Original Article

Episodic Memory Reliving and Personality

Do Good *Time Travelers* Have Distinctive Personality Profiles?

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Abstract: There are considerable individual differences in remembering past episodes. The current study aimed to examine the link between episodic memory reliving and the Five-Factor Model personality traits. Altogether 422 participants (67% women) described an autobiographical episode and rated the vividness and clarity of that recollection. Next, they assessed their general tendencies of autobiographical recollections, which resulted in two autobiographical episodic memory scores (AEMS) for each participant – episodic and general. Participants also filled in the Estonian version of the International Personality Item Pool NEO questionnaire. Findings from partial correlation analysis (controlling for age and gender) revealed distinguishable patterns of associations for the episodic and general-level reports of memory reliving: the episodic AEMS was positively associated with E4: Activity Level and E1: Friendliness, whereas the general AEMS was negatively correlated with N4: Self-Consciousness, and positively with E1: Friendliness, E6: Cheerfulness, O1: Imagination, O5: Intellect, C2: Orderliness, and C3: Dutifulness (all significant at $p < .005$). The associations between the general (but not the episodic) AEMS and personality facets were significantly correlated with the average social desirability ratings of the respective facets. We conclude that greater social adaptation together with the motivation of positive self-perception are plausible explanations of the links between personality traits and reporting the quality of reliving personal memories.

Keywords: episodic memory, mental time travel, social desirability, five-factor model of personality

The episodic memory system contains sensory, cognitive, and affective details that invoke visual imagery and autonoetic experience of mentally "reliving" a past event (Wheeler et al., 1997) and traveling back in time (Nyberg et al., 2010). There are individual differences in mental time travel tendencies, ranging from severely deficient memory (e.g., Palombo et al., 2015) to individuals with highly superior autobiographical memory (e.g., LePort et al., 2015). Most people are located somewhere between these two extremes. Previous research has suggested that differences in episodic memories are linked to personality (e.g.; Amrhein et al., 1999; Fossati et al., 2004; Kamiya & Ito, 2000; Klaming et al., 2017; Quoidbach et al., 2008; Rasmussen & Berntsen, 2010; Rubin & Siegler, 2004; Rönnlund et al., 2011; Sutin & Robins, 2008a). However, only a handful of these studies have measured personality traits according to the Five-Factor Model (FFM), which is the most widely used model of personality structure (Soto et al., 2016), consisting of a set of trait dimensions (Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness) that efficiently capture a wide range of individual differences in personality (Soto et al., 2016). Only a couple of those studies (e.g., Sutin & Robins, 2008a) have looked at these associations at the level of specific FFM facets, which are more unique aspects of personality traits. This study focuses specifically on examining the FFM domains and facets associated with autobiographical time travel tendencies.

The two most important aspects of re-experiencing past situations seem to be the accompanying mental imagery and emotional engagement (Boyer, 2008) – constructs which are also to some extent represented in personality models. For example, Openness to Experience includes narrower facets describing having a vivid imagination as well as attentiveness to – and intense experience of – emotions. A previous study indeed found that open individuals remember differently due to their enhanced creative and narrative abilities (Rasmussen & Berntsen, 2010). Relationships of Extraversion and Neuroticism with affective reactivity – an important aspect of personal memories – have been well-documented (e.g., Clark et al., 1994). Extraversion has a relevant role in the retrieval and reliving of positive

autobiographical memories (e.g., Denkova et al., 2012), whereas self-generating vivid thoughts have been argued to be the hallmark of the neurotic individual (Perkins et al., 2015; Quoidbach et al., 2008). At a more specific level, reliving past events is associated with two emotion-related facets – O3: Openness to Feelings as well as E6: Cheerfulness (Rubin & Siegler, 2004).

It is possible that memory reliving and personality dispositions are associated because they are all part of the wider personality system. From the perspective of different personality layers (see McAdams & Pals, 2006), we speculate that reliving autobiographical memories is one of the many characteristic adaptations, which help the individual fit into the ever-changing social environment (McCrae & Costa, 1999). Although autobiographical (e.g., self-defining) memories have previously been regarded as part of the narrative identity (McAdams & Pals, 2006), we argue that autobiographical recollection could be – through its motivated nature – one of the important factors of coping with challenges and adapting to the social world. At large, adaptive coping (e.g., Carver & Connor-Smith, 2010), as well as other favorable life outcomes (Roberts et al., 2007), have been associated with low levels of Neuroticism and high levels of Extraversion, Openness to Experience, Agreeableness, and Conscientiousness indicating a well-adjusted personality profile.

