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Mental transportation mediates nostalgia's psychological benefits

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ABSTRACT

Nostalgizing confers social, existential, and self-oriented psychological benefits or functions. But how does the experience of nostalgia conduce to these functions? We propose that it does so, in part, through mental transportation, which involves mentally leaving one's current space and transporting oneself into a past event. We addressed the role of mental transportation in one daily diary study and two experiments ($N = 514$). By assessing daily experiences of nostalgia in Study 1, we found that, on days in which participants felt more nostalgic, they were more likely to experience mental transportation. Following a narrative induction of nostalgia, we assessed mental transportation (Studies 2 and 3) and the three putative nostalgia functions: social, existential, self-oriented (Study 3). Nostalgic (vs. control) participants reported greater mental transportation (Studies 2 and 3), which in turn was associated with stronger functions (Study 3). The findings portray mental transportation as a key mechanism underlying the psychological benefits of nostalgia.

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Nostalgia confers psychological benefits, but how? Popular media depictions of nostalgic recollections are often characterised by a theme of reliving or flashing back (i.e. transporting) to an earlier time. Further, laypersons assert that, in addition to sentimental longing, reliving is a key component of the nostalgic experience. Given the apparent centrality of reliving in nostalgic experience, we asked, for the first time, whether mental transportation is intensified by nostalgia and conduces to its benefits.

Nostalgia and its functions

Dictionary definitions describe nostalgia as an emotion that entails sentimentality and wistfulness (Sedikides et al., 2015). Investigations of layperson definitions identify similar core features, with added cognitive components of reflecting and reliving (Hepper et al., 2012). Although these definitions often include seemingly negative features, such as missing and yearning, nostalgia is primarily a positive emotion involving

contentment or joy (Sedikides & Wildschut, 2016a; Van Tilburg et al., 2019). It is also a universal emotion (Hepper et al., 2014) experienced across the lifespan (Madoglou et al., 2017; Wildschut et al., 2018). Overall, nostalgia involves a tender, fond, and somewhat rosy reflection of momentous events from one's past (e.g. birthdays, anniversaries, graduations, vacations) accompanied by a tinge of longing.

The most common nostalgia induction over the last 15 years has been the Event Reflection Task (ERT; Sedikides et al., 2015; Wildschut et al., 2006). The ERT involves autobiographical memory immersion. In particular, participants muse over and write about a nostalgic (vs. ordinary) event from their lives. The ensuing literature has documented three broad psychological benefits (or functions) of nostalgia. One benefit is *social* (Sedikides & Wildschut, 2019). Nostalgia increases social connectedness, a sense of acceptance and belongingness. Another benefit is *existential* (Sedikides & Wildschut, 2018). Nostalgia strengthens the perception that one's life has a sense of personal

meaning (Routledge et al., 2012). The third benefit is *self-oriented* (Sedikides & Wildschut, 2016b, 2020). Nostalgia raises self-esteem (Wildschut et al., 2006), optimism (Cheung et al., 2013), inspiration (Stephan et al., 2015), and self-continuity (i.e. a sense of connection between one's past and present selves; Sedikides et al., 2016).

How nostalgia confers these psychological benefits is not well-understood. Nostalgia may be a mostly positive emotion, but appraising the experience as positive does not explain the relation between nostalgia and its functions (Sedikides et al., 2015; Sedikides & Wildschut, 2016a) nor does it explain why recalling positive non-nostalgic events fails to confer the same functions (Routledge et al., 2012; Van Tilburg et al., 2015). Furthermore, nostalgia involves memory, but it is unlikely that simply remembering the name of one's childhood pet or favourite toy heightens the abovementioned benefits. There seems to be something special, an extra step, involved in nostalgia that accounts for its experiential and psychological profile.

Nostalgia and mental transportation

Reliving, a central cognitive feature of nostalgia (Hepper et al., 2012), offers a clue. Nostalgia is not experienced by merely recalling details of an important life event. It also entails mental time travel to the event and re-experiencing it as if one were there. This is consistent with *autonoetic consciousness*, an imagery-based mental process associated with episodic memory (Wheeler et al., 1997) and autobiographical recall (Conway & Pleydell-Pearce, 2000).

Autonoetic consciousness is a form of mental transportation. It ensues from episodic and autobiographical memory retrieval based in mental imagery (Conway & Pleydell-Pearce, 2000; Wheeler et al., 1997). When momentous memories are encoded, they include detailed imagery associated with the relevant event ("event-specific knowledge;" Conway, 1990). Imagery becomes part of the memory schema for that event. At retrieval, the imagery mapped to the event-specific schema is activated through a spreading activation process (Conway, 1997), and its activation in consciousness allows the fluent re-experience of the event. Critically, imagery-based memory processes, such as mental transportation, have been associated with positive social outcomes (Conway & Pleydell-Pearce, 2000), and evidence has linked the experience of scent-triggered autonoetic

consciousness (the "Proust Effect;" Chu & Downes, 2000) to nostalgia and its benefits (Reid et al., 2015).

