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Reflecting on nostalgic, positive, and novel experiences increases state Openness

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Abstract

Objective: Personality change is a growing field of interest, but relatively few studies have examined causes of change in Openness. We investigated whether it is possible to influence state Openness, and through what mechanisms this effect may occur.

Method: In two experiments (Study 1: $N = 144$, $M_{age} = 36.4$, 58% female, 88% White; Study 2: $N = 269$, $M_{age} = 34.0$, 60% female, 91% White), participants reflected on and wrote about a personal experience requested to be either: nostalgic; positive and novel (Study 1); positive or novel (Study 2); or ordinary. They rated the events for nostalgia, positivity, novelty, and sociality, and completed measures of state positive affect, self-esteem, social connectedness, meaning in life, and state Openness.

Results: Participants who recalled positive and/or novel events reported greater state Openness than those who recalled ordinary events. In Study 1, this also applied to those recalling nostalgic events. Event ratings of positivity (both studies), nostalgia and novelty (Study 2) independently predicted state Openness. State positive affect and self-esteem were independent predictors in both studies, suggesting possible indirect paths.

Conclusions: Reflecting on nostalgic, positive, and novel experiences can increase state Openness. This finding may be useful for interventions targeting trait-level change.

KEYWORDS

intervention, nostalgia, novelty, Openness, personality change

1 | INTRODUCTION

Personality change is a growing field of research (Bleidorn et al., 2019). Although personality traits have traditionally been thought of as relatively stable, it is now recognized that they show patterns of development across our lives; for example, most adults increase in Conscientiousness, Agreeableness, and Extraversion as they mature (Roberts, Walton, & Viechtbauer, 2006). Additionally, changes in personality have been associated with life events such as marriage, beginning work, and retirement (Bleidorn, Hopwood, & Lucas, 2018). Change may also occur following interventions, such as undergoing psychological therapy, which has been found to reduce Neuroticism (Roberts et al., 2017).

However, relatively little empirical work to date has examined mechanisms of change.

One approach is to examine change at the state level. States are momentary expressions of traits, reflected in an individual's current thoughts, feelings and behavior. An individual's trait standing can be thought of as an average of their state expressions across time and situations (Fleeson, 2001; Fleeson & Jayawickreme, 2015), which show as much variability within-person as between-persons (Fleeson, 2001; Heller, Komar, & Lee, 2007). Understanding what causes this variation within individuals, by identifying antecedents of changes in states, can help to reveal the mechanisms underlying traits. A further benefit of state-level research is that states can be manipulated through experimentation, allowing proposed causal influences to be directly tested (Fleeson, 2017). This can also provide insight into the potential for trait-level change, which is theorized to result from repeated changes in states (Wrzus & Roberts, 2017). Examining influences on states also has potentially useful applications, for example, if increasing the range or flexibility of responses in a given situation is advantageous for an individual (Blackie, Roepke, Forgeard, Jayawickreme, & Fleeson, 2014). In the following studies, we investigated whether it is possible to influence state Openness, and through what mechanisms this effect may occur.

1.1 | Openness and change

Openness to Experience, also known as Openness/Intellect, is the Big Five personality trait associated with imagination, creativity, and curiosity. It describes a positive orientation toward novelty and exploration, both abstract and perceptual (DeYoung, 2014). Individuals high in Openness enjoy exploring new ideas and environments, while those low in Openness may prefer stability and familiarity. Openness has been associated with several positive outcomes including successful aging (Gregory, Nettelbeck, & Wilson, 2010), cognitive reserve (Franchow, Suchy, Thorgusen, & Williams, 2013), creative achievement (Kaufman, 2013), and reduced prejudice (Hotchin & West, 2018).

Increased state Openness has a number of positive implications. Openness has been associated with aspects of psychological well-being such as personal growth, autonomy, and positive emotions (Anglim, Horwood, Smillie, Marrero, & Wood, 2020). As such, experiencing increased state Openness could enhance these aspects of well-being, similarly to the effect of behavioral activation strategies used in therapy (Blackie et al., 2014). When experiencing greater Openness, individuals may also be more able to successfully cope with difficult life circumstances by finding ways to adapt, grow, and extract meaning from adversity (Blackie et al., 2014). As an example, individuals with medium levels

of Openness undergoing treatment for psychopathology have been found to increase in daily Openness, with these changes corresponding to a reduction in depressive symptoms (Forgeard et al., 2019). Greater Openness may also be helpful when creative approaches to problem solving are required (Blackie et al., 2014). Further, Openness may improve interpersonal relations by allowing individuals to consider alternative opinions or perspectives (DeYoung, 2014), thereby building empathy. Despite these positive implications, relatively little research has investigated causes and mechanisms of change in Openness.

To date, most research on change in Openness has been focused at the trait level. Trait Openness tends to rise in young adulthood, plateau across the middle of the life span, and decrease in older age (Roberts et al., 2006). In addition to these developmental trends, Openness has been found to increase following transformative experiences such as international sojourns (Zimmermann & Neyer, 2013), mystical experiences (MacLean, Johnson, & Griffiths, 2011), and significant life events such as retirement (Schwaba & Bleidorn, 2019). Openness also shows a bidirectional relationship with engagement in cultural activities (Schwaba, Luhmann, Denissen, Chung, & Bleidorn, 2018), and can increase after developing new skills, especially in older age (Jackson, Hill, Payne, Roberts, & Stine-Morrow, 2012; Mühlig-Versen, Bowen, & Staudinger, 2012). Research on what causes changes in Openness at the state level is lacking, however.

1.2 | Nostalgia and Openness

Some prior experimental research suggests that experiencing nostalgia may affect state Openness. Van Tilburg, Sedikides, and Wildschut (2015) found that participants who reflected on an event they felt nostalgic about reported greater Openness than those who recalled an ordinary event. Nostalgia has been defined as a "sentimental longing for one's past" (Sedikides & Wildschut, 2016). Nostalgic memories tend to occur following a negative mood and are typically self-oriented, social, and contain redemptive narratives (Wildschut, Sedikides, Arndt, & Routledge, 2006). Though popularly conceived of as a bittersweet emotion, nostalgia has been shown to have positive functions (Sedikides, Wildschut, & Stephan, 2018). It has been conceptualized as a coping mechanism to defend against negative feelings, by restoring positive feelings about the self, and enhancing sense of belonging and purpose (Wildschut et al., 2006).

Why might nostalgic reflection affect state Openness? Nostalgia can be thought of as a future-oriented emotion, in that through restoring positive feelings about the self, it encourages action and growth (Sedikides et al., 2018). In this sense, it shares conceptual similarities with Openness and the higher order trait of Plasticity, which reflect an orientation

toward exploration (DeYoung, 2006). Research involving experimental inductions of nostalgia has found effects on several outcomes relevant to these traits. For example, nostalgia can increase approach orientation (Stephan et al., 2014), as measured by the fun-seeking and drive subscales of the Behavioral Activation System (BAS; Carver & White, 1994), as well as optimism, including that related to undertaking new challenges (Cheung, Sedikides, & Wildschut, 2016). Nostalgia can also evoke inspiration, a state which involves transcending the routine and expanding awareness of possibilities. This effect was found to occur by strengthening feelings of self-esteem, and applied to both general inspiration and interest in specific activities associated with Openness, such as engagement in cultural activities and adventurous travel (Stephan et al., 2015). Finally, nostalgia has been found to promote positive psychological growth. By increasing feelings of self-worth, nostalgia enhanced specific growth-oriented behavioral intentions, such as engaging in novel activities (Baldwin & Landau, 2014), a key marker of Openness.

