *to* 7. very much
	To what extent do you agree with the following statements? When I read the information my first reaction was that I… 1. …didn´t want to think about it. 2. …wanted to reconsider my health behavior.	7-point scale: 1. strongly disagree *to* 7. strongly agree
	The information made me feel... 1. …frightened 2. …worried	7-point scale: 1. not at all *to* 7. very much
	1. How much of the article did you read? 2. How much of the information do you think you will be able to recall in a week?	6-point scale: 1. none 2. a bit 3. some 4. most 5. almost all 6. all
T1 Outro	*It's done! You have finished the first part of our study!* *In four weeks you will be invited by Prolific Academic to take part in the second part (which is way shorter, 10 min only!).* *Since we can only use questionnaires that have been filled out completely, at both times of measurement, we would be very happy if you take part in four weeks again!*	--
T1 Link	Thank you very much for your participation! Please click on this completion URL to show that you have finished the study: https://www.prolific.ac/submissions/complete?cc=BY6IYOX6">lifestyle&self-perception1/completion code BY6IYOX6 Thank you for completing this questionnaire! We would like to thank you very much for helping us. Your answers were transmitted, you may close the browser window or tab now.	Link

Survey section	Text[a]	Response format
T2 (follow-up, Day 29-36)		
T2 Intro	Please notice once again that... All of your information will be handled with strict confidence and in accordance with the legal provisions for data protection. Collected data will only be saved and published in an **anonymous form** and will be analyzed on a **group level**. There will be no way to draw conclusions about your identity or your individual answers. Again, we would like you to enter your code composed of 6 letters and numbers so that we can correctly assign your data. If you decide to cancel your participation we can use the participant-ID to identify and delete your data before data collection is completed. After matching the files the participant IDs will be deleted. By filling out the questionnaires completely you accept the conditions stated above. You can stop participating at any point without reason by closing the relevant tab. This will not result in any disadvantage for you. You can receive further information on the results at the end of the study in July 2018. If you are interested, please send an e-mail to the examiner (lquinten@uni-bonn.de) with the subject "study lifestyle". Of course, your e-mail-address cannot be linked to your answers and will be deleted after we sent you the results. Thank you very much for participating in this research project. For more information, please contact Laura Quinten: lquinten@uni-bonn.de, 0049-228-73-4114	--
ProA Participant ID	Please enter your Prolific ID:	Text field
T2 ID[b]	We would like to ask you to create a participant-ID so that we can correctly assign your data from both times of measurement. It is composed of the following 6 letters and numbers: 1. Please state the first two letters of your mother's first name: 2. Please state the first two letters of your father's first name: 3. Please state the first two digits of your mother's birthday (DD, please use two digits, e.g. 02 or 10) Example: • First name mother: **An**na • First name father: **Ma**x • Birthday mother: **27**.08.50 • ID: **ANMA27**	
T2 Intro (Un)healthy behavior	*Like last time we are interested in how you live, what kind of activities, food, etc. you like. Please answer the following questions about your last week as honestly as possible!*	--
T2 (Un)healthy behavior	Last week, how often did you… 1. eat out? 2. have fast food (e.g, Burger, Pizza, Fries)? 3. climb stairs instead of using a escalators or elevators? 4. read books or magazines? 5. eat fruit? 6. eat vegetables? 7. meet friends? 8. have sweets or a dessert? 9. cook using fresh ingredients? 10. drink soft drinks (e.g., Coke, Sprite)? 11. draw or paint? 12. do sports (e.g., fitness, jogging, etc.)? 13. engage in outdoor activities (e.g., going for a walk, gardening)?	Item 1-11: 5-point scale: 1. Never 2. One or two times 3. Three to five times 4. Six to ten times 5. More often Item 12, 13: 5-point scale: 1. Never 2. One or two times 3. Three or four times 4. Five or six times 5. Seven times or more
T2 Health status	1. Now please enter • your weight (and choose unit: kg – pound – stone) • your size (and choose unit: meter – feet/inch) And how do you actually feel about your health? 2. My current physical health status is... 3. I think I am…	Item 1: open text field Item 2: 5-point scale: 1. poor *to* 5. excellent Item 3: 1. not at all athletic *to* 5. very athletic

