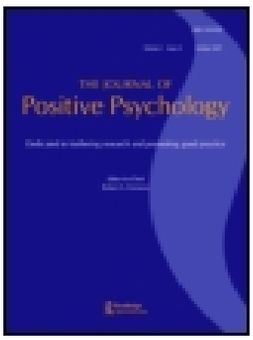

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The subjective quality of episodic future thought and the experience of meaning in life

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ABSTRACT

Two studies assessed whether mentally simulating specific future events to occur in familiar (vs. unfamiliar) settings indirectly increases meaning life via the subjective quality of the simulations. Participants in both studies (N = 344) were randomly assigned to visualize themselves doing something in familiar (e.g. home) or unfamiliar (e.g. fantasy world) settings in the future. They then rated the subjective quality of these visualizations and completed a measure of meaning in life. We replicated previous findings by showing that mental simulations involving familiar settings were of greater subjective quality than simulations involving unfamiliar settings. However, we also found that simulating future events in familiar (vs. unfamiliar) settings indirectly increased the perceived meaningfulness of life. These findings integrate research in cognitive psychology with research on the psychology of well-being and reveal how mental time travel contributes to the perception that one's life has meaning.

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Meaning; mental simulation; episodic thought; existential meaning; mental time travel

The capacity to mentally travel through time, to re-experience past events and pre-experience hypothetical events that have to occur, is one of humans' greatest capacities. It allows for such important behaviors as learning, planning, coordination with others, and goal pursuit. Mental time travel also helps people address significant psychological needs. For example, mental time travel aids in the creation of a stable sense of personal identity (Singer, 2004) and allows people to derive psychological comfort from positive moments in the past (Sedikides, Wildschut, Arndt, & Routledge, 2008). The mental processes that underlie mental time travel also play a prominent role in the construction of meaning in life, a central aspect of psychological well-being (Steger, 2012). In particular, when people are instructed to simulate past and future events, they tend to simulate highly meaningful events that in turn increase the global perception that life is meaningful overall (Waytz, Hershfield, & Tamir, 2015). In the present research, we further explored how mental time travel contributes to meaning in life by focusing on the subjective quality (e.g. vividness) of episodic future simulations. Previous research indicates that simulations involving familiar settings (e.g. one's home) are of a higher subjective quality than simulations involving unfamiliar settings (e.g. the North Pole). This effect is attributed to the fact that simulating events to occur in familiar settings draws upon richer information stored in memory (Szpunar & McDermott, 2008). Based on suggestive evidence that the vividness of mental simulations may be critical for their effect on meaning (Waytz et al., 2015), we hypothesized that simulating events in familiar vs. unfamiliar settings would impact meaning in life via their heightened subjective quality.

Mental time travel and the subjective quality of episodic future thought

The simulation of self-relevant future events (i.e. episodic future thought; Szpunar, 2010) is a facet of mental time travel, a process commonly attributed to Tulving's (1985) theorizing on episodic memory. Tulving and colleagues (e.g. Wheeler, Stuss, & Tulving, 1997) argued that a memory system attuned to the recollection of personal events underlies people's awareness of themselves across time and allows them to subjectively re-experience personal memories and pre-experience imagined future events that have yet to occur. Consistent with these ideas, recalling personal events from the past and simulating personal

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events that might happen in the future activate overlapping neural systems (Schacter, Addis, & Buckner, 2008). Likewise, information stored in memory directly contributes to the subjective quality of episodic future simulations. For instance, Szpunar and McDermott (2008) asked undergraduates to imagine future events occurring in recently (e.g. university campus) and distally (e.g. high school) experienced settings. These settings were selected because memories for recently experienced contexts are typically associated with greater detail than distally experienced ones. Consistent with the view that simulations of personal future events draw upon memories of the past, participants rated simulations of the future involving recently (vs. distally) experienced contexts as being higher in subjective quality. They were more vivid, more detailed, and more likely to foster the feeling of actually 'experiencing' the event that was simulated.

These differences in subjective quality carry important implications. For example, forming vivid mental images of future interactions with outgroup members mitigates intergroup anxiety and increases intentions to interact with outgroup members (Husnu & Crisp, 2010). Similarly, simulations focused on helping another person in the future increase actual willingness to help and this effect is mediated by the subjective quality of the simulations (Gaesser & Schacter, 2014). Moreover, the capacity to vividly imagine future positive events is negatively linked to depression and anxiety (Morina, Deeprose, Pusowski, Schmid, & Holmes, 2011), and is positively linked to optimism (Blackwell et al., 2013), a variable with significance for psychological and physical health (Scheier & Carver, 1992). These findings suggest that the subjective quality of episodic future simulations is not just a trivial by-product of mental processes but instead has significant psychological implications.

The subjective quality of episodic simulations and meaning in life

We propose that being able to subjectively 'pre-experience' personal future events vividly in one's mind also makes life feel more meaningful. Meaning in life is conceptualized as the degree to which people perceive that their lives have coherence, purpose, and significance (Heintzelman & King, 2014). It is a central facet of mental and physical well-being (Steger, 2012). Suggestive evidence already supports the idea that mental time travel plays a role in the meaning making process. For example, feeling nostalgic for the past (Routledge et al., 2011), thinking about how a past event could have turned out differently (Kray et al., 2010), maintaining future goals (McGregor & Little, 1998), and feeling hopeful about the future (Feldman & Snyder, 2005) are all positively linked to meaning. Likewise, Baumeister, Vohs, Aaker, and Garbinsky (2013) found that the self-reported frequency of thinking about the past and the future positively predicted meaning in life, whereas the frequency of being focused on the present was unrelated to meaning. More direct support for the role of episodic simulations, however, comes from recent research by Waytz and colleagues (2015) focused on the link between mental simulations and meaning in life.