It is important to note here the distinction between collective and personal nostalgia. Collective nostalgia is associated with conservatism and a desire to return to an idealized shared past, strengthening bonds within the in-group (Sedikides & Wildschut, 2019) but potentially also resulting in out-group prejudice (Smeekes, 2015). These outcomes are negatively associated with Openness (Sibley & Duckitt, 2010). However, personal nostalgia shows a different pattern. At the personal level, dispositional nostalgia is negatively linked with prejudice, and experimentally induced nostalgia can reduce prejudice via social connectedness and out-group inclusion (Sedikides & Wildschut, 2019).

Although van Tilburg and colleagues (2015) conceived of Openness as being manipulable, it was measured using the BFI trait questionnaire (Benet-Martínez & John, 1998) in their study, and change at the trait level is unlikely following a brief manipulation. Instead, it is more likely that their findings represent an effect on state Openness, leading to a biased state-congruent response to the trait questionnaire (Bolger, Davis, & Rafaeli, 2003). Potential mechanisms for the effect were not investigated, as Openness was tested as a mediator of the effect of nostalgia on creativity, rather than an outcome measure. However, research on the positive effects of nostalgia on related outcomes suggests possible indirect paths via greater positive affect, self-esteem, social connectedness, or sense of meaning in life (Hepper, Ritchie, Sedikides, & Wildschut, 2012).

Positive affect is a likely candidate for mediation of the effect of nostalgic recall on Openness as it has been associated with within-person variability in state Openness in an experience sampling study (Wilson, Thompson, & Vazire, 2016) and cross-cultural research (Ching et al., 2014). Further, the broaden and build theory of positive emotions (Fredrickson, 2001) is conceptually related to the exploratory tendencies associated with Openness. The theory proposes that positive feelings give an individual the confidence to explore and learn, thus, enhancing their positive feelings in an upward cycle. The higher-level trait of plasticity, of which Openness is a component (DeYoung, 2006), also consistently shows a relationship with positive affect (Lucas, 2018).

Increased feelings of self-esteem may also mediate the effect of nostalgia on Openness. Self-esteem has been positively associated with Openness at both the trait (von Soest, Wagner, Hansen, & Gerstorf, 2018; Zeigler-Hill et al., 2015), and state level (Magee & Biesanz, 2019). Further, self-esteem is linked with feelings of mastery and successful navigation of one's environment (Lyubomirsky, Tkach, & DiMatteo, 2006). Trait-level studies finding effects on Openness have involved training older adults to develop new skills (Mühlig-Versen et al., 2012), and successfully forming friend networks during the course of international sojourns (Zimmermann & Neyer, 2013). Some research also suggests that experiencing positive affect may lead to greater self-esteem, implying a potential serial mediation path (Benetti & Kambouropoulos, 2006; Liu, Wang, Zhou, & Li, 2014). Self-esteem is also considered as a crucial antecedent of personal growth (Baldwin & Landau, 2014).

Another possible explanation for the effect of nostalgia on Openness is that the nostalgic events recalled in an experimental setting may be characterized by greater novelty - that is, they stand out as unique or unusual memories for the participant. Nostalgic events are indeed frequently characterized as momentous (Wildschut, Sedikides, Arndt, & Routledge, 2006), unique (van Tilburg, Bruder, Wildschut, Sedikides, & Göritz, 2019), and atypical (Morewedge, 2013). Such experiences are relevant to the trait of Openness, as individuals high in Openness show greater interest in exploration and novelty (McCrae & Costa, 1997).

How might recalling such experiences increase Openness? Research on autobiographical memory proposes that it can serve a directive function with regard to current and future thoughts and behavior (Bluck, Alea, Habermas, & Rubin, 2005). For example, recently recalled memories of psychological need satisfaction can increase situational well-being (Philippe & Bernard-Desrosiers, 2017). Further, individuals who recalled positive past experiences of public speaking performed better in a public speaking task (Pezdek & Salim, 2011), and participants who recalled a positive memory of exercise reported increased physical activity over the following week (Biondolillo & Pillemer, 2015). As such, it may be the case that individuals who recall positive memories of past novel experiences show an increased orientation toward future novel experiences - that is, they may demonstrate greater state Openness. This theory can be tested by examining whether nostalgic experiences are high in novelty (and vice versa), and also by directly asking participants to recall

a novel, compared to nostalgic, experience and assessing the relative impact on state Openness.

It is worth noting that of all the Big Five traits, individuals tend to be least interested in increasing their levels of Openness (Baranski, Morse, & Dunlop, 2017; Hudson & Roberts, 2014). However, when individuals act more Open, they feel more authentic, regardless of their trait standing (Fleeson & Wilt, 2010). This suggests that individuals' conceptions of Openness could differ from their experience of it in the moment. Employing a paradigm where individuals recall past occasions in which they acted more Open (i.e., by engaging in positive novel experiences), and experience positive feelings about themselves as a result, may encourage future Openness. Additionally, such a paradigm could give individuals a practical tool with which to manage uncertainty and change, by drawing on positive memories of successfully navigating novel experiences in the past (which are in theory always internally accessible). In contrast, other approaches to eliciting state Openness (e.g., by manipulating aspects of situations) might not occur naturalistically, or may be too context dependent to be helpful in situations where greater state Openness would be most useful.

2 | THE PRESENT RESEARCH

The following two studies aimed to add to current knowledge of the potential effects of nostalgic recall on Openness. First, we assessed whether the effect applies to *state*, rather than trait Openness. Second, we assessed whether recalling novel events has a similar effect on Openness to recalling nostalgic events, and whether the trait-relevant event characteristic of novelty independently predicts state Openness. We did this by including an additional condition whereby participants recalled a novel experience, and by assessing all events for their degree of novelty and nostalgia. Third, we assessed potential mediators of this effect, namely positive affect and self-esteem.

3 | STUDY 1

Participants were randomly assigned to either a nostalgic, novel, or ordinary event recall condition. We assessed the following hypotheses:

> *H1*: Participants in both the nostalgic and novel conditions will have higher *state* Openness scores than those in the ordinary condition, following the event reflection task.
>
> *H2*: The event characteristics of nostalgia and novelty will independently predict state Openness scores.

> *H3*: Positive affect and self-esteem following the event reflection task will independently predict state Openness scores.
>
> *H4*: There will be an indirect path from nostalgic and novel event recall (compared to ordinary event recall) to state Openness via positive affect and self-esteem.

4 | METHOD

4.1 | Power analysis

We calculated that a sample size of 126 would be needed to have 80% power to detect an effect size ($d = 0.56$) equivalent to that found in previous research (van Tilburg et al., 2015), with an alpha level of 0.05. We increased this number to 200 to detect a potentially smaller effect and to account for expected attrition between the two parts of the study.

4.2 | Participants

Participants were recruited via the Prolific online platform (https://www.prolific.co/) and paid approximately £1.60. Demographic filters were applied such that participants were UK nationals, had English as a first language, were nonstudents, and were aged 25–45. We selected this age band as longitudinal research indicates that trait Openness is relatively stable across this period of life (Roberts et al., 2006). Initially, 203 participants registered for the study, with 150 completing both parts. The final sample were 58% female, aged 24–47 ($M = 36.40$, $SD = 5.98$), and 67.3% held a university degree. Most participants were nonreligious (65.3%), while 28% were Christian, 4% Muslim, and 2% of other religions. The majority (88%) identified as White.

4.3 | Materials

All items were answered using a sliding scale (0–100), where 0 = *Strongly disagree* and 100 = *Strongly agree*, unless otherwise indicated.

4.3.1 | Trait openness/intellect

We assessed Trait Openness/Intellect with the Big Five Aspect Scales (BFAS; DeYoung, Quilty, & Peterson, 2007) which divide each trait into two aspects. The 10 items assessing the Openness aspect ($\alpha = 0.77$) include: "Need a creative outlet"

and "Seldom get lost in thought" (reverse-coded); the 10 assessing the Intellect aspect ($\alpha = 0.84$) include: "Am quick to understand things" and "Avoid philosophical discussions" (reverse-coded). Items were answered on a 5-point Likert scale where $1 = Strongly\ disagree$ and $5 = Strongly\ agree$. Though we did not intend to analyze the data for the other Big Five traits, these were also collected to reduce the possibility of participants inferring the purpose of the second part of the study. This measure was collected 2 weeks prior to the experiment.