The Present Study

The main aim of the present study was to find out which FFM domains and facets are most strongly associated with memory reliving tendencies. To examine this, we constructed a measure (Autobiographical Episodic Memory Scale or the AEMS), which was partly based on previous questionnaires measuring self-reported episodic memory characteristics (D'Argembeau & Van Der Linden, 2006; Fitzgerald & Broadbridge, 2013; Greenberg et al., 2005; Johnson, 1994; Palombo et al., 2015; Sutin & Robins, 2007). The AEMS differs from previous self-report memory scales by its two-focused approach to exploring remembering: participants are asked to rate a single episode (AEMS-Episode) as well as their general tendencies of recalling past events (AEMS-General), enabling us to explore the personality-associations of memory reliving separately at two distinct levels. Based on the research literature cited above, we predict that both the AEMS-Episode and the AEMS-General are most strongly associated with the facets of Openness to Experience and Extraversion. Considering the importance of emotional experience in the retrieval of episodic and autobiographical memories, we also expect the AEMS-Episode to be significantly associated with some of the "affective" facets of Neuroticism (such as N3: Depression) and Extraversion (such as E6: Cheerfulness;

Schimmack et al., 2004). As an additional exploration, we examined the links between the AEMS-personality associations and the social desirability of personality traits. Emotionally and socially well-adjusted personality is generally considered desirable, given the advantages it can provide in the social world. Significant associations of reliving personal memories with socially desirable personality profiles could provide preliminary support regarding autobiographical memory reliving as a characteristic adaptation.

Method

Participants

Altogether, 422 respondents participated in this study. Sixty-six percent (279) of participants were women. The mean age of the participants was 22.4 years (SD = 6.5), ranging from 16 to 58 years; about half of the participants were aged 19–21 years. In subsequent analyses, three participants were removed from analyses due to being younger than 16 years. Of all the participants, 55% had completed secondary education, 25% had higher (tertiary) education, 8% had completed post-secondary vocational education, and 12% had compulsory elementary education (i.e., 9 years in Estonia). The data were collected from 2008 to 2011. The majority of participants (75%) filled in all questionnaires (which took about 1 hr) using an online survey platform, but there was also an opportunity to complete a paper questionnaire. If requested, participants received feedback about their personality traits. Most participants were recruited from the local university. The remaining part of the sample consisted of the acquaintances and relatives of recruited students (to increase the sample's age range and variability of education level). According to a post hoc calculation, to detect a simple correlation of $r = .21$ (an average the published effect in the field of personality; see Richard et al., 2003), using 0.5% significance level (see Benjamin & Berger, 2019) with 80% power, the required sample size is approximately $n = 296$, but detecting a slightly smaller correlation (e.g., $r = .18$) requires studying over 400 participants ($n = 405$, respectively).

Materials

Autobiographical Episodic Memory Scale (AEMS)

Participants were instructed to retrieve a personally experienced memory episode from their relatively recent past. The episode should have taken place more than 1 month, but no more than 5 years prior, and be related to a specific time and place. Apart from these restrictions, memory episodes were freely chosen. Participants were first instructed

to describe this memory episode briefly in their own words. Variety of episodes was represented, but the most frequent content categories of specific memories were different public events (such as concerts and gatherings; n = 32), graduation ceremonies (n = 28), unlucky incidents (n = 28) and traffic accidents (n = 21), outings (n = 28), examinations (n = 26), and birthdays (n = 26). In addition, many accounts were combinations of different events. The descriptions varied greatly in length: from 4 words to 655 words. The mean word count of the specific episode description was 63.1 (SD = 65.8), with a median of 44.