Using a variety of methods, Waytz et al. (2015) demonstrated that mental simulations, especially those that are detailed and vivid, positively contribute to the experience of meaning in life. First, they reported evidence that self-reported meaning in life is positively correlated with neural activation in the medial temporal lobes subsystem of the 'default mode network.' The medial temporal lobes are notably associated with *vivid* and *detailed* episodic simulations (Addis, Cheng, Roberts, & Schacter, 2011; for a review, Szpunar, 2010), suggesting that the vividness of simulations may be especially important to a sense of meaning in life. Waytz and colleagues also demonstrated that instructing people to recall a past event and to imagine a future event in a *detailed* fashion increased meaning relative to instructing participants to recall a past event and to imagine a future event in a 'gist' based fashion. Although Waytz et al. (2015) did not directly assess subjective qualities of the mental simulations, the positive correlation between meaning in life and medial temporal lobes activation, and the expermental effect of a detail (vs. gist) oriented simulation, both provide suggestive evidence that the subjective vividness of mental simulations may impact the perceived meaningfulness of people's lives.

The present research

The purpose of the present research was to extend the understanding of how episodic simulations affect meaning in life by focusing specifically on the enhanced subjective quality of episodic future simulations involving familiar (vs. unfamiliar) settings. In some ways, it seems surprising that no research has considered how subjective simulation quality affects meaning in life. After all, the ability to vividly and clearly project one's self into the future and subjectively pre-experience future events would seem to be intricately tethered to the subjective sense that one's life is traversing along a coherent and purposeful (i.e. meaningful) path. Thus, by examining how the differences in subjective simulation quality that result from familiar vs. unfamiliar simulations (Szpunar & McDermott, 2008) affect meaning, we sought to elucidate a previously unexamined process through which mental simulations of future personal events contribute to meaning in life.

To do so, we utilized established paradigms for inducing differences in the subjective quality of episodic future

thought. Participants imagined themselves in familiar or unfamiliar settings, rated the subjective quality of these visualizations, and reported on the perceived meaningfulness of their lives. Because the subjective quality of episodic simulations depends on information stored in memory, we expected to replicate previous research showing that episodic simulations focused on familiar (vs. unfamiliar) settings are higher in subjective quality (Szpunar & McDermott, 2008). However, we made the novel prediction that this enhanced subjective quality would, in turn, positively contribute to meaning in life. It is important to note that, because this is an indirect approach to inducing differences in subjective episodic simulation quality, our predictions focused specifically on the anticipated *indirect* effect of simulating events in familiar (vs. unfamiliar) settings through subjective quality. We did not have a clear prediction about a total (i.e. main) effect of setting familiarity on meaning in life, given the possibility of idiosyncratic effects that visualizing each setting could have. We therefore planned to test the indirect process model regardless of whether or not a total effect of the experimental manipulation on meaning in life was present. This is approach is consistent with contemporary recommendations for testing indirect effects.

Indeed, as described by Rucker, Preacher, Tormala, and Petty (2011), the likely presence of multiple indirect effects involving unmeasured variables can reduce the likelihood of observing a total effect of the independent variable on the dependent variable, even when a significant indirect effect involving a theoretically informed measured variable emerges. Rucker et al. offer several specific examples of situations where no total effect of the independent variable on the dependent variable is present, even though significant indirect effects exist. This is one reason why scholars have advocated dismissing the practice of requiring a total effect to test an indirect effect hypothesis (Hayes, 2009; Rucker et al., 2011; Zhao, Lynch, & Chen, 2010). As Rucker et al. (2011) note, 'if there are theoretical reasons to predict the presence of an indirect effect, or multiple indirect effects, researchers should explore these effects regardless of the significance of the total or direct effect' (p. 368). This is certainly the case in the present research. Previous studies have shown that meaning in life correlates with neural activation in brain networks associated with *vivid* temporal simulations and forming detailed (vs. gist based) simulations enhances meaning in life (Waytz et al., 2015). These findings provide sound rationale for predicting that the simulation of future personal events to occur in familiar (vs. unfamiliar) settings may increase meaning life via their enhanced subjective quality (e.g. vividness). However, this prediction is an indirect effect hypothesis that does not require a total (i.e. main) effect of familiarity on judgments of meaning in life. Evidence supporting this indirect effect hypothesis would therefore suggest a causal process by which familiar episodic simulations increase meaning in life via their heightened subjective quality (cf. Hayes, 2009).

Study 1

Methods

Participants

We targeted an on-line sample of 200 participants with a plan to terminate data collection once this sample size had been achieved. Power analyses indicated that this sample size was two times larger than what would be needed to achieve power of .80 based on the smallest published effect size for the experimental condition effect on simulation quality ($d = .53$; Szpunar & McDermott, 2008). It was also 69% larger than what would be needed to reliably detect an average sized effect in social and personality psychology, $r = .21$ (Funder et al., 2014). Given the robustness of bootstrapping techniques for testing indirect effects models (Hayes, 2009), we deemed this sample size appropriate for a test of our indirect effect hypothesis.

We recruited adults ($N = 201$; 101 females, 99 males, 1 unreported) living in the United States from MTurk (Buhrmester, Kwang, & Gosling, 2011) and compensated them with $0.40. Participants ranged in age from 18 to 68 years old ($M = 34.42$, SD = 11.88) and were predominantly Caucasian (78.1%; Multiple-Races, 5.5%; African-American, 5.0%; Asian, 4.5%; all other races >3.0%). Nine participants were excluded because they gave an incorrect response to an attention check question and 15 participants were excluded for not following directions on the mental simulation task. We excluded these participants based on an a priori decision to exclude participants who failed to meet these criteria, but including them does not alter the results. One-hundred seventy-seven participants were included in our analyses, a sample size that still exceeded what would be needed to reliably detect effects.