4.3.2 | Event reflection task

Participants were randomly allocated to one of three conditions where they were instructed to recall an event from their past, generate four key words describing the event, and write a (free-text) description of the event and how it made them feel. Participants could not progress with the study until they had spent 3 min on this task, though they could take longer. The three event types were: nostalgic, novel, or ordinary. Wording for the ordinary and nostalgic conditions followed exactly the event reflection task instructions described in the appendix of Sedikides et al. (2015), for example "Please think of a nostalgic event in your life. Specifically, try to think of a past event that makes you feel most nostalgic. Bring this nostalgic experience to mind. Immerse yourself in the nostalgic experience. How does it make you feel?", and "Please bring to mind an ordinary event in your life. Specifically, try to think of a past event that is ordinary. Bring this ordinary experience to mind. Immerse yourself in the ordinary experience. How does it make you feel?" Participants in the nostalgic condition were also provided with a definition of nostalgia as a "sentimental longing for the past." Participants in the novel condition were asked to: "Please bring to mind a positive novel event in your life. Specifically, try to think of a past event during which you experienced something new for the first time and enjoyed it. Immerse yourself in the novel experience. How does it make you feel?" We requested a positive novel event as we did not expect a negative novel event to increase state Openness.

4.3.3 | Event characteristics

We followed the protocol of van Tilburg et al. (2015) by including three nostalgia manipulation check items ($\alpha = 0.96$) after the event reflection task, for all conditions (e.g., "I feel nostalgic at the moment"). To ensure that participants had understood the novel condition instruction, and to account for the possibility that nostalgic events might also be novel, we also included three items ($\alpha = 0.93$) assessing how novel the event was (e.g., "The event I described was a new experience for me"). We further included two items assessing how positive and how social the experience was (e.g., "The event I

described was a positive experience"), and asked participants for their age at the time of the event, as well as how long ago it occurred. The three novelty ratings were averaged, as were the three nostalgia ratings.

4.3.4 | State functions of nostalgia

We included the scale used by Hepper et al. (2012) to assess the four state functions of nostalgia. Participants were asked to indicate the extent to which they agreed with a statement beginning: "Thinking about the event…" followed by one of 16 items (four per function). These were: positive affect ($\alpha = 0.81$; e.g., "puts me in a good mood"); self-esteem ($\alpha = 0.92$; e.g., "makes me value myself more"); social connectedness ($\alpha = 0.86$; e.g., "makes me feel connected to loved ones"); and meaning in life ($\alpha = 0.90$; e.g., "makes me feel life has a purpose"). The items were presented in a randomized order. The state Openness adjectives described below were also incorporated into this randomized list of items. The items for each function were averaged to create the function score.

4.3.5 | State openness

We assessed state Openness using four adjectives ($\alpha = 0.81$) derived from Goldberg (1992): "imaginative," "philosophical," "curious," and "creative." Participants were presented with the statement: "Thinking about the event makes me feel…" followed by the adjective.

4.3.6 | Post Openness/Intellect

We presented a second version of the BFAS comprising only the 20 Openness/Intellect items (Openness: $\alpha = 0.77$; Intellect: $\alpha = 0.85$) at the end of the study. We modified the instruction to request that participants answer the questions after "reflecting on how you feel at the moment." Items were answered using a 5-point Likert scale.

4.4 | Procedure

We presented the study using the Qualtrics online platform. It was administered in two parts: the first contained the trait BFAS measure and demographics; while the second (administered 2 weeks later) randomly allocated participants to conditions and contained the remaining measures, in the following order: event reflection task; event characteristics; state functions of nostalgia and state Openness; post Openness/Intellect.

We restricted the second part of the study to desktop/laptop only, to eliminate differences in performance on the event

reflection task due to mobile screen typing. Unfortunately, this led to approximately 25% of participants ($N = 53$) not participating in the experimental task. There were no significant differences on the prior measure of Openness/Intellect for this group compared to participants who completed both parts; however, participants who did not complete the full study were lower in Conscientiousness ($M = 3.33$, $SD = .55$) than the remainder ($M = 3.53$, $SD = .55$; $t = -2.08$, $p = .041$). They were also younger ($M = 34.05$, $SD = 5.59$; $M = 36.43$, $SD = 6.05$; $t = -2.30$, $p = .023$).

4.5 | Data screening

Prior to conducting the analyses, we excluded six participants who did not adequately complete the tasks, leaving a final sample size of 144. One was removed due to zero variance on the Openness/Intellect items before reverse-coding, indicating unreliable data, while one participant in the nostalgia condition was removed as they could not think of an event. To ensure that participants had understood the instruction to provide a novel versus ordinary event, we checked for extreme scores on participant ratings of event novelty (defined as <30 for the novel condition or >70 for the ordinary condition). Four participants in the ordinary condition were removed on this basis.

Following these exclusions, we used boxplots to identify any remaining extreme (>3* interquartile range) outliers on the primary event characteristics (nostalgia, positivity, and novelty). Four such outliers were identified (one low positivity rating in the nostalgia condition, one low positivity rating in the novel condition, and two high novelty ratings in the ordinary condition). These outliers are retained in the reported analyses, but we also report the results with the outliers removed where there were substantive differences.

5 | RESULTS

Means and standard deviations per condition are displayed in Table 1, and bivariate correlations in Table 2. Age was not significantly related to our dependent variables, and gender showed only a weak correlation with post Openness, so we did not consider these in further analyses. Event age difference (how long ago the event occurred) was moderately correlated with event nostalgia and sociality, but was not related to the Openness outcome variables, so we did not consider it further. Pre- and post-measures of trait Openness/Intellect were highly correlated as expected, but only the post measure was related to state Openness.

5.1 | Event characteristics

As expected, event recall condition had a significant effect on ratings of nostalgia ($F (2,141) = 39.49$, $p < .001$, $\eta_p^2 = .36$), positivity ($F (2,141) = 30.25$, $p < .001$, $\eta_p^2 = .30$), and novelty ($F (2,141) = 159.35$, $p < .001$, $\eta_p^2 = .69$). Games-Howell

TABLE 1 Study 1 means and standard deviations by condition

		Ordinary ($N = 43$)		Novel ($N = 53$)		Nostalgic ($N = 48$)	
	Alpha	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age	–	35.84	6.55	35.64	5.55	37.49	6.08
Prior Openness/Intellect	0.83	3.57	0.47	3.65	0.50	3.58	0.48
Prior Openness	0.77	3.63	0.54	3.53	0.59	3.45	0.64
Prior Intellect	0.84	3.52	0.58	3.78	0.62	3.71	0.63
Post Openness/Intellect	0.84	3.76	0.57	3.81	0.46	3.71	0.46
Post Openness	0.77	3.75	0.62	3.70	0.54	3.60	0.60
Post Intellect	0.85	3.77	0.69	3.91	0.58	3.82	0.55
State Openness	0.81	43.29	23.13	62.72	18.52	56.25	21.69
Event novelty	0.93	8.69	13.36	83.69	16.91	60.13	28.48
Event nostalgia	0.96	35.02	28.55	73.41	20.59	71.90	20.77
Event positivity	–	62.32	29.74	93.62	10.52	87.42	18.38
Event sociality	–	43.51	37.71	58.73	34.21	62.78	31.06
Positive affect	0.81	59.92	23.55	78.78	14.14	71.38	19.68
Self-esteem	0.92	57.72	25.70	75.47	18.66	71.65	18.81
Social connectedness	0.86	48.46	25.35	66.57	21.46	73.73	18.68
Meaning in life	0.90	54.85	23.81	75.12	21.48	79.47	18.04
Event age difference	–	2.53	6.08	5.83	6.83	15.87	11.35