Mental transportation has garnered wider empirical interest. Green and Brock (2000) focused on the capacity for transportation into fictional narratives ("transportability;" Zheng, 2014). Green and Brock's (2000, 2002) theory of mental transportation highlights the advantages of mentally placing oneself within a fictional narrative. For example, mental transportation enhances the extent to which people perceive the narrative as realistic (Green, 2004). When participants immerse themselves into a narrative, through mental transportation, they are better able to feel what the characters feel, which intensifies the narrative's persuasive appeal (Appel & Richter, 2010; Mazzocco et al., 2010; Zheng, 2014). Other work has linked similar imaginal processing to positive emotion (Holmes et al., 2006), as well as optimism and well-being (Blackwell et al., 2013), and negative emotion (Holmes & Mathews, 2005). The work of Holmes and Mathews (2005, 2006), in particular, compared imaginal processes (e.g. imagining descriptions of positive or negative events) to less imaginal or semantic ones (e.g. listening to event descriptions with a focus on verbal meaning). This work parallels research on nostalgia that uses the ERT as an imaginal exercise to induce the emotion and compare it with a less imaginal exercise (i.e. recall of an ordinary autobiographical event that is emotionally neutral). This is precisely why we postulate that mental transportation is one key feature of nostalgia: its clear association with imagery induction.

Taken together, we define mental transportation (congruently with Green & Brock, 2000) as an imaginal process in which individuals mentally leave their current physical space and transfer themselves into a narrative. As mentioned above, a key component of laypersons' descriptions of the phenomenology of nostalgia is reliving (Hepper et al., 2012), and nostalgia's main induction technique – the ERT – is an imaginal exercise. Reliving memories, or autonoetic consciousness, is an imagery-based effect in the episodic and autobiographical memory literature (Conway & Pleydell-Pearce, 2000; Wheeler et al., 1997). Further, nostalgic memory is a unique form of autobiographical memory (Cheung et al., 2018; Jiang et al., 2020) and involves pivotal events from one's life. Due to their personal importance, these events have been duly savoured (Biskas et al., 2019; Cheung et al., 2020) and so are more likely to be imbued with imagery (i.e. vividness, sounds, tastes), more

elaborately encoded, and more likely to be recalled in rich detail (Abeyta et al., 2015; Bryant et al., 2005; Wildschut et al., 2006).

As mental transportation appears to serve functions that resemble those of nostalgia (Blackwell et al., 2013; Holmes et al., 2006; Holmes & Mathews, 2005), we deemed it likely that mental transportation is drawn out by nostalgia. In process terms, we propose that nostalgic experiences, relative to ordinary autobiographical ones, involve the following sequence. First, one begins to recall the nostalgic event, which activates specific knowledge that was encoded as a part (schema) of that event, including the imagery. As nostalgisers relive a nostalgic event, they become increasingly mentally transported into it, imagining it in with all its details unfolding. Mental transportation will heighten the benefits of nostalgia – social, existential, and self-oriented.

In his book *Remembrance of Things Past*, and specifically in the volume *Swann's Way*, Proust (1992, pp. 36–39) linked masterfully nostalgia with mental transportation and ensuing benefits. Proust is tasting a madeleine, and the taste reminds him of pieces of cake with which his aunt Léonie treated him on lazy Sunday mornings when he would visit her in her bedroom, dipping them first in her cup of tea. This nostalgic memory transports him into those visits, cascading into an explosion of imagery, sounds, and scents. Psychological equanimity ensues. (For the most relevant section of *Swann's Way*, see Supplementary Materials.)

Overview

We tested the proposed process model in one daily-diary study and two experiments. Given the lack of mental transportation measures suitable for nostalgia research, we needed to create one. In Study 1, we used a single-item measure of daily mental transportation derived from Green and Brock's (2000) scale, whereas, in Studies 2 and 3, we used Green and Brock's full mental transportation scale adapted for autobiographical recall. dna.