Procedure and materials

An advertisement posted in MTurk described the study as focused on personality traits and imagination. Participants accessed the study by following an external survey link and completed the materials described below.

Mental simulation manipulation. After completing two filler measures, participants were randomly assigned to conditions of a mental simulation task modeled after previous research (Szpunar & McDermott, 2008). This task required participants to form two visualizations of themselves doing something in the future. For each visualization, participants were prompted with a distinct setting to visualize themselves in. The prompt

read 'Visualize yourself in the future doing something _____.' Participants in the *familiar setting* condition were instructed to visualize themselves in 'YOUR HOME' and in 'YOUR NEIGHBORHOOD.' Participants in the *unfamiliar setting* condition were instructed to visualize themselves on 'A FARAWAY PLANET' and in 'A REMOTE and UNEXPLORED JUNGLE.' Each prompt indicated that participants would have 30 s to form their visualization and that the survey would automatically advance after 30 s (participants could not advance on their own).

Quality of the simulations. Immediately after forming each visualization, participants responded to questions developed to assess its subjective quality. Four 'sensory detail' items assessed whether the visualization involved visual detail, sound, smell, and taste on 1 (*little to none*) to 7 (*a lot*) scales. Three 'clarity of context' items assessed the subjective clarity of the location, arrangement of objects, and arrangement of people in the visualization on 1 (*vague*) to 7 (*clear*) scales. Two 'subjective experience' items assessed participants' feeling of 'really experiencing' the visualized event and 'travelling forward to the time when it would happen' on 1 (*disagree strongly*) to 7 (*agree strongly*) scales. These items were taken directly from research on the phenomenology episodic simulations (D'Argembeau & Van der Linden, 2004, 2006; Szpunar & McDermott, 2008) and responses were averaged to create a single 'subjective quality' composite (M = 4.42, SD = 1.03, α = .90).

Imagination and fun. Participants also indicated how strongly they agreed that imagination was required for each visualization (M = 4.07, SD = 1.63) and that forming each visualization was fun (M = 5.35, SD = 1.42) on 1 (*disagree strongly*) to 7 (*agree strongly*) scales. These items were included to account for potential differences in imagination and enjoyment between the conditions.

Meaning in life. Finally, participants completed the presence of meaning in life subscale of the Meaning in Life Questionnaire (Steger, Frazier, Oishi, & Kaler, 2006). This instrument assesses the presence of meaning in life by asking participants to indicate how true 5 statements (e.g. 'I understand my life's meaning') are of them on 1 (*absolutely untrue*) to 7 (*absolute true*) scales. Responses were averaged to create a meaning in life composite (M = 4.61, SD = 1.48, α = .92).[1]

Results

Primary analyses

Consistent with previous research (Szpunar & McDermott, 2008), participants who visualized themselves in familiar settings reported that their visualizations were of greater subjective quality (M = 4.64, SD = .98) than participants who visualized themselves in unfamiliar settings (M = 4.20, SD = 1.03), $t(175) = 2.87$, $p = .005$, 95% CI: .14/.73, $d = .44$. In contrast, meaning in life did not differ between the familiar setting (M = 4.52, SD = 1.51) and unfamiliar setting (M = 4.70, SD = 1.46) conditions, $t(175) = .83$, $p = .407$, 95% CI: −.63/.26, $d = -.12$. However, and in line with our hypotheses, the subjective quality of participants' visualizations positively predicted meaning in life, $r = .24$, $p < .001$ (this association did not differ between visualization conditions). We thus tested our primary hypothesis that visualizing familiar (vs. unfamiliar) settings would have a positive indirect effect on meaning in life through the subjective quality of the visualizations.

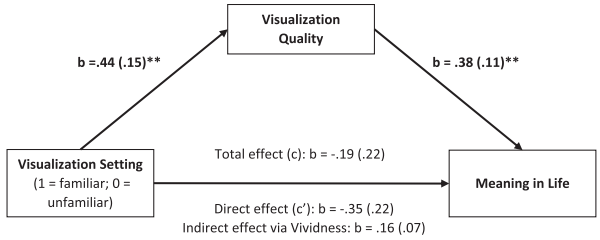

Figure 1. Significant indirect effect via visualization quality (lower/upper confidence intervals = .0533/.3409).
Note: *$p < .05$; **$p < .01$.

We utilized the PROCESS (Hayes, 2013) macro for SPSS to test our hypothesized indirect effects model. Visualization setting condition was entered as the independent variable, visualization quality was entered as the mediator, and meaning in life was entered as the dependent variable. As seen in Figure 1, support for the indirect effect of visualization condition on meaning in life through visualization quality was obtained. This provides evidence a causal process (Hayes, 2009) by which simulations of events to occur in familiar (vs. unfamiliar) settings increased perceptions of meaning in life through subjective simulation quality. Calculation of the Kappa Squared effect size estimate (Preacher & Kelley, 2011) suggests that this effect is in the nominally small to medium range, $\kappa^2 = .06$ (95% CI: .02/.12).

Ancillary analyses

We also assessed whether indirect effects occurred through participants' ratings of how much imagination was required to form their visualizations and how fun it was to do so. Less imagination was required to visualize familiar (vs. unfamiliar) settings, $t(175) = 2.57$, $p = .011$, 95% CI: −1.08/−.14, $d = -.38$, but imagination did not predict visualization quality ($r = .07$, $p = .367$) or meaning in life ($r = .05$, $p = .516$). In contrast, while perceptions of fun were positively associated with visualization quality ($r = .66$, $p < .001$) and meaning in life ($r = .24$, $p = .001$),

there was no effect of visualization setting condition on perceived fun, $t(175) = .45$, $p = .657$, 95% CI: −.52/.33, $d = -.07$. This suggests that imagination and perceived fun cannot mediate the effect of visualization condition on meaning in life. The indirect effect of visualization setting on meaning in life through subjective simulation quality remains significant when perceptions of fun are statistically controlled, $b = .14$ (.07), lower/upper confidence intervals = .0241/.3248.