TABLE 2 Study 1 bivariate correlations ($N = 144$)

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Age																	
2 Gender	.054																
3 Prior Openness/Intellect	.005	.009															
4 Prior Openness	.024	.120	.790**														
5 Prior Intellect	−.016	−.102	.805**	.272**													
6 Post Openness/Intellect	.027	.088	.858**	.724**	.646**												
7 Post Openness	.012	.184*	.706**	.865**	.270**	.827**											
8 Post Intellect	.033	−.034	.724**	.351**	.797**	.839**	.388**										
9 State Openness	.061	.040	.163	.153	.108	.255**	.235**	.192*									
10 Event novelty	.030	−.077	−.049	−.126	.045	−.054	−.103	.010	.291**								
11 Event nostalgia	.066	−.070	.182*	.084	.205*	.141	.132	.104	.348**	.516**							
12 Event positivity	.090	−.021	.205*	.131	.195*	.164*	.145	.129	.439**	.534**	.548**						
13 Event sociality	.068	−.087	.050	.037	.042	−.005	.026	−.034	.176*	.103	.224**	.344**					
14 Positive affect	.018	−.043	.160	.172*	.086	.197*	.219**	.110	.690**	.354**	.377**	.651**	.290**				
15 Self-esteem	.076	−.026	.066	.103	.004	.157	.156	.106	.666**	.372**	.355**	.571**	.155	.796**			
16 Social connectedness	.057	−.005	.161	.026	.228**	.162	.077	.191*	.539**	.323*	.493**	.561**	.414**	.597**	.548**		
17 Meaning in life	.152	.006	.038	−.058	.115	.101	.001	.165*	.566**	.427**	.464**	.563**	.164*	.624**	.751**	.731**	
18 Event age difference	.293**	−.184*	.158	.075	.175*	.085	.065	.076	.055	.169*	.322*	.202*	.303**	.115	.091	.257**	.146

**Correlation is significant at the .01 level (2-tailed).

*Correlation is significant at the .05 level (2-tailed).

post hoc comparisons indicated that events recalled in the ordinary condition had significantly lower ratings of nostalgia (vs. novel cond.: $p < .001$, $d = 1.64$; vs. nostalgia cond.: $p < .001$, $d = 1.58$), positivity (vs. novel cond.: $p < .001$, $d = 1.53$; vs. nostalgia cond.: $p < .001$, $d = 1.23$), and novelty (vs. novel cond.: $p < .001$, $d = 3.62$; vs. nostalgia cond.: $p < .001$, $d = 2.48$) than events recalled in the other conditions. However, although events in the novel condition had significantly higher ratings of novelty than those in the nostalgic condition ($p < .001$, $d = 1.14$), nostalgic and novel events did not differ significantly in ratings of nostalgia. Thus, although novel events were rated highest in novelty, both novel and nostalgic events were significantly more novel than ordinary events, and were experienced as equally nostalgic. Nostalgic and novel events did not differ significantly in positivity.

5.2 | Main results

H1: As predicted, there was a significant main effect of condition ($F (2,141) = 10.31$, $p < .001$, $\eta_p^2 = .13$) on state Openness. Post hoc Tukey comparisons indicated that participants in the ordinary condition ($M = 43.29$, $SD = 23.13$) had lower state Openness scores than those in the nostalgic ($M = 56.25$, $SD = 21.69$; $p = .011$, $d = .62$) and novel ($M = 62.72$, $SD = 18.52$; $p < .001$, $d = .92$) conditions. However, the nostalgic and novel conditions did not significantly differ from one another. Our hypothesis was thus supported.

We also tested whether there was an effect of condition on the post Openness/Intellect measure, using the prior trait Openness/Intellect measure as a covariate. We did not find an effect ($F (2,140) = .528$, $p = .591$, $\eta_p^2 = .007$) on this outcome measure.

In addition, we tested and found no moderation of the effect of event recall condition on state Openness by trait Openness/Intellect ($\Delta R^2 = .00$, $F (2, 138) = .24$, $p = .786$).

H2: We then ran a multiple regression analysis to assess whether participant ratings of event nostalgia and novelty would independently predict state Openness. We entered the ratings for all event characteristics (nostalgia, novelty, positivity, and sociality) into the model, which explained 21.1% of the variance in state Openness ($R^2 = .211$, $F (4,139) = 9.27$, $p < .001$). Event nostalgia ($\beta = .14$, $p = .142$, unique $R^2 = .01$) and novelty ($\beta = .04$, $p = .687$, unique $R^2 = .00$) were not significant predictors. The only significant predictor was event positivity ($\beta = .33$, $p = .001$, unique $R^2 = .06$). Our hypothesis was therefore not supported.

H3: We next tested whether the state functions of nostalgia, in particular positive affect and self-esteem, would independently predict state Openness. We regressed state Openness scores on all four state functions of nostalgia (positive affect, self-esteem, social connectedness, and meaning in life). The model explained 53% of the variance in state Openness ($R^2 = .53$, $F (4,139) = 39.20$, $p < .001$). Positive affect ($\beta = .37$, $p < .001$, unique $R^2 = .043$) and self-esteem ($\beta = .28$, $p = .019$, unique $R^2 = .019$) significantly predicted state Openness, supporting our hypothesis. Social connectedness ($\beta = .16$, $p = .083$, unique $R^2 = .010$) and meaning in life ($\beta = .01$, $p = .897$, unique $R^2 = .000$) were not significant predictors.

H4: We next tested models where the effect of event recall condition on state Openness was mediated by positive affect and self-esteem. First, using Process v3.0 (Hayes, 2017) we tested a parallel mediation model in which all four state functions of nostalgia were entered simultaneously. Event recall condition was the multi-categorical predictor, with the ordinary condition as reference category. Overall, the model explained 53.8% of the variance in state Openness. Both the nostalgic and novel conditions significantly predicted positive affect (nostalgic: $b = 11.46$, $SE = 4.03$, $p = .005$; novel: $b = 18.86$, $SE = 3.94$, $p < .001$) and self-esteem (nostalgic: $b = 13.94$, $SE = 4.42$, $p = .002$; novel: $b = 17.75$, $SE = 4.32$, $p < .001$). In turn, both positive affect ($b = .36$, $SE = .11$, $p = .002$) and self-esteem ($b = .28$, $SE = .12$, $p = .018$) predicted state Openness. In the presence of these variables, the nostalgic and novel conditions did not have a significant direct effect on Openness. Bootstrapped estimates indicated that the indirect path via positive affect was significant for only the novel condition ($b = 6.79$, $SE = 3.09$, 95% $CI = .205, 12.359$) condition, while the path via self-esteem was significant for both the nostalgic ($b = 3.95$, $SE = 2.56$, 95% $CI = .416, 10.444$) and novel ($b = 5.04$, $SE = 3.11$, 95% $CI = .611, 12.833$) conditions. There was no significant direct or indirect path from social connectedness or meaning in life to state Openness. When repeating the analysis with outliers excluded, the indirect path via positive affect was also significant for the nostalgic condition ($b = 5.09$, $SE = 2.38$, 95% $CI = .276, 9.689$).

Prior research has suggested that positive affect and self-esteem may operate as sequential mediators, with positive affect leading to greater self-esteem (Benetti & Kambouropoulos, 2006; Liu et al., 2014), so we also ran an exploratory analysis using a serial mediation model with only these two variables. We found a significant serial indirect path via positive affect and self-esteem for both the nostalgic ($b = 3.01$, $SE = 2.19$, 95% $CI = .346, 8.675$) and novel ($b = 4.96$, $SE = 2.66$, 95% $CI = 1.304, 11.588$) conditions, as well as an indirect path via positive affect only (nostalgic: $b = 5.06$, $SE = 2.38$, 95% $CI = .639, 9.860$; novel: $b = 8.33$, $SE = 3.13$, 95% $CI = 1.899, 14.158$). Overall, the model explained 12.76% of the variance in state Openness. There was no significant indirect path via self-esteem only, for either recall condition, and no direct effect of condition.