Survey section	Text[a]	Response format
T2 Alcohol	How much alcohol did you drink in the last 7 days? Please enter the number of standard drink units in the calendar. 1 standard drink unit (one shot) is equal to: ○ half a pint of BEER (10 oz / 300 ml) ○ 1 glass of WINE at 9% strength (4 oz / 125 ml) ○ 1 shot of HARD LIQUOR or SPIRITS (0,8 oz / 25 ml) So, if you had 6 beers on a given day, please enter "6". If you had 2 beers and 3 glasses of wine on a given day, please enter "5". If you had 1 bottle of wine (25 oz/750 ml), please enter "6", again. You should enter a digit for every day of the last week. If you did not have any alcohol on a given day, please enter "0". Try to be as accurate as possible – if you are not sure that's ok, just give your best guess!	Calendar over 7 days (past week: *yesterday -- the day before yesterday -- three days ago --...*) with 1 open text field per day for max. 2 numbers
T2 Instruction	*In the next part of the study, please answer some questions about your personality and how you perceive yourself.*	--
T2 Self-esteem (Robins et al., 2001; Rosenberg, 1965) T2 Brief Self-Control Scale (Tangney et al., 2004)	Using the scale provided, please indicate how much each of the following statements reflects how you typically are. I have high self-esteem. On the whole, I am satisfied with myself. e.g., I am good at resisting temptation. → *13 items*	5-point scale: 1. not at all *to* 5. very much
T2 Time Perspective Questionnaire (Fong & Hall, 2003)	Now once again, for each of the statements below, indicate your level of agreement or disagreement. e.g., Short-term goals are more important to me than long-term goals. → *13 items*	7-point scale: 1. disagree very strongly *to* 7. agree very strongly
T2 Vividness (van Gelder et al., 2015)	Now please indicate for each item to what extent you agree or disagree with it by ticking the answer that best reflects your opinion. e.g., I find it easy to imagine myself 20 years from now. → *5 items*	5-point scale: 1. disagree completely *to* 5. agree completely
Outro	*Good job, thank you very much! Find some information on the goals of our study on the next page.*	--
Participant information	Dear participant, we are very grateful for your contribution to our study and would now like to share with you the goals of our research. You have been randomly assigned to one of four groups; there were four different versions of questionnaires. One of them included a so called "Self-Affirmation Intervention" which makes people aware of their values and strengthens their self-esteem. The second version included a "Time-Orientation Intervention" which promotes a more vivid image of the future self. The third one was a combination of both. Psychological studies have shown that these interventions can have positive effects on a range of attitudes and behaviors; for example, people's health behavior can be improved. The fourth group did not engage in personal values, instead, they worked on common values ("Other-Affirmation", control group). Our aim was to identify if there was a greater positive effect on attitudes and behavior; specifically, in the areas of alcohol consumption, nutrition and physical activity, by a combination of interventions, "self-affirmation" and "time-orientation" than of single interventions and/or the control group. You can receive a summary of the results by July 2018. If you are interested, please send an e-mail to the examiner (lquinten@uni-bonn.de) with the subject "study lifestyle". Of course, your e-mail-address cannot be linked to your answers and will be deleted after sending the results.	--

Survey section	Text[a]	Response format
	The study has been conducted as part of our final thesis in the department B.Sc. Psychology and M.Sc. Psychology at Rheinische Friedrich-Wilhelms-Universtät Bonn. For more information, please contact Laura Quinten: lquinten@uni-bonn.de, 0049-228-73-4114 Thank you so much for your support!	
T2 Link	Thank you very much for your participation! Please click on this completion URL to show that you have finished the study: https://www.prolific.ac/submissions/complete?cc=03G4Z7SF">lifesty le&self-perception2/completion code 03G4Z7SF Thank you for completing this questionnaire! We would like to thank you very much for helping us. Your answers were transmitted, you may close the browser window or tab now.	Link

Note. [a] Each row within the "Text" column indicates a separate page in the online questionnaire. Item list numbers were not displayed in the online questionnaire. [b] Codes generated by the participants themselves often did not correspond between T1 and T2. Instead, we used the ProA IDs to match the data from the T1 and T2 questionnaire. [c] Units for weight and height were not queried at T1, thus both measures were re-assessed at T2.

Tests for differences in baseline measures and demographics a) between conditions with/without an S component, and b) between conditions with/without an F component.

Baseline measures:[50]

- Units of alcohol: a) $F(1, 208) = 0.31$, $\eta_p^2 < 0.01$, $p = .577$; b) $F(1, 208) = 0.11$, $\eta_p^2 < 0.01$, $p = .736$
- Unhealthy diet: a) $F(1, 208) < 0.01$, $\eta_p^2 < 0.01$, $p = .978$; b) $F(1, 208) = 0.34$, $\eta_p^2 < 0.01$, $p = .558$
- Physical inactivity: a) $F(1, 208) < 0.01$, $\eta_p^2 < 0.01$, $p = .935$; b) $F(1, 208) = 0.45$, $\eta_p^2 < 0.01$, $p = .505$
- Risky vs. not-risky alcohol consumption: a) $\chi^2(1) = 2.28$, $\phi = .10$, $p = .131$; b) $\chi^2(1) = 1.04$, $\phi = .07$, $p = .309$
- Risky vs. not risky baseline health status: a) $\chi^2(1) = 1.70$, $\phi = -.09$, $p = .193$; **b) $\chi^2(1) = 4.38$, $\phi = -.14$, $p = .036$**
- Self-esteem: a) $F(1, 208) = 3.61$, $\eta_p^2 = 0.02$, $p = .059$; b) $F(1, 208) = 0.04$, $\eta_p^2 < 0.01$, $p = .845$
- Vividness: a) $F(1, 208) = 0.04$, $\eta_p^2 < 0.01$, $p = .839$; b) $F(1, 208) = 1.36$, $\eta_p^2 = 0.01$, $p = .244$
- Self-control: a) $F(1, 208) = 0.25$, $\eta_p^2 < 0.01$, $p = .621$; b) $F(1, 208) = 0.89$, $\eta_p^2 < 0.01$, $p = .348$
- Future time perspective: a) $F(1, 208) = 0.07$, $\eta_p^2 < 0.01$, $p = .796$; b) $F(1, 208) = 0.18$, $\eta_p^2 < 0.01$, $p = .672$