Discussion

Simulations in familiar (vs. unfamiliar) settings were higher in subjective quality, which, in turn, led to enhanced meaning. These results provide evidence that the subjective quality of episodic future thoughts plays a significant role in shaping feelings of meaning in life.

Study 2

We conducted Study 2 to replicate these results and address additional issues. First, we considered the possibility that self-continuity (Sani, 2010) – the feeling that one's identity is consistent across time – might link the subjective quality of episodic future thoughts to meaning in life. The subjective quality of episodic future thought is enhanced when a simulation draws upon rich information stored in memory (Szpunar & McDermott, 2008). Because this process mentally links personal events in the future to personal events in the past, we hypothesized that episodic simulations involving familiar settings would be both higher in subjective quality and elicit stronger feelings of self-continuity. We also predicted that feelings of self-continuity and episodic simulation quality would shape perceptions of meaning in life. We tested this possibility formally in Study 2 to provide more insight into the processes by which episodic simulations affect meaning. In addition to considering self-continuity, however, we also assessed whether feelings of being loved by others account for the effects observed in Study 1. The feeling of being loved is a less theoretically informed variable in this context, but its inclusion in Study 2 was based on the fact that familiar settings (e.g. neighborhood) likely contain more 'social' elements than unfamiliar ones (e.g. a faraway planet), and because connectedness to others can mediate the effect of temporal thought on meaning in life (Routledge et al., 2011). Assessing the feeling of being loved by others thus allowed us to account for its potential influence. Finally, we assessed whether the primary indirect effect model observed in Study 1 could be accounted for by other variables linked to meaning in life (e.g. affect, self-esteem, optimism). Our primary analyses once again centered on a predicted indirect effect of simulating future events in familiar (vs. unfamiliar) settings on meaning in life through subjective simulation quality.

Methods

Participants

Introductory psychology students ($N = 167$; 92 females, 75 males) participated for course credit. Participants ranged in age from 18 to 51 years old ($M = 21.07$, SD = 4.84) and were predominantly Caucasian (86.2%; Multiple-Races, 5.4%; all other races >3.0%). Based on the effect sizes observed in Study 1, we estimated that a sample size of 150 participants would exceed the sample size needed to reliably detect the anticipated effects at power equals .80.

Procedure and materials

Participants (1–3 per session) arrived to the lab, were given a description of the study, and were ushered into private computer cubicles where they completed the materials (described below).

Mental simulation manipulation. After completing two filler measures, participants were randomly assigned to conditions of the mental simulation task utilized in Study 1. Three changes to the task were implemented. First, participants visualized themselves in three separate settings (vs. 2 settings in Study 1). *Familiar setting* participants visualized themselves in their home, a friend's home, and their neighborhood. *Unfamiliar setting* participants visualized themselves on a faraway planet, at the North Pole, and in a fantasy world. Participants spent 45 s forming each visualization and, after 45 s had elapsed, were instructed to type 'a few sentences' to describe the mental image that they formed. These changes were implemented to encourage participants to 'really get into' the visualization task.

Quality of the simulations. Participants responded to the visualization quality questions utilized in Study 1. We again averaged responses to create a single 'subjective quality' composite ($M = 4.48$, SD = .72, $\alpha = .87$).

Imagination and fun. Participants also indicated how strongly they agreed that imagination was required for each visualization ($M = 2.84$, SD = 1.04) and that forming each visualization was fun ($M = 4.03$, SD = .86) on 1 (*disagree strongly*) to 7 (*agree strongly*) scales.

Positive psychological functioning questionnaire. Next, participants completed a questionnaire described as an assessment of a 'variety of feelings that may or may not have been triggered by [their] visualizations.' The questionnaire contained several filler/distractor items

(e.g. 'I feel philosophical,' 'I feel tired') and items specifically included to assess constructs relevant to our hypotheses. We created this questionnaire so that we could present items measuring closely related constructs (e.g. self-continuity, self-esteem, affect) randomly to participants, thereby reducing the likelihood that participants would become suspicious of any one type of question. The meaning in life items were presented immediately after the simulation manipulation because meaning in life was our primary dependent variable. All other items were presented randomly. Participants indicated their agreement with each statement on 1 (*strongly disagree*) to 8 (*strongly agree*) scales.

Meaning in life. Four items assessed perceptions of meaning in life: 'I feel life is meaningful,' 'I feel life has a purpose,' 'I feel there is a greater purpose to life,' and 'I feel life is worth living.' Responses were averaged (M = 6.89, SD = 1.20, α = .81).

Self-continuity. Four items assessed perceptions of self-continuity: 'I feel connected with my past,' 'I feel connected with who I was in the past,' 'I feel there is continuity in my life,' and 'I feel important aspects of my personality remain the same across time.' Responses were averaged (M = 5.85, SD = 1.52, α = .81).

Affect. Four items assessed affect: 'I feel happy,' 'I feel in a good mood,' 'I feel unhappy,' and 'I feel sad.' Responses to the negative affect items were reverse scored and all responses were averaged (M = 6.87, SD = 1.05, α = .83).

Optimism. Four items assessed optimism about the future: 'I feel ready to take on new challenges,' 'I feel optimistic about my future,' 'I feel like the sky is the limit,' and 'I feel hopeful about my future.' Responses were averaged (M = 6.60, SD = 1.19, α = .86).