In Study 1, we hypothesised that daily experiences of nostalgia and mental transportation would be positively related. In particular, we hypothesised that (a) dispositional nostalgia proneness would be positively associated with daily nostalgic experiences and daily mental transportation, and (b) on days in which participants report being more nostalgic, they would concurrently report higher mental transportation. This study was an initial test of our model's first step. In

Study 2, we hypothesised that recalling a nostalgic (vs. ordinary) autobiographical event would be linked to increased self-reported mental transportation. We tested the same hypothesis in Study 3, in addition to testing that nostalgic (vs. ordinary) recall would confer psychological benefits. Here, we hypothesised that nostalgia would yield the aforementioned benefits via mental transportation.

Study 1

Study 1 was a foray into the relation between nostalgia and mental transportation. We examined the first part of our model. Specifically, we hypothesised that, on days when participants felt more nostalgia, they would concurrently experience more mental transportation.

Method

Participants

Our sampling plan was to recruit as many participants as possible, and no less than 100, in a one-week period for our initial assessment. Given that daily diary protocols examine within-person variance across multiple time points (i.e. days), this sample provides sufficient power to detect reliable effects. The findings from Fetterman et al. (2018) and Lenton et al. (2016), who used similar daily diary methods, support this sampling plan. We were initially unable to reach the 100-participant limit, and therefore extended our recruitment by an additional week, leaving us with 146 University of Texas at El Paso (UTEP) undergraduates. We removed one participant from the dataset due to failure to complete the initial assessment. Of the remaining 145 participants (120 women, 25 men; age in years: $Range = 18-43$, $M = 20.69$, $SD = 4.39$), 98 (82 women, 16 men) completed at least one daily survey. To curtail attrition, we had notified participants that, if they failed to complete six daily surveys, they would be dropped from the study and disqualified for subsequent credit. Nevertheless, attrition rate was high and likely due to the prolonged initial assessment period. Participants completed an average of 7.48 surveys. Overall, we had 789 daily observations to test our hypothesis.

Procedure

Participants were allotted a 2-week period to sign up for our study. They completed an initial assessment

comprising our measure of nostalgia proneness.¹ Starting the following Monday and for 14 days, participants received an email at 5pm containing a link to that day's survey. They had until 3am the morning after to complete the daily measures.

Materials

Initial assessment

Participants completed a 7-item measure of nostalgia proneness, the Southampton Nostalgia Scale (SNS; Sedikides et al., 2015). Preceded by a definition of nostalgia ("a sentimental longing or wistful affection for the past"; The New Oxford Dictionary, 1998, p. 1266), three items pertain to the personal significance of nostalgia (1 = *not at all*, 7 = *very much*), and four items to the frequency of nostalgic engagement (1 = *very rarely*, 7 = *very frequently*). The SNS has high construct validity (Sedikides et al., 2015), is strongly correlated with other measures of nostalgia proneness (i.e. convergent validity; Wildschut & Sedikides, *in press*), and predicts intensity of music-evoked (Barrett et al., 2010) and scent-evoked (Reid et al., 2015) nostalgia.

Daily measures

The daily assessments gauged participants' daily thoughts, feelings, behaviours, and events. We organised the items into randomised blocks according to these four categories, and randomised the questions within each block by participant. We included the mental transportation item in the block that assessed thoughts, whereas we included the nostalgia item in the block that assessed feelings. For each daily measure, participants reported their felt nostalgia and their experienced mental transportation. We measured daily nostalgia with a face-valid item, "Today, I felt nostalgic" (1 = *not at all*, 4 = *very much*). We measured daily mental transportation also with a face valid statement, "Today, I mentally transported myself somewhere else" (1 = *strongly disagree*, 4 = *strongly agree*), which we derived from Green and Brock's (2000) scale.

Results

Between-person correlations

As an initial between-subjects test of the relation between nostalgia and mental transportation, we ran zero-order correlations among nostalgia proneness ($M = 4.42$, $SD = 1.40$, $\alpha = .93$), daily nostalgia (M

$= 1.92$, $SD = .99$), and daily mental transportation ($M = 2.33$, $SD = 1.14$). (We averaged across the daily nostalgia and mental transportation responses.) All variables were significantly and positively correlated. Nostalgia proneness was positively related to daily nostalgia, $r(98) = .376$, $p < .001$, offering construct validation for our daily nostalgia item (and further construct validation for the SNS). Nostalgia proneness was also positively related to daily mental transportation, $r(98) = .325$, $p = .001$. Relatedly, and crucially, daily nostalgia was positively related to mental transportation, $r(98) = .516$, $p < .001$. Although this last finding provides initial support for the first part of our model, our data analysis was sub-optimal. By averaging across the daily responses, we lost within-person variance decreasing power. We proceeded with within-person analyses.