Demographics:

- Age: a) $F(1, 208) = 0.01$, $\eta_p^2 < 0.01$, $p = .944$; b) $F(1, 208) = 2.00$, $\eta_p^2 = 0.01$, $p = .159$
- Gender: a) $\chi^2(1) = 0.15$, $\phi = -.03$, $p = .696$; b) $\chi^2(1) = 0.01$, $\phi = -.01$, $p = .925$
- Education: a) $\chi^2(3) = 4.78$, $V = .15$, $p = .188$; b) $\chi^2(3) = 4.23$, $V = .14$, $p = .238$
- SES:[51] **a) $F(1, 208) = 4.89$, $\eta_p^2 = 0.023$, $p = .028$**; b) $F(1, 208) = 2.56$, $\eta_p^2 = 0.01$, $p = .111$
- State of residence: a) $\chi^2(20) = 30.25$, $V = .38$, $p = .066$; b) $\chi^2(20) = 24.16$, $V = .34$, $p = .235$
- Native language: a) $\chi^2(20) = 27.60$, $V = .36$, $p = .119$; b) $\chi^2(20) = 21.84$, $V = .32$, $p = .349$

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[50] Box's M-test: $p = .002$.

[51] Levene's test for SES: $p = .021$.

Table K1

Means and Standard Deviations of Alcohol Consumption, Unhealthy Diet, and Physical Inactivity in Study 4, Including the Whole Sample (N = 111, Left), or Only Participants Who Had Spent the Minimum Time to Read the Respective Topic of the Health Message (N = 159, Right).

		T1		T2		T2-T1		T1		T2		T2-T1
	n	*M*	*SD*	*M*	*SD*	*ΔM*	*n*	*M*	*SD*	*M*	*SD*	*ΔM*
Alcohol[a]	211	4.66	7.99	5.15	8.72	0.49	159	4.33	6.81	4.98	8.86	0.65
risky[b]	43	16.40	10.66	15.09	13.21	-1.31	33	14.45	8.20	14.33	13.78	-0.12
not risky	168	1.65	2.66	2.60	4.44	0.95	126	1.67	2.69	2.53	4.64	0.86
SF	54	5.22	6.10	5.91	7.93	0.69	40	5.50	6.30	6.03	8.69	0.73
risky	17	12.47	5.21	11.52	9.71	-0.95	14	12.57	5.27	11.79	10.74	-0.78
not risky	37	1.89	2.55	3.32	5.21	1.43	26	1.69	2.09	2.92	5.42	1.23
S	47	4.70	7.20	4.32	7.26	-0.38	34	4.82	6.00	4.24	6.68	-0.58
risky	8	17.00	8.38	15.00	10.31	-2.00	7	14.14	2.41	12.43	7.89	-1.71
not risky	39	2.18	3.39	2.13	3.91	-0.05	27	2.41	3.87	2.11	4.41	-0.30
F	59	4.47	9.70	4.58	9.91	0.11	44	3.34	6.45	3.84	9.27	0.50
risky	9	21.00	16.91	18.11	19.27	-2.89	5	15.80	12.87	15.20	23.68	-0.60
not risky	50	1.50	2.35	2.14	3.97	0.64	39	1.74	2.57	2.38	4.36	0.64
C	51	4.24	8.43	5.76	9.40	1.52	41	3.83	8.19	5.80	10.18	1.97
risky	9	18.67	11.52	18.89	14.50	0.22	7	17.57	12.67	20.71	16.09	3.14
not risky	42	1.14	2.28	2.95	14.50	1.81	34	1.00	1.94	2.74	4.67	1.74
Unhealthy diet[c]	211	2.37	0.72	2.43	0.70	0.06	135	2.37	0.67	2.40	0.69	0.03
risky[d]	39	2.75	0.77	2.82	0.80	0.07	26	2.92	0.72	2.95	0.69	0.03
not risky	172	2.28	0.68	2.34	0.65	0.06	109	2.25	0.59	2.27	0.62	0.02
SF	54	2.30	0.78	2.38	0.73	0.08	31	2.30	0.67	2.35	0.67	0.05
risky	6	2.23	0.87	2.47	1.00	0.24	3	2.67	0.70	3.00	0.87	0.33
not risky	48	2.32	0.78	2.38	0.70	0.06	28	2.26	0.67	2.28	0.62	0.02
S	47	2.44	0.65	2.43	0.58	-0.01	28	2.56	0.59	2.47	0.61	-0.09
risky	9	2.87	0.73	2.82	0.76	-0.05	5	3.16	0.65	3.12	0.54	-0.04
not risky	38	2.34	0.60	2.33	0.50	-0.01	23	2.43	0.50	2.33	0.54	-0.10
F	59	2.37	0.66	2.43	0.67	0.06	40	2.31	0.65	2.36	0.73	0.04
risky	9	2.71	0.69	2.69	0.49	-0.02	8	2.75	0.72	2.75	0.49	0.00
not risky	50	2.31	0.64	2.39	0.70	0.08	32	2.19	0.59	2.26	0.75	0.07
C	51	2.36	0.77	2.46	0.82	0.10	36	2.37	0.75	2.44	0.73	0.07
risky	15	2.91	0.79	3.03	0.90	0.12	10	3.00	0.81	3.00	0.89	0.00
not risky	36	2.13	0.65	2.23	0.67	0.10	26	2.13	0.58	2.23	0.54	0.10
Inactivity[c]	211	3.52	0.84	3.49	0.84	0.12	83	3.57	0.88	3.57	0.82	0.00
risky[d]	39	3.81	0.78	3.86	0.85	0.04	19	4.02	0.90	3.96	0.79	-0.08
not risky	172	3.45	0.83	3.40	0.82	-0.05	64	3.44	0.83	3.46	0.80	0.02
SF	54	3.52	0.80	3.41	0.84	-0.11	16	3.44	0.97	3.31	1.09	-0.15
risky	6	3.78	0.66	3.83	1.01	0.05	1	5.00	--	5.00	--	0.00
not risky	48	3.49	0.81	3.36	0.81	-0.13	15	3.33	0.91	3.20	1.03	-0.13
S	47	3.53	0.89	3.30	0.86	-0.23	15	3.47	0.93	3.36	0.77	-0.11
risky	9	3.74	0.98	3.63	1.01	-0.11	5	3.67	1.11	3.47	0.90	-0.20
not risky	38	3.48	0.88	3.22	0.82	-0.46	10	3.37	0.88	3.30	0.74	-0.07
F	59	3.45	0.92	3.56	0.85	0.11	25	3.51	0.97	3.55	0.86	0.04
risky	9	3.96	0.81	3.96	0.75	0.00	6	4.06	0.95	4.00	0.79	-0.06
not risky	50	3.36	0.91	3.49	0.86	0.13	19	3.33	0.93	3.40	0.85	0.07
C	51	3.59	0.74	3.64	0.79	0.05	27	3.77	0.70	3.88	0.53	0.11
risky	15	3.78	0.73	3.96	0.80	0.18	7	4.10	0.76	4.14	0.63	0.04
not risky	36	3.51	0.74	3.51	0.75	0.00	20	3.65	0.66	3.78	0.47	0.13