Self-esteem. Four items assessed self-esteem: 'I feel good about myself,' 'I feel like I like myself better,' 'I feel like I value myself more,' and 'I feel I have many positive qualities.' Responses were averaged (M = 5.97, SD = 1.27, α = .85).

Feeling loved by others. Two items assessed feelings of being loved: 'I feel connected to loved ones' and 'I feel loved.' Responses were averaged (M = 6.54, SD = 1.53, r = .69).

Presence of meaning. Finally, immediately after the positive psychological functioning questionnaire, we included the 5-item presence of meaning in life measure (Steger et al., 2006) utilized in Study 1 (M = 4.80, SD = 1.30, α = .85). Due to its immediate proximity to the simulation manipulation, our primary analyses focused on the meaning in life measure contained within the broader positive psychological functioning questionnaire. However, including the Steger et al. (2006) measure allowed us to also conduct a more direct replication of the Study 1 findings.

Results

Primary analyses

Replicating study 1. We first sought to replicate the results of Study 1 using the meaning in life measure presented immediately after the simulation manipulation. Consistent with Study 1, participants who visualized themselves in familiar settings reported that their visualizations were of greater quality (M = 4.65, SD = .78) than participants who visualized themselves in unfamiliar settings (M = 4.33, SD = .64), t(165) = 2.90, p = .004, 95% CI: .10/.53, d = .45. In contrast, meaning in life did not differ between the familiar setting (M = 7.05, SD = .99) and unfamiliar setting (M = 6.74, SD = 1.35) conditions, t(155.72) = 1.70, p = .091, 95% CI: −.05/.67, d = .26. The quality of participants' visualizations was, however, positively correlated with meaning in life, r = .35, p < .001 (this association did not differ between visualization conditions).

We thus tested the same indirect effects model that emerged in Study 1 (cf. Figure 1). Visualization setting condition positively impacted visualization quality (i.e. the a path; b = .32, p = .004), visualization quality positively predicted meaning in life (i.e. the b path; b = .56, p < .001), but visualization setting condition had no direct effect on meaning in life (i.e. the c path; b = .13, p = .463). The indirect effect of visualization setting on meaning in life via visualization quality was significant [lower/upper bias corrected 95% confidence intervals = .07/.33; κ^2 = .08 (95% CI: .03/.14].

Self-continuity. We also conducted an identical set of analyses on self-continuity to assess whether simulating familiar (vs. unfamiliar) future events increases the feeling of continuity in one's self across time. Visualizing familiar (M = 6.35, SD = 1.29), relative to unfamiliar (M = 5.39, SD = 1.57), settings increased self-continuity, t(161.80) = 4.34, p < .001, 95% CI: .52/1.40, d = .67. Self-continuity was positively associated with meaning in life (r = .32, p < .001). We therefore tested an indirect effect model that included visualization setting condition as the independent variable, meaning in life as the dependent variable, and self-continuity as the mediator. Visualization setting condition positively impacted self-continuity (i.e. the a path; b = .96, p < .001), self-continuity positively predicted meaning in life (i.e. the b path; b = .25, p < .001), but visualization setting condition had no direct effect on meaning in life (i.e. the c path; b = .07, p = .699). The indirect effect of visualization setting on meaning in life through self-continuity was significant (lower/upper bias corrected 95% confidence intervals = .12/.40), κ^2 = .10 (95% CI: .05/.16).

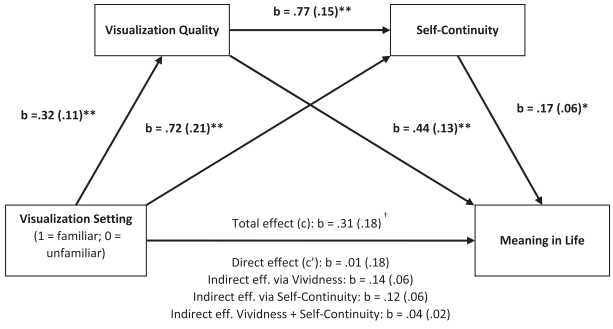

Figure 2. Significant indirect effects via visualization vividness (lower/upper confidence intervals = .0438/.2926), self-continuity (.0325/.2789), and the sequential path through both of these variables (.0118/.1124).
Note: †$p < .10$; *$p < .05$; **$p < .01$.

Multiple mediation: subjective quality and self-continuity. Given evidence for the indirect effects described above, we utilized PROCESS (Model 6) to test the multiple mediation model depicted in Figure 2. Visualization setting condition was entered as the independent variable, meaning in life was entered as the dependent variable, and both visualization quality and self-continuity were entered as mediators. The results of this analysis revealed three significant indirect paths through which visualization condition impacted meaning life. First, the indirect effects via visualization quality and self-continuity described above were both significant. In addition, there was a significant serial indirect effect of visualization condition on meaning in life through visualization quality and, in turn, self-continuity.

Ancillary analyses

To assess whether other variables might account for an indirect effect of simulation condition on meaning, we conducted a series of *t*-tests to determine which variables were significantly impacted by the visualization condition manipulation (see supplementary material). Only two significant effects emerged. Participants (as in Study 1) reported that visualizing themselves in familiar settings required less imagination than visualizing themselves in unfamiliar settings, $t(165) = 3.26$, $p = .001$, 95% CI: −.82/−.20, $d = -.50$, and participants reported that they felt more loved after visualizing themselves in familiar settings relative to unfamiliar ones, $t(165) = 1.98$, $p = .050$, 95% CI: .00/.93, $d = .31$. This latter effect is consistent with the fact that the familiar settings contained more 'socially relevant' elements than the unfamiliar settings. Of these two variables, however, only feelings of being loved positively predicted meaning in life ($r = .36$, $p < .001$).