Nostalgia as a daily predictor of mental transportation

We tested for within-person relations using a multi-level modelling approach (Raudenbush & Bryk, 2002) via SAS PROC MIXED (Singer, 1998), allowing us to separate within- and between-person sources of variance (Enders & Tofighi, 2007). For standard error specification regarding nostalgia as the within-subjects predictor, we included corresponding random effects (Barr et al., 2013). The resulting fixed effect supported our hypothesis. On days in which participants felt more nostalgic, they experienced greater mental transportation, $b = .102$, $t = 2.81$, $p = .005$, 95% CI [.031, .173].

Discussion

The results of Study 1 pointed to a link between nostalgia and mental transportation. Nostalgia proneness was positively associated with daily mental transportation. More important, daily nostalgia predicted daily mental transportation. We tested the same hypothesis in an additional daily diary study, where we replicated Study 1 findings. We report it (Study 1A) in Supplementary Materials.

Study 2

In Study 1, we linked nostalgia with mental transportation in daily life. However, as we assessed these variables concurrently for 14 days, we are unable to assume directionality. We addressed this issue in

Study 2. We hypothesised that nostalgia (vs. control) would cascade into greater mental transportation.

We opted to induce nostalgia via the ERT. One reason is *construct validity*. In the ERT, participants bring to mind either a nostalgic event (experimental condition) or a regular event (control condition) from their lives, ponder it briefly, and narrate it in writing. What distinguishes the experimental from the control condition is the very essence of the nostalgic experience. In the nostalgia condition, participants are requested to relive sentimentally a meaningful experience. These instructional components are defining features of nostalgic reverie (Hepper et al., 2012, 2014). Another reason we used the ERT is *discriminant validity*. The nostalgia and control conditions may differ in the valence of the transient affect they produce, thus raising the possibility of a confound. Indeed, the nostalgia condition often, but not always, raises positive affect, and it occasionally increases negative affect (Leunissen et al., *in press*). However, the psychological benefits of nostalgia persist even after controlling for positive and negative affect (Sedikides et al., 2015; Sedikides & Wildschut, 2019): Nostalgia has unique effects above and beyond transient affect. A final reason for opting for the ERT is *convergent validity*. This induction method has been used effectively in dozens (likely > 100) of published experiments on nostalgia, and it yields identical results to other nostalgia inductions (e.g. song lyrics, music, scents; Cheung et al., 2013; Reid et al., 2015; Routledge et al., 2011). In all, the ERT is the gold standard in the experimental analysis of nostalgia.

Method

Participants

We conducted a power analysis via G*Power (Faul et al., 2013) to determine the number of participants needed for adequate statistical power (i.e. 90%) based on the effect size of previous ERT experiments. The minimum sample to detect an effect size of $f = .252$ was 171 when $\alpha = .05$ (two-tailed). In anticipation of attrition, we proceeded to collect data from 200 MTurk workers, all US residents. We excluded 24 participants because they did not complete the experimental procedure, and 1 participant because they did not comply with the experimental instructions, leaving a final sample of 174 (89 women, 85 men; age in years: $Range = 20-71$, $M = 36.89$, $SD = 12.71$).

Procedure

Participants clicked a link to an online Qualtrics survey, consented, and were randomly assigned to the nostalgia ($N = 87$) or control ($N = 87$) condition. After 3 min, Qualtrics moved participants to the next section, where they completed a manipulation check, measures of positive and negative affect, and the mental transportation measure.² Participants then responded to demographic questions and received compensation (see Appendix I of the Supplemental Materials for stimulus materials).

Materials

Nostalgia induction

Participants completed the ERT. In the nostalgia condition, they read The New Oxford Dictionary (1998) definition of nostalgia (“a sentimental longing or wistful affection for the past”), reflected on a nostalgic event in their lives, and wrote about it for 3 min in a textbox. In the control condition, participants reflected on an ordinary event in their lives and wrote about it for 3 min in a textbox.

Manipulation check

Participants responded to a manipulation check, comprising two statements (e.g. “Right now, I am feeling quite nostalgic;” 1 = *strongly agree*, 5 = *strongly disagree*), that assesses currently felt nostalgia (Hepper et al., 2012; Sedikides et al., 2018).

Affect

Participants filled out measures of positive affect (“I feel happy,” “I feel in a good mood”), and of negative affect (“I feel unhappy,” “I feel sad”), preceded by the stem “With this event in mind” (1 = *strongly disagree*, 7 = *strongly agree*). These measures have been used extensively in prior research (Sedikides et al., 2015; Sedikides & Wildschut, 2019, 2020).