After the free description, participants were asked to make various judgments about the episode. They were instructed to rate the extent of their agreement with the items they were judging on a 5-point Likert-type scale (1 = *do not agree at all*; 5 = *totally agree*). Items adapted from previous memory rating scales (D'Argembeau & Van Der Linden, 2006; Greenberg et al., 2005; Sutin & Robins, 2007) were supplemented with various additional items. The items concerning time travel were part of a larger measure describing different qualities of the memory event, but in this study, 19 items (e.g., "As I recall this event, I get the feeling of having travelled back in time") were selected because of their high loadings on the first principal component. Reverse coded items were also used (8 items in the first part of the AEMS) to reduce acquiescence bias. The reversed items referred to the vagueness, fogginess, and unreality of the recalled episode. Cronbach's α for the 19 AEMS-Episode items was .84, and the average inter-item correlation was r = .22. Participants also rated the emotional valence of the reported memory episode: most episodes were positive in valence (n = 322, 77%).

In the second part of the questionnaire, participants were instructed to rate the characteristics of their autobiographical memories in general. The questionnaire included further items about different autobiographical memory characteristics, but again, 19 items (e.g., "When I think about past events, I usually feel like going back to the moment when these events took place") about the general reliving of past episodes were analyzed here (eight items were reverse coded). Items were rated on a 5-point Likert-type scale (1 = *do not agree at all*; 5 = *totally agree*). Cronbach's α for the scale of the 19 AEMS-General items was .89 and the average inter-item correlation was r = .30. The specific and general subscales of the AEMS were significantly related to each other, r = .51, p < .001. All items of the AEMS scales can be found in the Electronic Supplementary Material, ESM 1 (Table E1).

Personality Traits

Personality traits were measured by the 240-item Estonian version of the International Personality Item Pool NEO (EE.PIP-NEO; Mõttus et al., 2006), which is an adaptation of the International Personality Item Pool (IPIP; Goldberg et al., 2006). Like its original, the EE.PIP-NEO assesses the FFM personality domains – Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A), and Conscientiousness (C). Each of these is described by six facet scales/subscales, each of which is measured by eight items. Items are rated on a 5-point Likert-type scale (0 = *do not agree at all*; 4 = *totally agree*). The structure of the EE.PIP-NEO is analogous to the NEO PI-R (Costa & McCrae, 1992) and it has psychometric properties comparable to those of the NEO PI-R (Mõttus et al., 2006). On average, the Cronbach's αs of the EE.PIP-NEO facet scales (M_α = .79) are slightly higher than those of the NEO PI-R facet scales (M_α = .76; Mõttus et al., 2006).

Social Desirability Ratings

Previously, an independent group of participants (n = 124; 68% women; M_{age} = 19.4, SD = 1.1) had rated social desirability of each of the 240 EE.PIP-NEO (Mõttus et al., 2006) items. These data were collected as part of a separate study, during an introductory psychology course in 2005. Students were given the following instruction:

> Some personality characteristics are considered more socially desirable receiving approval from other people, whereas others are undesirable. If someone agrees strongly with this item – does this present that person in favourable or unfavourable light, or is agreeing with this item neutral as regards to others' approval?

Ratings were made on a 7-point Likert scale ranging from 1 = *extremely undesirable* to 7 = *extremely desirable*, with 4 as neutral (Konstabel et al., 2006). Ratings of these 240 items were averaged across respondents and thereafter averaged across facet scales to obtain the mean social desirability ratings of 30 personality facets. The mean scores of average ratings varied from 2.2 (SD = 0.4, for N3: Vulnerability) to 5.9 (SD = 0.2; for E1: Friendliness).

Results

Preliminary Analyses of the AEMS

Means and SDs of AEMS-Episode and AEMS-General scores (as well as those of personality traits and facets) can be found in ESM 1 (Table E2). According to the preliminary analyses, women had slightly higher scores than men in case of both AEMS-Episode (t = 3.25, p = .001, Cohen's d = 0.33) and AEMS-General (t = 2.55, p = .011, Cohen's d = 0.28). The age of the respondent was not statistically significantly (p < .05) correlated with either of the AEMS scores.

Associations Between the AEMS and Personality Traits

We calculated partial correlations between the five domains and 30 facets of EE.PIP-NEO and the AEMS-Episode and AEMS-General scores when controlling for age and gender. All partial correlations between personality and the AEMS scores can be found in Table 1 and all zero-order correlations are shown in ESM 1 (Table E3).