To test whether feelings of being loved might account for the indirect effects reported above, we entered visualization quality, self-continuity, and feelings of being loved into a regression analysis predicting meaning in life. Including feelings of being loved [$b = .18$ (SE = .06), $t(163) = 2.74$, $p = .007$] in the model eliminated the relationship between self-continuity and meaning in life [$b = .09$ (SE = .07), $t(163) = 1.30$, $p = .194$], but the relationship between simulation quality and meaning in life remained significant [$b = .39$ (SE = .13), $t(163) = 3.00$, $p = .003$]. In fact, the relationship between simulation quality and meaning in life remained significant when controlling for each of the additional psychological functioning measures included in the study (e.g. positive affect, self-esteem; see supplementary materials). Not surprisingly, given these results, the indirect effects of visualization condition on meaning in life that pass through self-continuity were not significant when feelings of being loved were statistically controlled. The indirect effect of visualization condition on meaning in life through visualization quality, however, remained significant even when feelings of being loved were controlled (lower/upper bias corrected 95% confidence intervals = .02/.25). These results indicate that, while visualization condition affected feelings of being loved, they cannot account for the effect of visualization quality on meaning in life.

Because we asked participants in Study 2 to 'type a brief description' of their simulations, we were able to code simulation descriptions in terms of three constructs that could viably account for the relationship between simulation quality and meaning in life. Four independent coders evaluated each simulation description in terms of event profoundness to the participant (1 = not at all profound; 7 = very profound), event plausibility (1 = not at all plausible; 7 = very plausible), and event valence (1 = very negative; 7 = very positive). The coding procedure was modeled after those utilized in previous research on mental simulation and meaning in life (Waytz et al., 2015). The coders' evaluations were averaged into single composites for each construct (profoundness, $M = 3.92$, SD = .83, $\alpha = .77$; plausibility, $\alpha = .95$, $M = 4.51$, SD = 1.74; valence, $M = 4.72$, SD = .64, $\alpha = .76$). As might be expected, simulation quality was positively associated with event profoundness ($r = .19$, $p = .015$), event plausibility ($r = .27$, $p < .001$), and event valence ($r = .26$, $p < .001$). We therefore tested, via a regression analysis, whether the relationship between simulation quality and meaning in life remained significant when these three variables were included as simultaneous predictors. The results supported the independent effect of simulation quality on meaning. Only simulation quality [$b = .54$ (SE = .13), $t(161) = 4.10$, $p < .001$] and event valence [$b = .42$ (SE = .15), $t(161) = 2.81$, $p = .006$] significantly predicted meaning in life in this regression model.

Finally, we conducted a direct replication of Study 1 using the Steger et al. (2006) meaning in life measure that participants completed after the broad positive

psychological functioning questionnaire. The primary results were replicated. Visualization setting condition positively impacted visualization quality (i.e. the a path; $b = .32$, $p = .004$), visualization quality positively predicted meaning in life (i.e. the *b* path; $b = .46$, $p < .001$), and visualization setting condition had no direct effect on meaning in life (i.e. the *c* path; $b = .34$, $p = .082$). Most critically, the indirect effect of visualization setting on meaning in life via visualization quality was significant, $b = .15$ (.05), lower/upper bias corrected 95% confidence intervals = .0581/.2739; $\kappa^{2=}.06$ (95% CI: .02/.11] (see supplementary materials).

Discussion

As in Study 1, visualizing future events in familiar (vs. unfamiliar) settings increased subjective visualization quality, which, in turn, led to enhanced meaning in life. Visualizing future events in familiar (vs. unfamiliar) settings also increased self-continuity, a notable finding given that self-continuity encompasses feelings of connectedness to past selves. In other words, imagining *future* events in familiar settings made people feel more connected to their *past*, a finding that supports the view that episodic future thought draws upon personal memories (Schacter et al., 2008). We also found that the enhanced self-continuity triggered by episodic future simulations contributed to heightened meaning in life and partially mediated the positive effect that visualization quality had on meaning in life. Finally, although episodic simulations focused on familiar (vs. unfamiliar) settings elicited greater feelings of being loved, the positive relationship between visualization quality and meaning in life remained significant when these feelings were controlled. Thus, Study 2 provides further evidence that the subjective quality of episodic future simulations plays an important role in the experience of meaning in life, over and above other variables known to affect meaning.

General discussion

The current research focused on the well-being implications of mentally simulating specific future events. Several lines of research have indicated that mental time travel plays a role in the meaning making process (e.g. Kray et al., 2010; Routledge et al., 2011), and Waytz and colleagues (2015) recently provided suggestive evidence that the vividness of mental simulations might be especially important. They reported a positive correlation between meaning in life and neural activation in brain systems known to be associated with *vivid* episodic simulations, and they demonstrated that inducing participants to simulate events in a detailed (vs. gist based) fashion increased meaning in life. These suggestive studies, however, did not directly assess the perceived subjective quality (e.g. vividness, clarity) of the simulations, leaving a potentially important process that links simulations to meaning in life unexamined. Does the subjective quality of an episodic future simulation contribute to meaning in life? We reasoned that the subjective experience of vividly 'pre-experiencing' events in one's mind should have a positive effect on meaning in life because it should fundamentally underlie the feeling that one's life is traversing along a coherent and purposeful path. Our findings provided initial support for this prediction. As expected, we replicated research showing that simulations focused on familiar (vs. unfamiliar) settings were higher in subjective quality (Szpunar & McDermott, 2008). However, we also found that simulating a familiar (vs. unfamiliar) event had a positive effect on meaning in life *through* this enhanced subjective simulation quality.