Mental transportation

Participants completed a mental transportation measure that we derived from Green and Brock (2000) and adapted accordingly. They rated how well each of 11 statements (e.g. “I could picture myself in the scene of the events that I wrote about”) applied to their nostalgic or ordinary event reflections (1 = *not at all*, 7 = *very much*). Each statement was preceded by the stem: “While I was writing about the event ...”. We thought that three mental transportation items might have

limited relevance to our research objectives. We present these items and discuss the issues in Appendix II of Supplemental Materials. We opted to use the validated 11-item scale in our analyses.³

Results

Manipulation check

We submitted the manipulation check ($M = 3.78$, $SD = 1.32$, $\alpha = .97$) to a one-way Analysis of Variance (ANOVA). As intended, participants felt more nostalgic in the nostalgia ($M = 4.52$, $SD = 0.80$) than control ($M = 3.03$, $SD = 1.32$) condition, $F(1, 172) = 81.44$, $p < .001$, $\eta^2 = .32$, 95% CI [.212, .419]. The manipulation was effective.

Affect

We submitted both positive affect ($M = 5.72$, $SD = 1.42$, $\alpha = .89$) and negative affect ($M = 2.28$, $SD = 1.60$, $\alpha = .87$) to an ANOVA. Participants in the nostalgia ($M = 5.75$, $SD = 1.40$) and control ($M = 5.68$, $SD = 1.45$) conditions did not differ significantly on positive affect, $F(1, 172) = .10$, $p = .750$, or on negative affect ($M = 2.49$, $SD = 1.68$ and $M = 2.07$, $SD = 1.49$ for nostalgia and control conditions, respectively), $F(1, 172) = 2.95$, $p = .088$.

Mental transportation

Nostalgia and mental transportation

We submitted mental transportation ($M = 5.21$, $SD = .78$, $\alpha = .60$) to an ANOVA. Nostalgic ($M = 5.38$, $SD = 0.75$) compared to control ($M = 5.04$, $SD = 0.77$) participants reported higher mental transportation, $F(1, 172) = 8.97$, $p = .003$, $\eta^2 = .05$, 95% CI [.006, .125]. Mental transportation, then, increased in the context of nostalgic engagement.

Felt nostalgia and mental transportation

We asked next whether felt nostalgia (i.e. participants' scores on the manipulation check) mediated the effect of the manipulation (ERT) on mental transportation. To begin, felt nostalgia was positively related to mental transportation, $r(174) = .485$, $p < .001$. We proceeded to test for an indirect effect using Hayes (2013) PROCESS (10,000 bootstrap samples). Indeed, felt nostalgia mediated the effect of the manipulation on transportation, indirect effect $B = .464$, 95% CI [.297, .665]; this effect was no longer significant when controlling for felt nostalgia, $p = .344$.

Discussion

The findings are consistent with the hypothesis that nostalgizing about an episode from one's life facilitates mental transportation to that episode (i.e. first part of the model). Next, we tested the replicability of this finding along with the second part of our model, namely, that mental transportation mediates the effect of nostalgia on psychological benefits.

Study 3

In Study 3, we tested our hypothesis in full (i.e. both parts of our proposed mediational sequence). Feeling nostalgic would cascade into mental transportation, which, in turn, would intensify the benefits of nostalgia.

Method

Participants

We conducted a power analysis using G*Power (Faul et al., 2013) based on the same effect size for Study 2: $f = .252$. The sample size needed to achieve power of 90%, for $\alpha = .05$ (two-tailed), was 171 when $\alpha = .05$ (two-tailed). As in Study 2, we recruited 200 UTEP undergraduates in anticipation of attrition. Indeed, we excluded five participants for not complying with the ERT, leaving 195 (123 women, 72 men; age in years: $Range = 18\text{--}48$, $M = 20.81$, $SD = 4.39$) in the final sample.

Procedure

After clicking a link to an online Qualtrics survey and consenting, participants were randomly assigned to the nostalgia ($N = 96$) or control ($N = 99$) condition. Following the nostalgia manipulation and manipulation check, participants completed the mental transportation scale and measures of the putative nostalgia benefits (including affect). Finally, they responded to demographic questions (see Appendix I of the Supplemental Materials for stimulus materials).

Materials

Nostalgia induction

We induced nostalgia with the ERT, as in Study 2, with one exception. We condensed the writing task from 3 to 2 min, as our experience indicated that 2 min sufficed for it.

Manipulation check

We used the same two statements for a manipulation check as in Study 2.