AEMS and the FFM Personality Domains

AEMS-Episode was not significantly ($p < .005$, see Benjamin & Berger, 2019) correlated with any of the broad traits. There was a trend toward a significant correlation only in case of Extraversion, $r = .13$, $p = .009$, 95% CI [.04; .22]. The AEMS-General was negatively correlated with Neuroticism ($r = −.16$, 95% CI [−.25; .07]) and positively with Extraversion ($r = .15$, 95% CI [.06; .24]), Openness to Experience ($r = .15$, 95% CI [.06; .24]), and Conscientiousness ($r = .16$, 95% CI [.07; .25]; all significant at $p < .005$).

AEMS and the 30 Personality Facets

As seen in Table 1, the AEMS-Episode was significantly ($p < .005$) correlated with two facets of Extraversion: E4: Activity Level ($r = .17$, 95% CI [.08; .26]) and E1: Friendliness ($r = .15$, 95% CI [.06; .24]). The AEMS-General was significantly correlated with seven personality facets – negatively with the N4: Self-Consciousness facet ($r = −.16$, 95% CI [−.25; .07]), and positively with E1: Friendliness ($r = .19$, 95% CI [.10; .28]), E6: Cheerfulness ($r = .15$, 95% CI [.06; .24]), O1: Imagination ($r = .15$, 95% CI [.06; .24]), O5: Intellect ($r = .16$, 95% CI [.07; .25]), C2: Orderliness ($r = .15$, 95% CI [.06; .24]), and C3: Dutifulness ($r = .14$, 95% CI [.05; .23]; all significant at $p < .005$).

Exploratory Analysis: The Role of Social Desirability in the AEMS

The pattern of findings reported above points to possible associations of AEMS-General with a socially desirable personality profile. Therefore, we decided to carry out a data-driven exploratory analysis to examine this possibility. For both episodic and general AEMS, we took the partial correlations (controlling for age and gender) with 30 personality facets and correlated (using Spearman's ρ) these with the average social desirability ratings of the respective personality facets that had been previously provided by an independent panel of judges. For these analyses, we reflected the facets of Neuroticism into Emotional Stability, as this allows the direction of effects to be consistent across the FFM traits. Results showed that there was a significant

Table 1. Partial correlations between Autobiographical Episodic Memory Scale (AEMS) and personality domains and facets (controlling for age and gender)

EE.PIP-NEO domains/facets	AEMS-Episode Pearson r [95% CI]	AEMS-General Pearson r [95% CI]
Neuroticism	−.08 [−.17; .02]	**−.16**** [−.25; .07]
Extraversion	.13 [.04; .22]	**.15*** [.06; .24]
Openness to Experience	.06 [−.04; .16]	**.15*** [.06; .24]
Agreeableness	.05 [−.05; .15]	.11 [.01; .20]
Conscientiousness	.05 [−.05; .15]	**.16**** [.07; .25]
N1: Anxiety	−.08 [−.17; .02]	−.07 [−.16; .03]
N2: Anger	.03 [−.07; .13]	−.12 [−.21; .02]
N3: Depression	−.04 [−.14; .06]	−.11 [−.20; −.01]
N4: Self-Consciousness	−.12 [−.21; .02]	**−.16**** [−.25; .07]
N5: Immoderation	−.07 [−.17; .03]	−.09 [−.18; .01]
N6: Vulnerability	−.07 [−.17; .03]	−.13 [−.22; −.04]
E1: Friendliness	**.15*** [.06; .24]	**.19**** [.10; .28]
E2: Gregariousness	.04 [−.06; .14]	.05 [−.05; .15]
E3: Assertiveness	.08 [−.02; .18]	.13 [.04; .22]
E4: Activity Level	**.17**** [.08; .26]	.12 [.02; .21]
E5: Excitement-Seeking	.00 [−.10; .10]	.02 [−.08; .12]
E6: Cheerfulness	.12 [.02; .21]	**.15*** [.06; .24]
O1: Imagination	.05 [−.05; .15]	**.15*** [.06; .24]
O2: Artistic Interests	−.01 [−.11; .09]	.10 [.00; .19]
O3: Emotionality	.06 [−.04; .16]	.07 [−.03; .17]
O4: Adventurousness	.05 [−.05; .15]	.00 [−.10; .10]
O5: Intellect	.03 [−.07; .13]	**.16**** [.07; .25]
O6: Liberalism	.06 [−.04; .16]	.06 [−.04; .16]
A1: Trust	−.02 [−.12; .08]	.08 [−.02; .18]
A2: Morality	.10 [.00; .19]	.13 [.04; .22]
A3: Altruism	.07 [−.03; .17]	.11 [.01; .20]
A4: Cooperation	.03 [−.07; .13]	.04 [−.06; .14]
A5: Modesty	−.04 [−.14; .06]	.01 [−.09; .11]
A6: Sympathy	.08 [−.02; .18]	.08 [−.02; .18]
C1: Self-Efficacy	.01 [−.09; .11]	.13 [.04; .22]
C2: Orderliness	.09 [−.01; .18]	**.15*** [.06; .24]
C3: Dutifulness	.04 [−.06; .14]	**.14*** [.05; .23]
C4: Achievement Striving	.04 [−.06; .14]	.12 [.02; .21]
C5: Self-Discipline	.05 [−.05; .15]	.11 [.01; .20]
C6: Cautiousness	−.03 [−.13; .07]	.08 [−.02; .18]