These results lend support for the hypothesis that positive affect and self-esteem mediate the effects of event recall

condition on state Openness, and suggest that these variables could follow a sequential path. However, as the mediators were not experimentally manipulated, we cannot conclude that their relationship with the DV is causal, and we acknowledge that alternative models may also fit the data.

6 | DISCUSSION

In Study 1, we replicated the findings of van Tilburg et al. (2015) that participants who recalled nostalgic events reported greater Openness than those who recalled ordinary events, and found that the effect was on state rather than trait Openness. Further, by including an additional condition whereby participants were asked to recall a novel event, we showed that this produced the same effect on state Openness as recalling a nostalgic event. We also found support for our hypotheses that positive affect and self-esteem would mediate the effect of event recall condition on state Openness. In addition, we found support for a serial indirect path, with positive affect predicting greater self-esteem.

We also hypothesized that the event ratings of nostalgia and novelty would independently predict state Openness, but found that the only significant event characteristic to predict state Openness was event positivity. However, there was a confound in our design, in that events recalled in the novel condition were explicitly requested to be positive. Therefore, the effects of event positivity and novelty could not be easily disentangled and the model may have been biased to detect an effect of positivity, given that nostalgic events also tended to be rated high in positivity. We address this issue in Study 2.

We also note some further concerns with the study design. The state functions of nostalgia showed moderate-high correlations (ranging from .54 to .80) with each other and with state Openness. As we measured both in the same questionnaire, we could not be sure that the results of our mediation analysis were not partially due to common method variance. We used only a four-item measure of state Openness, which contained no negatively worded items, and the state functions were also all positively worded. Further, we did not include adjective measures for the other Big Five states, which could have increased variance in responses. To address the above concerns and to test if the effects we found could be replicated, we conducted a second, preregistered study (https://osf.io/u29bf/).

7 | STUDY 2

Participants were randomly assigned to one of four event recall conditions: nostalgic, positive, novel, and ordinary. Novel events were not requested to be positive, allowing us to test the effect of recalling novel and positive events

separately. We adapted the state functions of nostalgia items to include 1–2 negatively worded items per function (see Supporting Informations). We also administered the adjective measure of Openness separately to the state functions, and included all Big Five states, using an established measure (Saucier, 1994) which incorporates negatively worded items. We did not include the post Openness/Intellect measure. We preregistered and assessed the following hypotheses[1]:

> *H1*: There will be a main effect of event recall condition on state Openness. Participants who recall nostalgic, positive, or novel events will have higher state Openness scores than those who recall an ordinary event. The nostalgic, positive, and novel event conditions will not significantly differ from one another.

> *H2*: Event positivity and event novelty will independently predict state Openness.

> *H3*: Positive affect and self-esteem will independently predict state Openness.

> *H4*: There will be a serial indirect effect of event recall condition (nostalgic, positive, or novel compared to ordinary) on state Openness via positive affect and self-esteem, as well as an indirect effect via positive affect only.

> *H5*: There will be an effect of event recall condition on state Openness after adjusting for age, gender, and preexisting differences in trait Openness/Intellect and trait Extraversion.

8 | METHOD

8.1 | Power analysis

Previous research found effects on Openness of $d = 0.58$ (van Tilburg et al., 2015), and Study 1 found effect sizes of $d = 0.62$ and greater. Using a more conservative estimate of $d = 0.4$, a power analysis indicated that a sample size of 280 would be required to detect such an effect of condition on state Openness at an alpha level of .05 with power of 80%. This number was increased to 300 to allow for possible exclusions.

8.2 | Participants

Participants ($N = 300$) were recruited via Prolific and paid approximately £1.25. We used the same demographic filters as

Study 1. Following prespecified exclusions (reported below), the final sample consisted of 269 participants. The sample were aged 22 to 45 ($M = 34.00$, $SD = 5.85$), 59.5% female, and 62.1% held a university degree. The majority (65.4%) were not religious, 29% were Christian, 2.2% Muslim, and 2.2% of other religions. Most participants (91.4%) were White.

8.3 │ Materials

All questionnaire items were answered using a sliding scale (1–5), where 1 = *Strongly disagree* and 5 = *Strongly agree*, unless otherwise indicated.

8.3.1 │ Trait openness/intellect and extraversion

We used the BFAS (DeYoung et al., 2007) as in Study 1. We included 20 items each for Openness/Intellect and Extraversion and four items each for Conscientiousness, Agreeableness, and Neuroticism, in a randomized order. We did not intend to analyze the data for the latter three traits.

8.3.2 │ Event reflection task

Participants were assigned to one of four event recall conditions (nostalgic, positive, novel, and ordinary). The procedure and wording followed that of Study 1, except that the novel event wording was changed to: "Please bring to mind a novel event in your life. Specifically, try to think of a past event during which you experienced something new for the first time," and the positive condition specified: "Please bring to mind a positive event in your life. Specifically, try to think of a past event that is positive."

8.3.3 │ Event characteristics

As per Study 1, with the addition of event negativity (1 item).

8.3.4 │ State functions of nostalgia

As per Study 1, but with 1–2 items per function negatively worded (see Supporting Informations).

8.3.5 │ State Openness

We assessed state Openness using Saucier's Big Five Mini-Markers (Saucier, 1994). We included all eight[2] items

for each of the Big Five states, plus an additional item for Openness which was used in Study 1 ("curious"), but did not feature in the Mini-Markers. We did not intend to analyze the data for Agreeableness, Neuroticism, and Conscientiousness; these were included at both trait and state level to reduce the possibility of participants discerning the intent of the study, and to increase variation in responses.[3]

8.4 │ Procedure

The procedure was the same as Study 1, except that initial trait Openness/Intellect scores were collected at the same time as the rest of the data, as the post measure was no longer included. Additionally, the state adjective items were administered separately to and following the state functions of nostalgia items.

8.5 │ Data screening

To eliminate unreliable or inattentive responding, we preregistered the following criteria for data exclusion. Participants with zero variance on trait Openness/Intellect or Extraversion scores ($N = 1$), or on any state scores ($N = 12$) prior to reverse coding were excluded. We further prespecified exclusion if more than 20% of items were missing for trait Openness/Intellect or Extraversion, or more than two items were missing for any state scores; no participants were excluded on this basis. We also prespecified exclusion if participants in the nostalgia condition rated the event lower than 2.5 in induced nostalgia ($N = 4$); if those in the positive condition were rated below 2.5 in positivity (not applicable); if those in the ordinary condition were rated higher than 3.5 in novelty ($N = 9$); if those in the novel condition were rated lower than 2.5 in novelty ($N = 2$); or if no event was described ($N = 3$).

After the above exclusions ($N = 31$), the total sample size was 269. We also preregistered the following criteria regarding outliers: if outliers (+-3 SDs from the mean) were present for the primary DV (state Openness) or primary event characteristics (nostalgia, positivity, and novelty) per condition the analyses would be performed with and without these outliers. Four outliers with low positivity ratings in the nostalgia condition and one with low nostalgia ratings in the positive condition were found; the results without these outliers are reported where the pattern is substantively different.