Mental transportation

We implemented the same 11-item mental transportation scale as in Study 2.⁴

Nostalgia benefits

We assessed the social benefit (*social connectedness*) with four items from Wildschut et al. (2006). An example is: "I feel connected to loved ones". We assessed the existential benefit (*meaning in life*) with four items from Routledge et al. (2011). An example is: "I feel that life is meaningful". We assessed the self-oriented benefit as follows. For *self-esteem*, we used the 4-item Hepper et al. (2012) scale. An example is: "I feel good about myself". For *optimism*, we used the 4-item Cheung et al. (2013) scale. An example is: "I feel optimistic about my future". For *inspiration*, we used the 4-item Stephan et al. (2015) scale. An example is: "I feel filled with inspiration". For *self-continuity*, we used the 4-item scale from Sedikides et al. (2016). An example is: "I feel connected with my past". All items were preceded by the stem: "With this event in mind ...". Responses to each item ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

We also measured positive affect and negative affect. Affect did not qualify the results. Given that these variables are not directly relevant to our hypotheses, we present descriptive and inferential statistics in the Appendix III of the Supplementary Materials, Tables S3.1 and S3.2.

Results

Replicating Study 2 findings

Manipulation check

An ANOVA on the manipulation check ($M = 3.57$, $SD = 1.22$, $\alpha = .94$) revealed that, as intended, participants in the nostalgia condition reported feeling more nostalgic ($M = 4.14$, $SD = 0.92$) than those in the control condition ($M = 3.02$, $SD = 1.22$), $F(1, 193) = 52.36$, $p < .001$, $\eta^2 = .21$, 95% CI [.119, .308].

Nostalgia and mental transportation

An ANOVA on mental transportation ($M = 5.01$, $SD = .90$, $\alpha = .64$) indicated that, as in Study 2, nostalgic participants ($M = 5.28$, $SD = 0.82$) reported greater mental transportation than controls ($M = 4.20$, $SD =$

1.53), $F(1, 193) = 19.73$, $p < .001$, $\eta^2 = .09$, 95% CI [.029, .176].

Felt nostalgia and mental transportation

Felt nostalgia (i.e. manipulation check) was positively linked to mental transportation, $r(195) = .49$, $p < .001$. We examined next whether felt nostalgia mediated the effect of the manipulation (ERT) on mental transportation. We used Hayes (2013) PROCESS macro to test for an indirect effect (10,000 bootstrap samples). Felt nostalgia emerged as a mediator, indirect effect $B = .185$, 95% CI [.115, .269]; the effect was no longer significant when controlling for felt nostalgia, $p = .166$.

Effect of nostalgia on the functions

We subsequently tested, through a series of ANOVAs, whether nostalgia strengthened the relevant benefits (Table 1). Consistent with our hypothesis, nostalgic participants reported higher social connectedness, meaning in life, inspiration, and self-continuity compared to controls. Contrary to our hypothesis, nostalgic participants did not report higher self-esteem or optimism compared to controls ($ps > .28$).

Relation between mental transportation and functions

Mental transportation was positively and significantly related to all benefits: social connectedness, $r(195) = .35$, $p < .001$; meaning in life, $r(195) = .42$, $p < .001$; self-esteem, $r(195) = .16$, $p = .029$; optimism, $r(195) = .29$, $p < .001$; inspiration, $r(195) = .27$, $p < .001$; and self-continuity, $r(195) = .40$, $p < .001$.

Mental transportation as a mediator of the effect of nostalgia on the benefits

We hypothesised that mental transportation would transmit the effect of nostalgia to the benefits. We ran mediation models using Hayes (2013) PROCESS macro to test for an indirect effect (with 10,000 bootstrap samples) of nostalgia (vs. control) on the benefits via mental transportation (see Table 2 for model statistics). Each indirect effect was significant, aside from the self-esteem model.

Discussion

Nostalgic engagement (vs. control) contributed to increased mental transportation, which in turn

Table 1. Descriptive statistics of Nostalgia's benefits and main effects of condition on the benefits in Study 3.

Function	Descriptive Statistics		Condition <i>M(SD)</i>		<i>F</i> (1, 193)	η^2	95% CI
	<i>M(SD)</i>	α	Nostalgia	Control			
1. Social Connectedness	4.73(1.56)	.88	5.29(1.39)	4.20(1.53)	26.91***	.12	.049, .210
2. Meaning in Life	5.47(1.42)	.91	5.86(1.19)	4.74(0.89)	15.05***	.07	.018, .150
3. Self-Esteem	5.21(1.41)	.92	5.32(1.53)	5.10(1.46)	1.18	.01	.000, .046
4. Optimism	5.31(1.34)	.87	5.38(1.19)	5.24(1.48)	.53	.00	.000, .036
5. Inspiration	5.09(1.34)	.89	5.29(1.15)	4.89(1.47)	4.52*	.02	.000, .079
6. Self-Continuity	5.38(1.15)	.72	5.75(0.96)	5.02(1.21)	21.73***	.10	.035, .186

* $p < .05$, ** $p < .01$, *** $p < .001$.

predicted social connectedness, meaning in life, optimism, inspiration, and self-continuity, thus generally supporting our hypothesis. These findings bolster the link between nostalgia and mental transportation, replicating the findings of Study 2, and implicate mental transportation as a mediator of the psychological benefits of nostalgia.