Note. [a] Indicated in standard drink units, 1 unit ~ 0.33l of beer, 0.25l of wine, 0.02l of liquor; [b] Baseline alcohol consumption coded as "risky": > 3 (women) or > 4 (men) units/day, > 14 units/week (Alcohol Policy Team, Department of Health, 2016); [c] Potential range = 1-5, higher values indicate higher frequency of unhealthy behaviors; [d] Self-reported baseline health status coded as "risky" if two criteria applied out of: BMI ≥ 30, "poor overall health," "not at all athletic"; Experimental conditions: SF = self-affirmation & future orientation, S = self-affirmation, F = future orientation, C = control.

Table K2

Repeated-Measures ANOVA on Alcohol Consumption in Study 4, with S (Given, Not Given) and F (Given, Not Given) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects Factor, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 17 Seconds on the Health Message (n = 159).

	N = 211			n = 159		
	$F(1, 207)$	η_p^2	*p*	$F(1, 155)$	η_p^2	*p*
Time	1.52	0.01	.219	1.69	0.01	.196
S	0.06	<0.01	.802	0.64	<0.01	.424
F	0.07	<0.01	.791	<0.01	<0.01	.998
S x F	0.49	<0.01	.485	1.10	0.01	.297
Time x S	0.72	<0.01	.398	1.87	0.01	.174
Time x F	0.05	<0.01	.819	0.04	<0.01	.846
Time x S x F	2.53	0.01	.113	1.94	0.01	.165

Note. Box's *M*-test: *p* = .002; S = self-affirmation, F = future orientation.

Table K3

Multiple Linear Regression in Study 4, with Alcohol Consumption at T2 as Criterium, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 17 Seconds on the Health Message (n = 159).