Note. $N = 418$. The values in bold are statistically significant at $p < .005$. 95% CI = 95% confidence interval of the Pearson correlation. EE.PIP-NEO = Estonian version of the International Personality Item Pool NEO. *$p < .005$; **$p < .001$.

positive correlation of the socially desirable profile with the associations between the AEMS-General and personality facets (Spearman's ρ = .41, $p = .024$, 95% CI [.07; .76]; see Figure 1). Social desirability was not significantly correlated with the associations between the AEMS-Episode and personality (Spearman's ρ = .10, $p = .611$, 95% CI [−.35; .54], see Figure E1 in ESM 1).
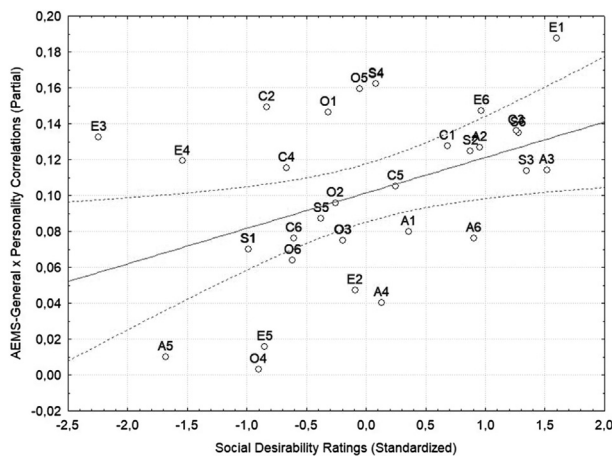
Figure 1. Partial correlations between general assessments of the Autobiographical Episodic Memory Scale (AEMS-General) and thirty personality facets, and the average social desirability ratings of the respective personality facets (standardized). Solid line shows the linear trend and the dotted lines show the 95% confidence interval. Personality self-reports and social desirability ratings were obtained using the Estonian version of the International Personality Item Pool NEO questionnaire (EE.PIP-NEO). S1–S6 refer to facets of Emotional Stability (i.e., reversed facet scales of Neuroticism), E1–E6 refer to facets of Extraversion, O1–O6 refer to facets of Openness to Experience, A1–A6 refer to facets of Agreeableness, and C1–C6 refer to facets of Conscientiousness.

Discussion

According to previous studies, Extraversion seems to facilitate and Neuroticism to inhibit episodic memory performance (Arbune et al., 2015; Bombardier et al., 2016; Klaming et al., 2017; Quoidbach et al., 2008; Siegler et al., 1991), but there is no clear evidence that vivid autobiographical memories are associated with any specific personality profile at the level of personality facets. Based on the scarce research literature, we expected that the quality of autobiographical memories (i.e., the AEMS-Episode and AEMS-General scores) is most strongly associated with the imagination- and emotion-related personality facets from the Openness to Experience and Extraversion domains, and we also predicted that the AEMS-Episode would be associated with the "affective" facets of Neuroticism and Extraversion.

When controlling for age and gender, Neuroticism was significantly negatively and Extraversion, Openness to Experience, and Conscientiousness positively associated with the AEMS-General, that is, how people evaluate their overall episodic memories. People with higher scores of AEMS-General scored also higher on E1: Friendliness, E6: Cheerfulness, O1: Imagination, O5: Intellect, C2: Orderliness, and C3: Dutifulness, and lower on N4: Self-Consciousness. The reliving of a single episode (the AEMS-Episode) was not significantly associated with any of the FFM

domains (at $p < .005$), but it was correlated with the E4: Activity Level and E1: Friendliness facets from the Extraversion domain. Thus, looking at the results of this study, the association between personality traits and remembering past experiences appears to be somewhat different for how people describe the reliving of a single memory episode and how they assess their general recollection tendencies.