General discussion

Nostalgia as an emotional experience involves cognitively reliving self-defining and meaningful events in one's life. However, the mental processes triggered by nostalgia are relatively unexplored. Popular (e.g. in television and film) and layperson depictions of nostalgia point to a mental revisiting of past events (Hepper et al., 2012, 2014) or mental transportation. In three studies, we investigated the role of mental transportation, an imagery-based memory process, in nostalgic engagement. The studies used diverse methodological approaches to assess or manipulate nostalgia (Campbell & Fiske, 1959), and produced consistent findings.

In Study 1, nostalgia proneness was positively associated with frequency of daily experiences of mental transportation. Also, daily fluctuations in

nostalgia corresponded with daily fluctuations of mental transportation. In Study 2, recalling a nostalgic (vs. ordinary autobiographical) event was associated with enhanced mental transportation fluency. Study 3 directly replicated these findings. In addition, mental transportation was positively associated with beneficial psychological outcomes. Moreover, tests of indirect effects indicated that mental transportation plausibly mediated the beneficial influence of nostalgia on social connectedness, meaning in life, optimism, inspiration, and self-continuity.

Implications

Our findings help to draw links among literatures on transportation (Green & Brock, 2002), autobiographical recall (Wheeler et al., 1997), and life narratives (McAdams, 1996). For example, mental transportation, when applied to life narratives, may offer benefits that parallel those of fictional narratives. Mental transportation increases perceived realism of fictional stories (Green, 2004), and influences attitudes, emotions, and intentions (Appel & Richter, 2010; Mazzocco et al., 2010; Murphy et al., 2013). Likewise, experiencing nostalgia confers psychological benefits (Sedikides et al., 2015, 2016; Sedikides & Wildschut, 2019), in part, through mental transportation.

Further, Green and Brock's (2000, 2002) theory of mental transportation, in the case of fictional narratives, is applicable to the stories that people tell of their own lives (McAdams, 1996). Mental transportation may be even more useful when applied to life narratives. Fictional narratives are one-dimensional: People only have access to words, from which mental transportation allows them to create accompanying images, smells, and sounds as well as compose scenes. When remembering one's own life narrative, on the other hand, people already have access to the pertinent scenic information (e.g. visual, auditory, olfactory) necessary to recreate the exact setting

Table 2. Mental transportation as a mediator of the effect of condition (Nostalgia vs. Control) on the benefits in Study 3.

Function	A Path	B Path	C' Path	95% CI for Indirect Effect
1. Social Connectedness	.27***	.46***	.42***	.049, .224
2. Meaning in Life	.27***	.59***	.22*	.078, .261
3. Self-Esteem	.27***	.23	.05	-.001, .141
4. Optimism	.27***	.45***	-.05	.050, .217
5. Inspiration	.27***	.37***	.10	.040, .178
6. Self-Continuity	.27***	.43***	.25**	.053, .195

Note: Regression coefficients are depicted for each path (* $p < .05$, ** $p < .01$, *** $p < .001$). "A Path" = Condition to Mediator; "B Path" = Mediator to Outcome; "C Path" = Condition to Outcome controlling for the Mediator.

(Conway & Pleydell-Pearce, 2000). Therefore, with this information readily accessible, people would be able to transport back to this experience with relative ease, an experience known as auto-noetic consciousness (Wheeler et al., 1997). The relative ease with which people mentally transport to nostalgic experiences may explain the benefit of self-continuity, for example (Sedikides et al., 2016). Given that nostalgic memories and their corresponding scenic information are so salient, people can relive them as if they are happening for the first time. Such reliving contributes to the sense that the self has remained stable across time. In essence, nostalgia enables people to feel “in-touch” with themselves.

Limitations and future directions

Assuming that mental transportation is a central component of nostalgia, our findings may help researchers identify and understand potential deficits in the ability to experience nostalgia. If nostalgia triggers mental transportation, and if mental transportation is a defining feature of nostalgia, then the inability to transport mentally with ease may render some individuals less able to experience nostalgia and derive its benefits. Although we assessed mental transportation as a state (rather than a trait), we take the liberty to speculate about such deficits as aphantasia, the lack of ability to create mental images (Zeman et al., 2015). Mental transportation is an imagery-based process, and so it necessitates the capacity for mental images. If mental transportation underlies nostalgia, then individuals with aphantasia will have difficulty in experiencing nostalgia and may need to find alternative routes to it. This deficit is consequential, as individuals with aphantasia may be at a disadvantage when it comes to reaping fully the psychological benefits of nostalgia.