		N = 211						n = 159				
Predictor	ΔR^2	*B*	SE_B	β	*t*	*p*	ΔR^2	*B*	SE_B	β	*t*	*p*
Step 1	.60						.57					
(Constant)		-5.36	0.38	-	<0.01	1.000		0.16	0.47	-	0.34	.733
T1 alc.		**0.84**	**0.05**	**0.77**	**17.58**	**<.001**		**0.98**	**0.07**	**0.75**	**14.30**	**<.001**
Step 2	< .01						.01					
(Constant)		0.98	1.69	-	0.58	.562		2.30	2.02	-	1.14	.255
T1 alc.		**0.85**	**0.05**	**0.77**	**17.53**	**<.001**		**0.99**	**0.07**	**0.76**	**14.33**	**<.001**
S		-0.48	0.77	-0.03	-0.63	.533		-1.18	0.94	-0.07	-1.25	.213
F		-0.18	0.77	-0.01	-0.23	.821		-0.27	0.93	-0.02	-0.29	.769
Step 3	.01						.01					
(Constant)		6.75	3.87	-	1.75	.083		8.11	4.62	-	1.76	.081
T1 alc.		**0.84**	**0.05**	**0.77**	**17.58**	**<.001**		**0.99**	**0.07**	**0.76**	**14.30**	**<.001**
S		-4.38	2.48	-0.25	-1.77	.078		-5.16	3.00	-0.29	-1.72	.088
F		-3.93	2.39	-0.23	-1.64	.102		-4.09	2.88	-0.23	-1.42	.158
S x F		2.54	1.53	0.32	1.66	.099		2.61	1.87	0.32	1.40	.164
Step 4	< .01						.01					
(Constant)		6.66	3.89	-	1.71	.088		7.57	4.65	-	1.63	.105
T1 alc.		**0.71**	**0.23**	**0.65**	**3.17**	**.002**		**0.88**	**0.27**	**0.68**	**3.26**	**.001**
S		-4.32	2.49	-0.25	-1.74	.084		-4.85	3.01	-0.27	-1.61	.110
F		-3.87	2.41	-0.22	-1.61	.109		-3.63	2.91	-0.21	-1.25	.214
S x F		2.50	1.54	0.31	1.62	.107		2.356	1.88	0.29	1.25	.212
S x T1 alc.		0.07	0.10	0.08	0.63	.529		-0.11	0.14	-0.12	-0.74	.462
F x T1 alc.		0.03	0.10	0.04	0.29	.775		0.17	0.14	0.20	1.22	.225
Step 5	< .01						< .01					
(Constant)		6.66	3.89	-	1.71	.089		7.54	4.67	-	1.61	.109
T1 alc.		0.80	0.48	0.73	1.66	.098		0.80	0.65	0.61	1.23	.221
S		-4.32	2.49	-0.25	-1.73	.085		-4.84	3.02	-0.27	-1.60	.112
F		-3.87	2.41	-0.22	-1.61	.110		-3.61	2.93	-0.20	-1.23	.219
S x F		2.49	1.55	0.31	1.61	.109		2.35	1.89	0.29	1.25	.215
S x T1 alc.		<0.01	0.33	<0.01	0.01	.996		-0.04	0.46	-0.05	-0.09	.925
F x T1 alc.		-0.03	0.30	-0.04	-0.10	.923		0.23	0.42	0.27	0.54	.591
S x F x T1 alc.		0.04	0.21	0.09	0.20	.839		-0.04	0.29	-0.08	-0.15	.885

Note. T1 alc. = baseline units of alcohol consumed in the past week, S = self-affirmation, F = future orientation.

Table K4

Repeated-Measures ANOVA on Alcohol Consumption in Study 4, with S (Given, Not Given), F (Given, Not Given), and Baseline Alcohol Intake (Risky, Not Risky) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects Factor, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 17 Seconds on the Health Message (n = 159).

	$N = 211$			$n = 159$		
	F(1, 203)	η_p^2	*p*	*F*(1, 151)	η_p^2	*p*
Time	**5.97**	**0.03**	**.015**	0.91	0.01	.341
S	**5.83**	**0.03**	**.017**	3.71	0.02	.056
F	0.59	< 0.01	.445	1.03	0.01	.312
Risky intake	**217.75**	**0.52**	**< .001**	**135.30**	**0.47**	**< .001**
S x F	1.10	0.01	.296	0.29	< 0.01	.591
S x Risky intake	**8.24**	**0.04**	**.005**	**4.89**	**0.03**	**.028**
F x T1 alc.	0.78	< 0.01	.379	1.27	0.01	.262
Time x S	0.11	< 0.01	.737	1.78	0.01	.185
Time x F	0.19	< 0.01	.664	0.24	< 0.01	.625
Time x Risky intake	**5.57**	**0.03**	**.019**	0.43	< 0.01	.503
Time x S x F	2.91	0.01	.090	2.25	0.02	.136
Time x S x Risky intake	0.04	< 0.01	.843	0.55	< 0.01	.460
Time x F x Risky intake	0.35	< 0.01	.555	0.45	< 0.01	.506
S x F x Risky intake	1.95	0.01	.164	0.37	< 0.01	.546
Time x S x F x Risky intake	0.14	< 0.01	.705	0.18	< 0.01	.674

Note. S = self-affirmation, F = future orientation, Risky intake = baseline alcohol consumption coded as "risky": > 3 (women) or > 4 (men) units/day, >14 units / week (Alcohol Policy Team, Department of Health, 2016).

Table K5

Separate Repeated-Measures ANOVAs on Alcohol Consumption for the Four Conditions in Study 4, with Baseline Alcohol Intake (Risky, Not Risky) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects Factor, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 17 Seconds on the Health Message (n = 159).

	$N = 211$				$n = 159$			
	df	*F*	η_p^2	*p*	*df*	*F*	η_p^2	*p*
SF (*n* = 54 → 40)								
Time	1, 52	0.09	< 0.01	.766	1, 38	0.05	< 0.01	.824
Risky intake	**1, 52**	**44.45**	**0.46**	**< .001**	**1, 38**	**33.33**	**0.47**	**< .001**
Time x Risky intake	1, 52	2.10	0.04	.154	1, 38	1.03	0.03	.316
S (*n* = 47 → 34)								
Time	1, 45	1.84	0.04	.181	1, 32	1.17	0.04	.288
Risky intake	**1, 45**	**59.93**	**0.57**	**< .001**	**1, 32**	**43.46**	**0.58**	**< .001**
Time x Risky intake	1, 45	1.66	0.04	.204	1, 32	0.58	0.02	.452
F (*n* = 59 → 44)								
Time	1, 57	1.10	0.02	.298	1, 42	< 0.01	< 0.01	.988
Risky intake	**1, 57**	**51.55**	**0.48**	**< .001**	**1, 42**	**21.29**	**0.34**	**< .001**
Time x Risky intake	1, 57	2.71	0.05	.105	1, 42	0.20	0.01	.658
C (*n* = 51 → 41)								
Time	1, 49	0.69	0.01	.409	1, 39	3.03	0.07	.090
Risky intake	**1, 49**	**74.36**	**0.60**	**< .001**	**1, 39**	**54.68**	**0.58**	**< .001**
Time x Risky intake	1, 49	0.42	< 0.01	.518	1, 39	0.52	< 0.01	.618