9 │ RESULTS

Means and SDs per condition are presented in Table 3, and bivariate correlations are displayed in Table 4 below. Age, gender and years since the event occurred were not correlated

TABLE 3 Study 2 means and standard deviations by condition

	Alpha	Ordinary (N = 62)		Positive (N = 72)		Novel (N = 66)		Nostalgic (N = 69)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	–	33.54	6.02	33.46	5.45	34.74	5.97	34.2	6.00
Trait Openness	0.81	3.71	0.46	3.52	0.43	3.44	0.47	3.64	0.52
Trait Extraversion	0.90	3.26	0.59	3.12	0.64	3.19	0.56	3.18	0.65
Event novelty	0.93	1.72	0.70	3.63	1.12	4.30	0.80	3.35	1.32
Event nostalgia	0.97	2.81	1.22	4.04	0.81	3.72	1.02	4.20	0.52
Event sociality	–	2.99	1.32	3.00	1.48	3.04	1.47	3.94	1.21
Event positivity	–	3.72	1.10	4.68	0.35	4.33	1.15	4.41	1.01
Event negativity	–	1.90	1.08	1.19	0.34	1.67	1.17	1.46	1.02
Years since event	–	0.72	3.05	3.63	4.66	5.39	6.82	14.70	9.91
Positive affect	0.75	3.47	0.93	4.01	0.53	3.68	0.93	3.79	0.77
Self-esteem	0.83	3.83	0.79	4.23	0.61	3.96	0.95	4.06	0.71
Social connectedness	0.61	3.59	0.76	4.07	0.63	3.69	0.73	3.87	0.71
Meaning in life	0.70	3.92	0.80	4.43	0.59	4.15	0.81	4.23	0.51
State Openness	0.76	2.97	0.74	3.34	0.64	3.27	0.60	3.22	0.61
State Extraversion	0.65	3.25	0.64	3.53	0.56	3.51	0.61	3.34	0.54
State Agreeableness	0.75	3.65	0.62	4.02	0.47	3.87	0.63	3.92	0.56
State Conscientiousness	0.66	3.63	0.64	3.67	0.52	3.66	0.56	3.39	0.50
State Neuroticism	0.78	2.14	0.57	1.90	0.63	2.14	0.72	2.10	0.72

with state Openness. However, trait Openness/Intellect and trait Extraversion were. As such, we also report the main analyses with and without the latter measures as covariates.[4]

9.1 | Event characteristics

There was a significant effect of condition on ratings of nostalgia (F (3,265) = 29.54, p < .001, η_p^2 = .25), positivity (F (3,265) = 11.95, p < .001, η_p^2 = .12), and novelty (F (3,265) = 72.72, p < .001, η_p^2 = .45). Games-Howell post hoc tests indicated that events recalled in the ordinary condition had significantly lower ratings of nostalgia (vs. positive cond.: p < .001, d = 1.34; vs. novel cond.: p < .001, d = .99; vs. nostalgia cond.: p < .001, d = 1.52), positivity (vs. positive cond.: p < .001, d = 1.01; vs. novel cond.: p = .014, d = 0.65; vs. nostalgia cond.: p = .002, d = .72), and novelty (vs. positive cond.: p < .001, d = 1.87; vs. novel cond.: p < .001, d = 2.52; vs. nostalgia cond.: p < .001, d = 1.59) than those in the other three conditions, as expected. Additionally, events recalled in the nostalgic condition were rated higher in nostalgia than those in the novel condition (p = .004, d = .53), but did not significantly differ from those in the positive condition. Events recalled in the novel condition had higher ratings of novelty than those recalled in the positive (p < .001, d = .65) and nostalgic (p < .001, d = .93) conditions, which did not significantly differ from

one another. There were no significant differences in positivity ratings for events recalled in the positive, novel, and nostalgic conditions. Thus, nostalgic and novel events tended to be as high in positivity as those requested to be positive, and events requested to be nostalgic or positive tended to be similarly high in nostalgia. Nostalgic and positive events were rated significantly more novel than ordinary events, but not as highly as novel events.

9.2 | Main results

H1 and H5: We found the hypothesized main effect of condition on state Openness (F (3,265) = 3.94, p = .009, η_p^2 = .04). However, Tukey post hoc tests indicated that although participants who recalled positive (M = 3.34, SD = .65; p = .007 d = .57) and novel (M = 3.27, SD = .60; p = .047, d = .46) events had significantly higher state Openness scores than those who recalled an ordinary (M = 2.97, SD = .74) event, those who recalled nostalgic events did not (M = 3.22, SD = .61, p = .125, d = .39). The nostalgic, positive, and novel event conditions did not significantly differ from one another. Mean state Openness scores by event recall condition are displayed in Figure 1.

We preregistered the hypothesis that the main effect of condition would remain after adjusting for differences in age, gender, and trait Openness/Intellect, and Extraversion scores,

TABLE 4 Study 2 bivariate correlations ($N = 269$)

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Age																				
2 Gender	−0.052																			
3 Trait Openness/Intellect	.165**	−0.068																		
4 Trait Openness	.137*	0.069	.802**																	
5 Trait intellect	.125*	−.180**	.789**	.267**																
6 Trait Extraversion	0.102	0.048	.282**	.124*	.327**															
7 Event novelty	0.098	0.062	−0.094	−0.047	−0.103	0.036														
8 Event nostalgia	−0.016	0.084	0.076	0.097	0.024	0.069	.381**													
9 Event positivity	0.017	0.07	0.033	0.045	0.007	.187**	.208**	.405**												
10 Event sociality	−0.018	−0.023	0.084	0.005	.130*	0.083	−0.026	.171**	.255**											
11 Event negativity	−0.022	0.004	−.123*	−0.068	−.128*	−0.086	−0.094	−.326**	−.850**	−.225**										
12 Years since event	.166**	−0.103	0.108	0.043	.130*	0.09	.159**	.319**	.166**	.216**	−.145*									
13 Positive affect	0.052	−0.001	0.093	0.092	0.055	.223**	.139*	.323**	.686**	.141*	−.701**	0.107								
14 Self esteem	.145*	−0.006	.137*	.124*	0.093	.275**	.214**	.321**	.585**	0.07	−.573**	0.095	.737**							
15 Social connectedness	0.077	.129*	0.071	0.065	0.048	.267**	.144*	.315**	.602**	.142*	−.555**	.124*	.674**	.697**						
16 Meaning in life	0.074	.144*	0.101	.133*	0.027	.231**	.266**	.413**	.550**	.161**	−.473**	0.109	.620**	.753**	.684**					
17 State Openness	0.1	0.012	.207**	.256**	0.07	.175**	.283**	.391**	.300**	0.09	−.219**	0.094	.405**	.440**	.243**	.464**				
18 State Extraversion	0.001	0.011	0.069	0.069	0.041	.386**	.205**	.242**	.451**	.193**	−.344**	0.011	.563**	.572**	.506**	.554**	.422**			
19 State Agreeableness	.168**	0.067	.137*	.132*	0.086	.238**	.183**	.307**	.569**	.142*	−.547**	.155*	.657**	.695**	.677**	.643**	.506**	.538**		
20 State Conscientiousness	.190**	0.052	0.006	0.022	−0.012	.196**	0.057	0.037	.256**	−0.004	−.222**	−0.11	.396**	.480**	.337**	.390**	.435**	.458**	.485**	
21 State Neuroticism	−0.074	−0.052	−.135*	−0.061	−.156*	−.219**	−0.068	−0.103	−.484**	−0.011	.545**	−0.045	−.582**	−.619**	−.535**	−.521**	−.189**	−.458**	−.566**	−.374**

**Correlation is significant at the .01 level (2-tailed).

*Correlation is significant at the .05 level (2-tailed).

which it did (F (3,260) = 5.59, p = .001, η_p^2 = .06). Age and gender did not have an effect on state Openness scores. However, there was an effect of both trait Openness/Intellect (F (1,260) = 11.31, p = .001, η_p^2 = .04) and trait Extraversion (F (1,260) = 4.59, p = .033, η_p^2 = .02) on state Openness scores. Bonferroni adjusted post hoc comparisons indicated the same pattern of results as before the covariates were included, with only the positive (p < .001, d = .68) and novel (p = .01, d = .59) conditions significantly differing from the ordinary condition. Nostalgic, positive, and novel events did not differ significantly from one another. After the removal of outliers, trait Extraversion no longer had a significant effect on state Openness. Otherwise, the pattern of results was the same.