Another literature stream attributes the inability to create easily mental images, for the purposes of autobiographical recall, to mental health issues. For example, neuroscience research has associated deficits in certain brain regions with the underlying feature of mental transportation, mental imagery (e.g. the default network). These deficits are seen in depression, anxiety, and Alzheimer’s disease (Andrews-Hanna et al., 2013). Further, research on mental imagery has linked hippocampal damage to impaired autobiographical and episodic memory (Hassabis et al., 2007; Hassabis & Maguire, 2007; McCormick et al., 2018). We surmise that similar brain networks

may be associated with one link to the experience of nostalgia, namely mental transportation.

As nostalgia confers social, existential, and self-related benefits, especially in older adults (i.e. those prone to memory deficits; Hepper et al., 2020) and also persons living with dementia (Ismail et al., 2018), finding a way to enhance mental transportation may improve psychological well-being in this population. One possibility to enhance mental transportation is via Virtual Reality (VR) experiences, which help recruit memory-associated imagery. Self-defining or pivotal memories include, at encoding, detailed event imagery (Conway, 1990). The associated imagery accompanies recall (Conway, 1997). Therefore, when one is virtually transported to their childhood home, the added imagery appears to strengthen mental transportation. As details of event-specific knowledge decay, so does the vividness of their imagery, leaving only the gist behind (Nadel & Moscovitch, 1997). Immersive VR might re-establish this imagery and render reliving the memory more vivid. Indeed, seeing visual stimuli that were present during encoding enhances recall in episodic memory (Tulving & Thompson, 1973). Future work could address these possibilities.

Mental transportation, as an imagery-based process (Zheng, 2014), is multi-faceted. It is closely related to other introspective mental experiences like mind-wandering, mental time travel, prospection, imagination, and daydreaming, which can be intentional or unintentional and more or less fluent. These experiences may, in turn, be stimulus-dependent or stimulus-independent (Seli et al., 2018). We measured mental transportation rather broadly. If researchers are to understand the specific psychological processes that will help them identify neurological mechanisms and potential deficits, they would need to zero-in on the specific type of mental experience triggered by nostalgia.

In addition to the ERT, nostalgia can be induced via music and lyrics (Cheung et al., 2013; Routledge et al., 2011), scents (Chu & Downes, 2000; Reid et al., 2015), food (Viladrich & Tagliaferro, 2016; Zhou et al., 2019), or childhood objects (Holbrook & Schindler, 1996). Given the consistent links between nostalgia and mental transportation in our research, we would expect to obtain similar results regardless of induction type. For one, all inductions harken back to momentous events from one’s past. In addition, the effects of nostalgia on the benefits generalise across induction type (Sedikides et al., 2015; Sedikides & Wildschut,

2020). Regardless, follow-up research will need to test the generality of our findings.

Although our mediation model was supported, these findings should be interpreted with due caution. As nostalgia and mental transportation were measured at the same time each day in Study 1, we were unable to test conclusively the directionality of the relationship between these variables. Through an experimental manipulation, Studies 2 and 3 accounted for this issue, but only as it pertains to the first step in our proposed process model. The mediating effect of mental transportation found in Study 3 must be considered in light of the fact that mental transportation and nostalgia's benefits were measured cross-sectionally. Therefore, future work would benefit from a longitudinal design, in which mental transportation and nostalgia's benefits are measured with greater temporal distance following a nostalgia manipulation.

Conclusion

In three studies, we examined the role of mental transportation in the experience of nostalgia. Mental transportation emerged as a key cognitive component of the nostalgic experience. Specifically, trait-level and daily nostalgia were associated with mental transportation. Furthermore, nostalgic recall was associated with increased mental transportation, which then predicted social, existential, and self-oriented psychological benefits. This work provides a crucial first step toward identifying the cognitive mechanisms of nostalgia, an emotion that has implications for psychological well-being.

Notes

1. As for most time-intensive protocols, we included several measures in the initial assessment and daily surveys for unrelated purposes. We only report measures relevant to hypothesis-testing.
2. We included a few more measures that were not pertinent to our hypothesis.
3. Additional analyses on the 8-item scale (i.e., excluding the three potentially inapplicable items) yielded results that were virtually identical to the reported ones.
4. In analyses on the 8-item mental transportation scale (excluding the three potentially inapplicable items), we obtained very similar results to those we report in the text.

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