In this way, our findings add to research on the psychological consequences associated with the subjective quality of episodic thought by linking it to a central facet of well-being. Our results also critically build upon the finding that detailed mental simulations increase meaning in life relative to 'gist' oriented ones (Waytz et al., 2015). Of course, our studies took an indirect approach to tackling this issue by inducing people to simulate events in familiar or unfamiliar settings. This approach allowed us to build upon cognitive research indicating that information stored in memory contributes to the subjective quality of episodic simulations. We believe this is a notable contribution because, in many respects, our indirect approach is most similar to the types of simulations that people form in their daily lives. It is likely that people most frequently simulate events to occur in familiar places (e.g. simulating events to occur at work), and the present research suggests that doing so indirectly contributes to meaning in life through the enhanced subjective quality that familiar (vs. unfamiliar) simulations foster. This positive effect of simulating events in familiar (vs. unfamiliar) settings would have gone unnoticed, however, had we not assessed the indirect effect through subjective quality. Thus, our methodological approach and results allows for at least two notable contributions. They extend research on mental simulations and meaning in life, and they support the legitimacy of recent arguments for testing indirect effects in the absence of a total effect in order to enhance theoretical understandings of psychological processes (Rucker et al., 2011). At the same time, however, the lack of a total effect raises questions about the possibility of other intervening variables that could affect meaning in the opposite direction of simulation quality. For instance, the familiar condition may have led to a more concrete construal level (Trope & Liberman, 2010), which could have in turn led to lower levels of

meaning (given that meaning is often associated with more abstract ideals). More research will be needed to assess such possibilities.

Our results also suggest that a deeper consideration of how memory processes (i.e. the phenomenology of mental time travel) contribute to meaning in life could advance our understanding of the interface between cognition and subjective well-being. Deeper consideration of how psychological dysfunction associated with declines in cognitive capacities for mental time travel could be especially useful. For example, elderly adults show deficiencies in the quality of episodic future simulations, as do veterans suffering from Post-Traumatic Stress Disorder (Addis, Musicaro, Pan, & Schacter, 2010; Brown et al., 2014). Our findings suggest that these deficits may elicit declines in meaning in life and that cognitive interventions focused on enhancing the subjective quality of episodic simulations (Madore, Gaesser, & Schacter, 2014) might be especially effective at curtailing them. Moreover, a consideration of other variables (e.g. individual differences) that might influence the subjective quality of episodic simulations could provide useful information about how to enhance the well-being of vulnerable groups. Likewise, while previous work suggests that recalling past events (Routledge et al., 2011; Waytz et al., 2015) and simulating ways that past events could have turned out differently (Kray et al., 2010) can increase meaning in life, future research using episodic memory specific paradigms should test whether the subjective quality of episodic recall also contributes to enhanced meaning in life. Such research would help broaden our understanding of how subjective aspects of mental time travel, both forward and backward in time, contributes to subjective well-being.

Of course, while our findings supported our predictions, they only provided initial support for the implications described above. Future research will need to more fully examine the factors that affect the link between mental time travel and meaning in life, as well as carve out important distinctions between different types of mental time travel. For example, Szpunar, Spreng, and Schacter (2014) recently proposed a taxonomy of future-oriented thought that identifies different types of future thinking (e.g. planning, simulation) and specifies that future-oriented thought varies on a continuum ranging from purely episodic (personal) to purely semantic (abstract state of world). Future research might test whether the link between simulation quality and meaning in life only exists for episodic (vs. semantic) forms of prospection. As noted above, future research might also consider how the subjective quality of remembering episodic events in one's past impacts meaning in life. In addition, the lack of a no simulation control topic or a non-future simulation comparison condition limits present conclusions to the effect of familiar (vs. unfamiliar) future simulations on meaning via simulation quality. Regardless, while notable avenues of inquiry remain, the current studies provide an initial foundation for understanding how phenomenological aspects of projecting one's self (forward) in time contributes to the sense that life is meaningful.

Note

1. Participants also completed the search for meaning in life subscale. No significant effects emerged.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Addis, D. R., Cheng, T., Roberts, R. P., & Schacter, D. L. (2011). Hippocampal contributions to the episodic simulation of specific and general future events. *Hippocampus, 21*, 1045–1052. doi:10.1002/hipo.20870

Addis, D. R., Musicaro, R., Pan, L., & Schacter, D. L. (2010). Episodic simulation of past and future events in older adults: Evidence from an experimental recombination task. *Psychology and Aging, 25*, 369–376. doi:10.1037/a0017280

Baumeister, R. F., Vohs, K. D., Aaker, J. L., & Garbinsky, E. N. (2013). Some key differences between a happy life and a meaningful life. *The Journal of Positive Psychology, 8*, 505–516. doi:10.1080/17439760.2013.830764

Blackwell, S. E., Rius-Ottenheim, N., Schulte-van Maaren, Y. W. M., Carlier, I. V. E., Middelkoop, V. D., Zitman, F. G., … Giltay, E. J. (2013). Optimism and mental imagery: A possible cognitive marker to promote well-being? *Psychiatry Research, 206*, 56–61. doi:10.1016/j.psychres.2012.09.047

Brown, A. D., Addis, D. R., Romano, T. A., Marmar, C. R., Bryant, R. A., Hirst, W., & Schacter, D. L. (2014). Episodic and semantic components of autobiographical memories and imagined future events in post-traumatic stress disorder. *Memory, 22*, 595–604. doi:10.1080/09658211.2013.807842

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's mechanical turk a new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science, 6*, 3–5. doi:10.1177/1745691610393980

D'Argembeau, A., & Van der Linden, M. (2004). Phenomenal characteristics associated with projecting oneself back into the past and forward into the future: Influence of valence and temporal distance. *Consciousness and Cognition, 13*, 844–858. doi:10.1016/j.concog.2004.07.007

D'Argembeau, A., & Van der Linden, M. (2006). Individual differences in the phenomenology of mental time travel: The effect of vivid visual imagery and emotion regulation strategies. *Consciousness and Cognition, 15*, 342–350. doi:10.1016/j.concog.2005.09.001

Feldman, D. B., & Snyder, C. R. (2005). Hope and the meaningful life: Theoretical and empirical associations between goal–directed thinking and life meaning. *Journal of Social and Clinical Psychology, 24*, 401–421. doi:10.1521/jscp.24.3.401.65616

Funder, D. C., Levine, J. M., Mackie, D. M., Morf, C. C., Sansone, C., Vazire, D., & West, S. G. (2014). Improving dependability of research in personality and social psychology: Recommendations for research and educational practice. *Personality and Social Psychology Review, 18*, 3–12.