We also conducted an exploratory moderation analysis to test if the effect of event recall condition on state Openness was dependent on levels of trait Openness/Intellect. The interaction was not significant (ΔR^2 = .00, F (3, 261) = .13, p = .942).

H2: We next tested whether event positivity and event novelty would independently predict state Openness, now that novel events were no longer requested to be positive. We entered all event characteristics (nostalgia, novelty, positivity, sociality, negativity, and time since event occurred)[5] into a multiple regression with state Openness as the dependent variable. The model explained 20% of the variance in state Openness (R^2 = .20, F (6,260) = 10.79, p < .001). Event positivity (β = .22, p = .047, unique R^2 = .012) and novelty (β = .14, p = .023, unique R^2 = .016) were significant independent predictors of state Openness, supporting our hypothesis. In contrast to Study 1, event nostalgia (β = .28, p < .001, unique R^2 = .057) was the single largest predictor. Around half of the overall variance explained by the model was shared by these three predictors. No other variables were significant predictors.

Adding trait Openness/Intellect and Extraversion to the model explained an extra 5% of the variance (R^2 = .25, F (8,258) = 10.72, p < .001; R^2 change = .05, F (2,258) = 8.61, p < .001), but only trait Openness/Intellect was a significant predictor (β = .20, p = .001, unique R^2 = .035). Nostalgia (β = .27, p < .001, unique R^2 = .049), novelty (β = .16, p = .007, unique R^2 = .022), and positivity (β = .25, p = .027, unique R^2 = .014) remained significant predictors.

H3: We next assessed whether positive affect and self-esteem would independently predict state Openness. We entered all state functions of nostalgia (positive affect, self-esteem, social connectedness, and meaning in life) into a multiple regression with state Openness as the outcome. The model explained 28% of the variance in state Openness (R^2 = .28, F (4,264) = 26.12, p < .001). Positive affect (β = .23, p = .005, unique R^2 = .022), self-esteem (β = .20, p = .040, unique R^2 = .011), social connectedness (β = −.32, p < .001, unique R^2 = .041), and meaning in life (β = .39, p < .001, unique R^2 = .058) all significantly predicted state Openness. Our
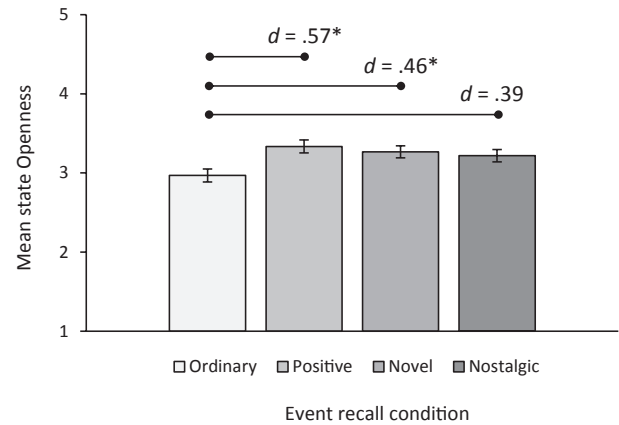

FIGURE 1 Average state Openness by event recall condition (+-SE). Significant differences are at p < .05

hypothesis was thus supported, though we did not make predictions regarding the role of social connectedness and meaning in life.

When trait Openness/Intellect and Extraversion were added to the model, an additional 2% of the variance was explained (R^2 = .31, F (6,262) = 19.14, p < .001; R^2 change = .02, F (2,262) = 4.00, p = .019). Trait Openness/Intellect (β = .14, p = .012, unique R^2 = .017), positive affect (β = .23, p = .004, unique R^2 = .022), social connectedness (β = −.31, p < .001, unique R^2 = .040), and meaning in life (β = .39, p < .001, unique R^2 = .057) were significant predictors, but self-esteem was not (β = .17, p = .077, unique R^2 = .008). Social connectedness may have functioned as a suppressor variable, given the change in sign between the bivariate correlation and beta. We also note that the alpha coefficient for this variable was questionable (.61), suggesting that the measurement may not be reliable.

H4: In an attempt to replicate the exploratory findings of Study 1, we hypothesized a serial indirect path from event recall condition (nostalgic, positive, or novel compared to ordinary) to state Openness via positive affect and self-esteem, as well as an indirect path via positive affect only. We tested this using Process v3.0 (Hayes, 2017) to specify a serial mediation model, including positive affect and self-esteem as mediators, with event recall condition as the multi-categorical predictor. The ordinary event condition was the reference category. Overall, the model explained 22.5% of the variance in state Openness. In the presence of these variables, only the novel condition had a direct effect on state Openness scores (b = .24, SE = .10, p = .024) compared to the ordinary condition. We did not find an indirect path via positive affect or self-esteem alone for any condition. However, there was a significant serial indirect path via positive affect and self-esteem for the nostalgic (b = .058, SE = .031, 95% CI = .002, .122) and positive (b = .098, SE = .035, 95% CI = .035, .172) conditions only. Our hypothesis was therefore partially supported.

Including trait Openness/Intellect and Extraversion as covariates did not change the pattern of results. When excluding outliers, there was a significant direct effect of the positive condition on state Openness scores compared to the ordinary condition ($b = .21$, $SE = .11$, $p = .023$). Otherwise, the pattern of results was the same. In sum, our hypothesis was partially supported for the nostalgic and positive conditions only. The model was consistent with our hypothesis of serial indirect paths for these conditions, but not an indirect path via positive affect only. These mediators did not explain the effect of the novel condition on state Openness. As the mediators were not manipulated and the model from Study 1 was not fully replicated, these results should be treated with caution. Alternative models may also be plausible.

10 | GENERAL DISCUSSION

Personality change is a growing field of interest, but relatively little work has examined changes in Openness. By focusing on states rather than traits, we sought to establish whether it is possible to influence momentary experiences of Openness, and through what mechanisms this effect may occur. In Study 1, we replicated a finding reported by van Tilburg and colleagues (2015) that reflecting on nostalgic experiences can increase Openness, and found that this effect was at the state, rather than trait, level. We also found that the effect was not dependent on levels of trait Openness. Further, we found that the effect extended to the recall of (positive) novel experiences, and that ratings of event positivity predicted state Openness. In Study 2, we replicated and extended these findings, showing that recalling *either* positive or novel experiences increased state Openness (though the effect of recalling nostalgic experiences did not reach significance). We also found that ratings of event positivity, novelty, and nostalgia independently predicted state Openness. Across both studies, we provided tentative support for the hypothesis that the mechanisms for these effects may be increased positive affect and self-esteem, which independently predicted state Openness. These findings contribute to the understanding of processes underlying changes in state Openness, and may also contribute to the development of interventions targeting trait-level change.

As far as we are aware, with the exception of Van Tilburg and colleagues (2015), who may have intended to investigate state-level change even if this was not made explicit, no previous research has attempted to experimentally influence levels of state Openness. Therefore, our findings make an important contribution to research in this area. A criticism of trait-level intervention studies is that reported changes may not reflect true change, but rather a temporary mood or state bias in self-perception, which may then revert to baseline levels (Brown, 2007; Querengässer & Schindler, 2014). Examining changes in states themselves reduces this uncertainty about whether effects are genuine. While the goal of researchers may be to understand change at the trait level, focusing on state dynamics represents a first step in this direction, as repeated changes in states may eventually result in trait-level change (Wrzus & Roberts, 2017).