Note. Experimental conditions: SF = self-affirmation & future orientation, S = self-affirmation, F = future orientation, C = control; Risky intake = baseline alcohol consumption coded as "risky": > 3 (women) or > 4 (men) units/day, > 14 units/week (Alcohol Policy Team, Department of Health, 2016).

Table K6

Repeated-Measures ANOVA on Unhealthy Diet in Study 4, with S (Given, Not Given) and F (Given, Not Given) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects Factor, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 25 Seconds on the Health Message (n = 135).

	$N = 211$			$n = 135$		
	$F(1, 207)$	η_p^2	p	$F(1, 155)$	η_p^2	p
Time	3.44	0.02	.065	0.30	< 0.01	.583
S	0.04	< 0.01	.851	0.20	< 0.01	.652
F	0.26	< 0.01	.610	1.40	0.01	.238
S x F	0.16	< 0.01	.687	0.24	< 0.01	.626
Time x S	0.66	< 0.01	.418	1.21	0.01	.274
Time x F	0.05	< 0.01	.819	0.54	< 0.01	.465
Time x S x F	1.05	0.01	.306	1.07	0.01	.304

Note. S = self-affirmation, F = future orientation.

Table K7

Multiple Linear Regression in Study 4, with Unhealthy Diet at T2 as Criterium, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 25 Seconds on the Health Message (n = 135).

Predictor	ΔR^2	B	SE_B	β	t	p	ΔR^2	B	SE_B	β	t	p
		$N = 211$						$n = 135$				
Step 1	.64						.65					
(Constant)		4.85	0.03		<0.01	1.000		-0.03	0.04	-	-0.90	.372
T1 diet		**0.79**	**0.04**	**0.80**	**19.22**	**<.001**		**0.83**	**0.05**	**0.80**	**15.57**	**<.001**
Step 2	<.01						<.01					
(Constant)		0.05	0.13	-	0.39	.699		0.03	0.15	-	0.19	.852
T1 diet		**0.79**	**0.04**	**0.80**	**19.15**	**<.001**		**0.83**	**0.05**	**0.81**	**15.46**	**<.001**
S		-0.05	0.06	-0.03	-0.78	.439		-0.06	0.07	-0.05	-0.87	.384
F		0.01	0.06	0.01	0.19	.847		0.02	0.07	0.01	0.27	.788
Step 3	.01						<.01					
(Constant)		0.27	0.30	-	0.92	.358		0.30	0.35	-	0.84	.401
T1 diet		**0.79**	**0.04**	**0.80**	**19.15**	**<.001**		**0.83**	**0.05**	**0.81**	**15.47**	**<.001**
S		-0.20	0.19	-0.14	-1.04	.302		-0.25	0.23	-0.18	-1.08	.284
F		-0.13	0.18	-0.10	-0.73	.466		-0.16	0.22	-0.11	-0.71	.478
S x F		0.10	0.19	0.15	0.84	.404		0.12	0.14	0.19	0.85	.399
Step 4	<.01						<.01					
(Constant)		0.27	0.30	-	0.90	.371		0.27	0.36	-	0.77	.442
T1 diet		**0.95**	**0.17**	**0.96**	**5.61**	**<.001**		**0.62**	**0.22**	**0.61**	**2.87**	**.005**
S		-0.19	0.19	-0.14	-0.99	.322		-0.23	0.24	-0.17	-0.98	.332
F		-0.13	0.18	-0.09	-0.70	.483		-0.14	0.22	-0.10	-0.65	.518
S x F		0.09	0.12	0.15	0.79	.430		0.11	0.15	0.18	0.77	.442
S x T1 diet		-0.09	0.08	-0.14	-1.02	.309		0.01	0.11	0.02	0.13	.900
F x T1 diet		-0.02	0.08	-0.03	-0.24	.809		0.13	0.11	0.19	1.16	.249
Step 5	<.01						<.01					
(Constant)		0.26	0.30	-	0.89	.376		0.29	0.36	-	0.82	.413
T1 diet		**1.14**	**0.41**	**1.16**	**2.76**	**.006**		0.23	0.52	0.22	0.44	.660
S		-0.19	0.19	-0.13	-0.98	.330		-0.25	0.24	-0.18	-1.06	.293
F		-0.13	0.19	-0.09	-0.70	.487		-0.15	0.22	-0.11	-0.67	.503
S x F		0.09	0.12	0.14	0.78	.436		0.12	0.15	0.19	0.82	.413
S x T1 diet		-0.22	0.27	-0.35	-0.80	.425		0.30	0.36	0.44	0.84	.403
F x T1 diet		-0.15	0.26	-0.24	-0.56	.574		0.39	0.33	0.60	1.18	.241
S x F x T1diet		0.09	0.17	0.23	0.51	.609		-0.19	0.22	-0.44	-0.84	.402

Note. T1 diet = baseline unhealthy diet scores, S = self-affirmation, F = future orientation.