Gaesser, B., & Schacter, D. L. (2014). Episodic simulation and episodic memory can increase intentions to help others. *Proceedings of the National Academy of Sciences, 111*, 4415–4420. doi:10.1073/pnas.1402461111

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs, 76*, 408–420. doi:10.1080/03637750903310360

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Heintzelman, S. J., & King, L. A. (2014). Life is pretty meaningful. *American Psychologist, 69*, 561–574. doi:10.1037/a0035049

Husnu, S., & Crisp, R. J. (2010). Elaboration enhances the imagined contact effect. *Journal of Experimental Social Psychology, 46*, 943–950. doi:10.1016/j.jesp.2010.05.014

Kray, L. J., George, L. G., Liljenquist, K. A., Galinsky, A. D., Tetlock, P. E., & Roese, N. J. (2010). From what might have been to what must have been: Counterfactual thinking creates meaning. *Journal of Personality and Social Psychology, 98*, 106–118. doi:10.1037/a0017905

Madore, K. P., Gaesser, B., & Schacter, D. L. (2014). Constructive episodic simulation: Dissociable effects of a specificity induction on remembering, imagining, and describing in young and older adults. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 40*, 609–622. doi:10.1037/a0034885

McGregor, I., & Little, B. R. (1998). Personal projects, happiness, and meaning: On doing well and being yourself. *Journal of Personality and Social Psychology, 74*, 494–512. doi:10.1037/0022-3514.74.2.494

Morina, N., Deeprose, C., Pusowski, C., Schmid, M., & Holmes, E. A. (2011). Prospective mental imagery in patients with major depressive disorder or anxiety disorders. *Journal of Anxiety Disorders, 25*, 1032–1037. doi:10.1016/j.janxdis.2011.06.012

Preacher, K. J., & Kelley, K. (2011). Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. *Psychological Methods, 16*, 93–115.

Routledge, C., Arndt, J., Wildschut, T., Sedikides, C., Hart, C. M., Juhl, J., … Schlotz, W. (2011). The past makes the present meaningful: Nostalgia as an existential resource. *Journal of Personality and Social Psychology, 101*, 638–652. doi:10.1037/a0024292

Rucker, D. D., Preacher, K. J., Tormala, Z. L., & Petty, R. E. (2011). Mediation analysis in social psychology: Current practices and new recommendations. *Social and Personality Psychology Compass, 5*, 359–371.

Sani, F. (Ed.). (2010). *Self continuity: individual and collective perspectives*. New York, NY: Psychology Press.

Schacter, D. L., Addis, D. R., & Buckner, R. L. (2008). Episodic simulation of future events. *Annals of the New York Academy of Sciences, 1124*, 39–60. doi:10.1196/annals.1440.001

Scheier, M. F., & Carver, C. S. (1992). Effects of optimism on psychological and physical well-being: Theoretical overview and empirical update. *Cognitive Therapy and Research, 16*, 201–228. doi:10.1007/BF01173489

Sedikides, C., Wildschut, T., Arndt, J., & Routledge, C. (2008). Nostalgia past, present, and future. *Current Directions in Psychological Science, 17*, 304–307. doi:10.1111/j.1467-8721.2008.00595.x

Singer, J. A. (2004). Narrative identity and meaning making across the adult lifespan: An introduction. *Journal of Personality, 72*, 437–460. doi:10.1111/j.0022-3506.2004.00268.x

Steger, M. F. (2012). Experiencing meaning in life: Optimal functioning at the nexus of well-being, psychopathology, and spirituality. In P. T. P. Wong (Ed.), *The human quest for meaning: Theories, research, and applications* (2nd ed., pp. 165–184). New York, NY: Routledge.

Steger, M. F., Frazier, P., Oishi, S., & Kaler, M. (2006). The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology, 53*, 80–93. doi:10.1037/0022-0167.53.1.80

Szpunar, K. K. (2010). Episodic future thought: An emerging concept. *Perspectives on Psychological Science, 5*, 142–162. doi:10.1177/1745691610362350

Szpunar, K. K., & McDermott, K. B. (2008). Episodic future thought and its relation to remembering: Evidence from ratings of subjective experience. *Consciousness and Cognition, 17*, 330–334. doi:10.1016/j.concog.2007.04.006

Szpunar, K. K., Spreng, R. N., & Schacter, D. L. (2014). A taxonomy of prospection: Introducing an organizational framework for future-oriented cognition. *Proceedings of the National Academy of Sciences, 111*, 18414–18421. doi:10.1073/pnas.1417144111

Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review, 117*, 440–463.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology/Psychologie Canadienne, 26*(1), 1–12. doi:10.1037/h0080017

Waytz, A., Hershfield, H. E., & Tamir, D. I. (2015). Mental simulation and meaning in life. *Journal of Personality and Social Psychology, 108*, 336–355. doi:10.1037/a0038322

Wheeler, M. A., Stuss, D. T., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychological Bulletin, 121*, 331–354.

Zhao, X., Lynch, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research, 37*, 197–206. doi:10.1086/651257