For some reason, people who are more active and outgoing, who do and interact more (i.e., have higher levels of E4: Activity Level and E1: Friendliness), described their specific memory episodes as more vivid and rich in detail, compared to those who are less lively and warm. It is possible that we were unable to detect some other personality effects due to the variability of the reported memory episodes – participants of this study described episodes of different topics, time frames, and emotional valence. In future research, it would be useful to analyze the personality correlations separately for positive and negative memory events. This could not be done in this study due to the small proportion of negative episodes (less than 20%). Therefore, there remains a possibility that exploring the personality associations of just negatively valenced memories would yield different results.

Regarding the general assessments of memory reliving, we found significant associations with Openness to Experience, which was in line with previous research showing that open individuals remember differently due to their enhanced creative and narrative abilities (Rasmussen & Berntsen, 2010). In addition, the facet-level personality associations were not only "affective" (e.g., with E6: Cheerfulness), but also "social" in nature. Namely, the significant negative correlation with N4: Self-Consciousness and positive correlation with E1: Friendliness seem to suggest the importance of social feelings and behavior in autobiographical time travel. These findings lend some support to the idea that autobiographical remembering is linked to how individuals adapt to their social environment. The significant negative association of AEMS-General with Neuroticism and positive correlations with Conscientiousness pointed to the possible link with a socially desirable personality profile, which was confirmed by an exploratory analysis. More specifically, there was a statistically significant trend toward reporting more vivid recall tendencies in association with personality traits that are regarded as socially desirable. We could speculate that vivid autobiographical recollection has an important advantage in social life, facilitating social adjustment. It is possible that mental time travel and autobiographical remembering, in general, is one of the motivational tools for defining how individuals perceive themselves (McAdams & Pals, 2006). Studies have indeed shown that episodic recollection helps us identify people (MacKenzie & Donaldson, 2016) and make rapid social inferences (Klein et al., 2009). According to

Davidson et al. (2012), episodic memory may serve as a kind of "social glue," enabling people to form and maintain social bonds more easily.

As an alternative explanation, however, people's descriptions of their personality traits and general tendencies to recollect past events may be to some degree affected by the response bias of presenting one-self – intentionally or unintentionally – in a desirable and positive manner. Research has shown that people with higher self-esteem tend to self-enhance more over a variety of contexts (e.g., Kwan et al., 2004). Different self processes, including the motive for self-esteem, play an active role already in the retrieval of personal memories (Sutin & Robins, 2008b). One of the mechanisms of the desired self-perception is a selective recall of autobiographical memories, as motivation selectively increases the accessibility of information consistent with the desired self (Brunot & Sanitioso, 2004). At present, it remains unanswered why social desirability played no significant role in how people recalled a specific episode. It is plausible that the decision of choosing the memory episode for detailed evaluation was influenced by self-presentational or self-esteem motives, to begin with. Future research should address the possibility that socially desirable personality profiles could be associated with reporting specific types of memory episodes (e.g., regarding sensitive topics).

In conclusion, our findings indicated a distinctive personality profile of individuals with vivid and detailed episodic memories, highlighting the role of Extraversion (especially the subscales tapping activity level and friendliness) in reliving a single episode, and a more varied set of socially desirable traits (including lower levels of N4: Self-Consciousness, and higher levels of E1: Friendliness, E6: Cheerfulness, O1: Imagination, O5: Intellect, C2: Orderliness, and C3: Dutifulness) when assessing the recollection of autobiographical memories in general. Greater social adaptation together with the motivation of positive self-perception are possible explanations to the links between personality traits and reporting the general quality of reliving personal memories.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at https://doi.org/10.1027/1614-0001/a000353

ESM 1. Autobiographical episodic memory scale (AEMS) items (Table E1); means and standard deviations of key variables (Table E2); zero-order and partial (controlling for age and gender) correlations of AEMS-episode and AEMS-general with personality facets and domains (Table E3);

associations between the AEMS-episode–personality correlations and social desirability ratings of personality (Figure E1)

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