Table K8

Repeated-Measures ANOVA on Unhealthy Diet in Study 4, with S (Given, Not Given), F (Given, Not Given), and
Baseline Health Status (Risky, Not Risky) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects
Factor, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 25 Seconds on the
Health Message (n = 135).

	N = 211			n = 135		
	F(1, 203)	η_p^2	*p*	*F*(1, 131)	η_p^2	*p*
Time	2.32	0.01	.129	0.84	0.01	.362
S	0.44	< 0.01	.507	0.68	0.01	.412
F	1.46	0.01	.229	1.19	0.01	.278
T1 risky health	**11.75**	**0.55**	**.001**	**22.07**	**0.15**	**< .001**
S x F	0.01	< 0.01	.929	0.02	< 0.01	.904
S x T1 risky health	0.30	< 0.01	.585	1.19	0.01	.278
F x T1 risky health	0.03	< 0.01	.816	0.27	< 0.01	.605
Time x S	0.63	< 0.01	.427	0.13	< 0.01	.751
Time x F	1.67	0.01	.197	< 0.01	< 0.01	.971
Time x T1 risky health	3.81	0.02	.052	0.76	0.01	.386
Time x S x F	2.18	0.01	.141	1.62	0.01	.206
Time x S x T1risky health	0.40	< 0.01	.529	1.72	0.01	.192
Time x F x T1risky health	0.07	< 0.01	.798	0.54	< 0.01	.464
S x F x T1 risky health	0.02	< 0.01	.881	0.03	< 0.01	.868
Time x S x F x T1 risky health	1.03	0.01	.312	0.31	< 0.01	.582

Note. S = self-affirmation, F = future orientation, T1 risky health = self-rated baseline health status coded as
risky if two criteria applied out of: BMI ≥ 30, "poor overall health," "not at all athletic."

Table K9

Separate Repeated-Measures ANOVAs on Unhealthy Diet for the Four Conditions in Study 4, Including the
Whole Sample (N = 211), or Only Participants Who Had Spent at Least 25 Seconds on the Health Message (n =
135).

	N = 211				n = 135			
	df	*F*	η_p^2	*p*	*df*	*F*	η_p^2	*p*
SF (*n* = 54 → 31)	1, 53	1.46	0.03	.233	1, 30	0.49	0.02	.491
S (*n* = 47 → 28)	1, 46	0.05	< 0.01	.821	1, 27	1.56	0.06	.222
F (*n* = 59 → 40)	1, 58	1.26	0.02	.267	1, 39	0.60	0.02	.445
C (*n* = 51 → 36)	1, 50	2.18	0.04	.147	1, 35	0.67	0.02	.420

Note. Experimental conditions: SF = self-affirmation & future orientation, S = self-affirmation, F = future
orientation, C = control.

Table K10

Repeated-Measures ANOVA on Physical Inactivity in Study 4, with S (Given, Not Given) and F (Given, Not Given) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects Factor, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 50 Seconds on the Health Message (n = 83).

	$N = 211$			$n = 83$		
	$F(1, 207)$	η_p^2	*p*	$F(1, 155)$	η_p^2	*p*
Time	0.99	0.01	.321	0.07	< 0.01	.787
S	1.20	0.01	.275	2.57	0.03	.113
F	0.08	< 0.01	.776	0.89	0.01	.349
S x F	0.53	< 0.01	.468	0.54	0.01	.463
Time x S	**8.06**	**0.04**	**.005**	1.52	0.02	.221
Time x F	0.53	< 0.01	.468	0.54	0.01	.463
Time x S x F	0.15	< 0.01	.699	0.03	< 0.01	.856

Note. S = self-affirmation, F = future orientation.

Table K11

Multiple Linear Regression in Study 4, with Physical Inactivity at T2 as Criterium, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 50 Seconds on the Health Message (n = 83).