Our research has confirmed a means by which state Openness may be influenced: via nostalgic reflection. Why might this be the case? Previous research on nostalgia has suggested that in everyday life it tends to occur following a negative mood, with its function being to increase positive affect, self-esteem, social connectedness, or sense of meaning in life, thereby reducing unpleasant feelings (Wildschut et al., 2006). We hypothesized positive affect and self-esteem would be the most likely mechanisms of an effect of nostalgia on Openness. Positive affect and self-esteem independently predicted state Openness in both our studies (in addition to meaning in life in Study 2). The mediation models we tested supported our hypothesis in Study 1, and provided partial support in Study 2, though we acknowledge that as the mediators were not experimentally manipulated, we cannot be sure of the direction of these relationships. However, our findings are in line with experience sampling studies which have found associations between state Openness and both self-esteem (Magee & Biesanz, 2019) and positive affect (Wilson et al., 2016). Additionally, trait-level studies suggest that changes in Openness may occur through feelings of mastery and self-empowerment (Mühlig-Versen et al., 2012; Zimmermann & Neyer, 2013). Further, our findings are in keeping with the broaden and build theory of positive emotions (Fredrickson, 2001), which suggests a bidirectional relationship between positive affect and state Openness. Both of our studies found support for a serial indirect path via positive affect and self-esteem (with the exception of the novel condition in Study 2). Although other models may be plausible, conceptually this finding aligns with research suggesting that positive affect can lead to increased self-esteem (Benetti & Kambouropoulos, 2006; Liu et al., 2014).

We also proposed that the content of nostalgic reflections may be an important factor in their effect on state Openness, namely that nostalgic events may be higher in the trait-relevant characteristic of novelty. We theorized that recalling involvement in positive novel events could boost positive feelings and self-esteem, due to having successfully navigated the novel experience, and that the combined result would be to encourage Openness toward future exploration. We found that nostalgic events were indeed rated significantly higher in novelty than ordinary events. Importantly, we also found that asking participants to recall a novel event had a similar effect on state Openness to a asking them to recall a nostalgic event.

Some inconsistencies between the two studies require further interpretation. In Study 2, there was no significant difference between state Openness scores in the nostalgic versus ordinary event recall conditions. However, the nostalgic,

positive, and novel conditions did not significantly differ from one another, and the size of the difference between the nostalgic and ordinary conditions was small-moderate, despite the lack of significance. This suggests that a reliable effect could be apparent with further replications. Perhaps more importantly, ratings of event nostalgia were the single largest event characteristic to predict state Openness in Study 2, and were similarly high in all three experimental conditions. We can thus infer that participants requested to reflect on a positive or novel event are likely to experience nostalgia while doing so. We also found in Study 2, where the positive and novel conditions were separated, that event positivity and novelty had independent predictive value with regard to state Openness. Overall, this pattern of results suggests that requesting participants recall events that are both positive and novel is most likely to reliably produce both an experience of nostalgia, and greater state Openness.

We note that although in Study 1 there was an indirect path from recalling nostalgic and novel events to state Openness via positive affect and self-esteem, in Study 2 this was not the case for novel events. As ratings of event novelty and positivity were more modestly correlated in Study 2, it may be that for positive affect to be induced, novel events should be specifically requested to be positive. Reflecting on novel experiences may affect state Openness through additional processes we did not capture in the present studies.

We had concerns that due to the positive wording of the state functions in Study 1, and the inclusion of the state Openness items in the same questionnaire, common method variance may have explained the high correlations between them. Therefore, in Study 2, we addressed this issue by separating the questionnaires and including negatively worded items in each. The amount of variance in state Openness explained by the state functions was reduced, but still substantial. Importantly, the main effect of condition on state Openness was replicated.

11 | LIMITATIONS AND FUTURE DIRECTIONS

As we did not measure state personality prior to the manipulation, we cannot be sure whether state Openness increased or decreased as a function of the event recall condition. It is conceivable that reflecting on an ordinary and uninspiring event may have decreased state Openness, rather than nostalgic recall increasing it. Future research could include a control condition involving an unrelated neutral task to clarify the direction of the effect. However, the implication that Openness is sensitive to affect remains the same. Additionally, our findings support a systematic body of research on the positive effects of nostalgia on other outcomes (Cheung et al., 2016; Stephan et al., 2015; Wildschut et al., 2006).

It is unclear why van Tilburg et al. (2015) found an effect on trait Openness, when in our study the effect was on state rather than trait scores. We suggested that their finding may reflect a temporary change in self-perception due to a state-congruent bias in reporting, if the effect was actually on state Openness. We modified the instructions for our trait outcome measure to encourage participants to reflect on their current state when responding, but still found no effect. It could be that the trait measure we used, the BFAS, is less amenable to mood or state influences than the BFI. Future research could address whether this is the case.

With regard to our mediation models, we acknowledge that a casual effect of the mediators cannot be confirmed. Admittedly, it is difficult when speaking of affective states and personality states to determine which precedes the other, as the time course of each is not defined and they may be experienced simultaneously. As one of the goals of personality research is to uncover mechanisms which produce personality states (Fleeson, 2017), in the models tested we have taken the position that positive affect is a determinant rather than a consequence of state Openness. The opposite could be argued, however, and the broaden and build theory suggests that the relationship may go both ways (Fredrickson, 2001). Future research could investigate this issue further by systematically manipulating the valence of each event type recalled.

A possible drawback of our design is that the state Openness stem in both studies asked participants how reflecting on their past experiences made them "feel," which we acknowledge is an ambiguous term that can refer to affect as well as perception. We chose this stem to be in keeping with the established wording used to assess the state functions of nostalgia, and because we thought it would encourage self-awareness and evaluation of internal states. While the Openness adjectives themselves (e.g., curious, imaginative) did not imply affective content, the instruction may nevertheless have encouraged a focus on affect, and thus, increased the similarity of responses between the post-recall measures. Additionally, it referred to causality and the IV itself. Future research could consider how best to phrase assessments of internal states (as opposed to outward manifestations of behavior), which would be particularly relevant to measurement of Openness as it comprises largely cognitive content (Wilt & Revelle, 2015).

A strength of our research is that we used nonstudent samples, with a greater mean age and age range than typical student samples. However, future research could investigate whether the effects hold or are perhaps enhanced in different age groups, such as older adults, who may experience additional benefits from nostalgia (Abeyta & Routledge, 2016). Future research could also assess whether the effects we found extend to measures of behavior, in addition to self-reported states. For example, do participants demonstrate greater exploratory behavior, or a

higher tolerance for uncertainty, when experiencing greater state Openness?

12 | CONCLUSION

In summary, our findings represent an important contribution to the literature on the dynamics of state personality, providing an indication of what may cause individuals to feel more open, and what might lead to enduring trait-level change. Importantly, our findings were not dependent on levels of trait Openness, implying that this approach can be equally beneficial for people low or high in trait Openness. We suggest that future Openness interventions consider promoting positive affect and self-esteem, and that nostalgic reflection on positive, novel experiences may be a promising way to do so.

CONFLICT OF INTEREST
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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ENDNOTES
[1] We also preregistered and tested a hypothesis regarding the effect of event recall condition on state Extraversion, which is conceptually linked with Openness under the broader trait of plasticity (DeYoung, 2006). For brevity, these results are included in the supplementary materials.

[2] This was incorrectly stated as seven items per state in the preregistration.

[3] Analyses of the effect of condition on state Extraversion are included in the supplementary materials

[4] The inclusion of these covariates was preregistered for the primary hypothesis (H1/H5) only. Therefore, their inclusion in additional analyses can be considered exploratory.

[5] Due to concerns about overlap between time since the event occurred and nostalgia, and between event negativity and positivity, we repeated the analysis hierarchically, with time and negativity added in a second step. The pattern of results in step one was the same (positivity $\beta = .16$, $p = .01$; novelty $\beta = .14$, $p = .02$; nostalgia: $\beta = .27$, $p < .001$), and the second model did not explain any additional variance ($\Delta R^2 = .00$, $F(2, 260) = .54$, $p = .584$).

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