	$N = 211$						$n = 83$					
Predictor	ΔR^2	*B*	SE_B	β	*t*	*p*	ΔR^2	*B*	SE_B	β	*t*	*p*
Step 1	.51						.46					
(Constant)		2.91	0.04	-	< .01	1.000		0.06	0.07	-	.85	.396
T1 inact.		**0.72**	**0.05**	**0.71**	**14.68**	**<.001**		**0.64**	**0.08**	**0.68**	**8.28**	**<.001**
Step 2	.02						.03					
(Constant)		0.26	0.18	-	1.46	.146		**0.60**	**0.28**	**-**	**2.14**	**.035**
T1 inact.		**0.72**	**0.05**	**0.72**	**14.99**	**<.001**		**0.61**	**0.08**	**0.65**	**8.03**	**<.001**
S		-0.24	0.08	-0.14	-3.01	.003		-0.26	0.14	-0.16	-1.93	.057
F		0.07	0.08	0.04	0.81	.417		-0.12	0.13	-0.07	-0.88	.381
Step 3	< .01						< .01					
(Constant)		0.49	0.41	-	1.20	.230		0.90	0.63	-	1.42	.159
T1 inact.		**0.72**	**0.05**	**0.71**	**14.93**	**<.001**		**0.61**	**0.08**	**0.65**	**7.94**	**<.001**
S		-0.40	0.26	-0.24	-1.53	.127		-0.49	0.44	-0.29	-1.11	.269
F		-0.09	0.25	-0.05	-0.34	.734		-0.32	0.40	-0.20	-0.80	.429
S x F		0.10	0.16	0.13	0.63	.527		0.15	0.27	0.19	0.54	.594
Step 4	.01						.06					
(Constant)		0.51	0.41	-	1.27	.206		1.19	0.61	-	1.94	.056
T1 inact.		**0.57**	**0.23**	**0.57**	**2.48**	**.014**		-0.28	0.34	-0.30	-0.82	.416
S		-0.41	0.26	-0.25	-1.59	.114		-0.63	0.42	-0.37	-1.51	.135
F		-0.10	0.25	-0.06	-0.42	.678		-0.48	0.39	-0.29	-1.24	.219
S x F		0.11	0.16	0.15	0.70	.486		0.23	0.26	0.30	0.89	.376
S x T1 inact.		0.14	0.10	0.22	1.45	.149		**0.48**	**0.15**	**0.77**	**3.24**	**.002**
F x T1 inact.		-0.04	0.10	-0.07	-0.43	.668		0.13	0.15	0.23	0.87	.389
Step 5	< .01						.01					
(Constant)		0.51	0.41		1.24	.215		1.09	0.61	-	1.79	.078
T1 inact.		0.87	0.52	0.87	1.68	.095		0.70	0.77	0.75	0.92	.361
S		-0.41	0.26	-0.24	-1.57	.119		-0.60	0.42	-0.35	-1.43	.157
F		-0.10	0.25	-0.06	-0.41	.686		-0.44	0.38	-0.27	-1.14	.260
S x F		0.11	0.16	0.14	0.69	.493		0.22	0.26	0.28	0.85	.400
S x T1 inact.		-0.06	0.32	-0.09	-0.17	.864		-0.20	0.49	-0.31	-0.39	.695
F x T1 inact.		-0.23	0.31	-0.38	-0.74	.458		-0.49	0.46	-0.86	-1.07	.289
S x F x T1 inact.		0.13	0.20	0.31	0.64	.522		0.43	0.30	1.12	1.43	.157

Note. T1 inact. = baseline physical inactivity scores, S = self-affirmation, F = future orientation.

Table K12

Repeated-Measures ANOVA on Physical Inactivity in Study 4, with S (Given, Not Given), F (Given, Not Given), and Baseline Health Status (Risky, Not Risky) as Between-Subjects Factors, and Time (T1, T2) as a Within-Subjects Factor, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 50 Seconds on the Health Message (n = 83).

	$N = 211$			$n = 83$		
	$F(1, 203)$	η_p^2	p	$F(1, 75)$	η_p^2	p
Time	0.08	< 0.01	.780	0.05	< 0.01	.829
S	0.75	< 0.01	.389	< 0.01	< 0.01	.948
F	0.12	< 0.01	.728	0.88	0.01	.351
T1 risky health	**7.94**	**0.04**	**.005**	**9.38**	**0.11**	**.003**
S x F	2.50	0.01	.115	0.40	0.01	.530
S x T1 risky health	0.28	< 0.01	.601	< 0.01	< 0.01	.972
F x T1 risky health	0.64	< 0.01	.423	0.05	< 0.01	.823
Time x S	0.10	< 0.01	.755	3.34	0.04	.072
Time x F	0.11	< 0.01	.746	0.84	0.01	.363
Time x T1 risky health	0.17	< 0.01	.682	3.16	0.04	.080
Time x S x F	0.55	< 0.01	.458	0.10	< 0.01	.752
Time x S x T1 risky health	0.34	< 0.01	.560	0.05	< 0.01	.823
Time x F x T1 risky health	0.33	< 0.01	.568	0.06	< 0.01	.811
S x F x T1 risky health	0.05	< 0.01	.820	1.58	0.02	.213
Time x S x F x T1 risky health	0.54	< 0.01	.465	0.12	< 0.01	.746

Note. S = self-affirmation, F = future orientation, T1 risky health = self-rated baseline health status coded as risky if two criteria applied out of: BMI ≥ 30, "poor overall health," "not at all athletic."

Table K13

Separate Repeated-Measures ANOVAs on Physical Inactivity for the Four Conditions in Study 4, Including the Whole Sample (N = 211), or Only Participants Who Had Spent at Least 50 Seconds on the Health Message (n = 183).

	$N = 211$				$n = 83$			
	df	F	η_p^2	p	df	F	η_p^2	p
SF ($n = 54 \rightarrow 16$)	1, 53	1.87	0.03	.177	1, 15	1.55	0.09	.232
S ($n = 47 \rightarrow 15$)	**1, 46**	**8.34**	**0.15**	**.006**	1, 14	0.66	0.05	.430
F ($n = 59 \rightarrow 25$)	1, 58	1.24	0.02	.271	1, 24	0.04	< 0.01	.839
C ($n = 51 \rightarrow 27$)	1, 50	0.36	0.01	.549	1, 26	1.00	0.04	.327

Note. Experimental conditions: SF = self-affirmation & future orientation, S = self-affirmation, F = future orientation, C = control.