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ARTICLE

Nostalgia encourages exploration and fosters uncertainty in response to AI technology

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Abstract

The burgeoning progress of cutting-edge technology paradoxically evokes nostalgia. How does this emotion influence responses to innovative technology, such as Artificial Intelligence (AI)? We hypothesized that two pathways operate concurrently. First, by enhancing connection with significant others, nostalgia constitutes a psychological resource that supports exploration of technological innovation, thereby promoting positive responses to AI. Second, by reinforcing scepticism toward change, nostalgia heightens uncertainty about innovative technology, thereby fostering negative responses to AI. Three preregistered experiments, testing participants ($\Sigma N = 1397$) across cultures (China, UK, USA), supported the two pathways. Nostalgia influenced responses to ChatGPT via two opposing serial pathways (Experiment 1). Further, social connectedness bolstered favourable responses to AI avatars via increased technology exploration (Experiment 2), whereas scepticism about change reduced favourable responses to companion robots via increased technology uncertainty (Experiment 3). This dualistic role of nostalgia can be harnessed to sustain new technology or instill caution for its risks.

KEYWORDS

emotion, innovative technology, nostalgia, scepticism about change, social connectedness, technology exploration, technology uncertainty

Technology advances, but past technology allures. For example, in 2023, nearly 50 million vinyl albums sold in the United States, a sharp increase compared to the less than 5 million sold annually from 1995 to 2010 (Statista, 2024). Similarly, there is enduring appreciation for the classic Sony Walkman (Ryan, 2024). A key factor driving enthusiasm for retro technology is said to be nostalgia, an emotion characterized by cherishing and longing for the past (Asmelash, 2022; Liao, 2019). This possibility prompts an intriguing question: how does nostalgia impact attitudes and behaviours toward innovative technology?

The literature has offered two conflicting viewpoints. One viewpoint indicates that nostalgia constitutes a psychological resource supporting engagement in novel experiences (FioRito & Routledge, 2020; Xia et al., 2021; Zhou et al., 2021). Another viewpoint indicates that nostalgia acts as a barrier to embracing innovations (Fleury et al., 2021; Hsieh, 2019; Reisenwitz et al., 2007). Integrating the two literature streams, Dang et al. (2024) proposed a dual-pathway model, which posits that nostalgia simultaneously strengthens and inhibits favourable responses to innovative technology via different psychological processes.

However, the original dual-pathway model faces two challenges. Theoretically, it does not elucidate the intermediate steps through which the general processes triggered by nostalgia (i.e., social connectedness and scepticism about change) influence attitudes and behaviours toward a specific target (Artificial Intelligence or AI), limiting understanding of how nostalgia shapes responses to innovative technology. Methodologically, the original dual-pathway model was only tested with general AI technology or a specific AI product (companion robots), overlooking the diverse range of AI applications available today, from social and companion robots to large language models. To address these gaps, we proposed an extended model attempting to specify how nostalgia and its ensuing processes influence responses to AI and tested it with a broader spectrum of AI. Taken together, the current research broadens the scope of the original dual-pathway model both theoretically and practically.

Nostalgia and responses to AI technology

Nostalgia is "a sentimental longing or wistful affection for the past" (The New Oxford Dictionary of English, 1998, p. 1266). This meaningful past can be one's childhood, close others (e.g., family members, friends, partners), landmark occasions where the person is surrounded by close others (e.g., birthday celebrations, anniversaries, Thanksgiving holidays), and scents, tastes, or songs reminiscent of close others or landmark occasions (Reid et al., 2023; Sedikides et al., 2015; Wildschut et al., 2006). Nostalgizing involves fondness, tenderness, contentment, and happiness, but also yearning for irredeemably gone moments (Hepper et al., 2012; Leunissen et al., 2021). Nostalgia is experienced frequently (i.e., several times a week; Hepper et al., 2021; Wildschut et al., 2006), and by individuals of all ages (Hepper et al., 2021; Juhl et al., 2020) and cultures (Hepper et al., 2014, 2024; Sedikides & Wildschut, 2022).

AI is a prominent innovative technology. It operates semi or fully autonomously to perform roles that are traditionally carried out by humans (Clarke, 2019). AI manifests in various forms (e.g., digital assistance, robotics, algorithms) and has considerably changed daily life (Bonnefon et al., 2016; Williams, 2020). Although the field of AI was established in 1956, it has gained prominence in the last 15 years (Fast & Horvitz, 2017). Social responses to AI have become a scholarly focal point (Yam et al., 2024). Generally, people express ambivalent attitudes toward AI (Alessandro, Federica, et al., 2024; Dang & Liu, 2021), perceiving it both as a threat (Alessandro, Dimitri, et al., 2024) and an opportunity (Dang & Liu, 2022a). As more AI products, such as social robots, are designed to exhibit reasoning capabilities and humanlike interactions, people increasingly attribute mental states to them, treating them as social actors rather than as mere tools for task completion (Duffy, 2003; Waytz et al., 2014; Yam et al., 2021). Recent advances in AI, coupled with its widespread use, have prompted inquiries into the appropriateness of allowing AI to make decisions on behalf of humans. The literature indicates that people show both aversion (Dietvorst et al., 2015; Longoni et al., 2019) and appreciation (Logg et al., 2019; Thurman et al., 2019) toward AI (vs. human) decision-making.

This ambivalent attitude extends to AI-powered products (Alessandro, Federica, et al., 2024; McKee et al., 2023). In the current research, we focused on responses to three typical exemplars of AI technology, that is, ChatGPT, AI avatars, and companion robots. Although these AI-powered products are designed to interact with humans, they represent distinct interaction modes. Specifically, ChatGPT engages through text, AI avatars through visual and behavioural mimicry, and companion robots through physical presence and movement. Furthermore, these products reflect current trends in AI technology. ChatGPT operates as a virtual agent without body representation, AI avatars are AI-based digital representation of persons, and companion robots are embodied agents. By using these three exemplars, we aimed to capture a broad spectrum of responses to AI technology. Indeed, we used "responses to AI technology" as an umbrella term to indicate support for research on and adoption of these AI products.

Studying the impact of nostalgia on reactions to AI technology is crucial for both theoretical and practical reasons, as the advancement and increased use of innovative technology are drawing people to nostalgia (Errajaa et al., 2013; Huang et al., 2023; Niemeyer, 2014). We propose an extended dual-pathway model to specify how nostalgia and its ensuing processes influence responses to AI. We hypothesized an excitatory pathway (nostalgia → social connectedness → technology exploration → responses to AI) and an inhibitory pathway (nostalgia → scepticism about change → technology uncertainty → responses to AI). We elaborate on the two pathways next.

Excitatory pathway via social connectedness: Technology exploration as the missing link

As a social emotion, nostalgia is associated with, and increases, social connectedness (Juhl & Biskas, 2023; Sedikides & Wildschut, 2019), defined as subjective closeness with one's social environment, or as acceptance, belongingness, and support (Bastian & Haslam, 2010; Lee & Robbins, 1998). In people with high trait-level nostalgia, memories of interpersonal relationships are central (Batcho, 1998). Content analysis of nostalgic narratives indicated that nostalgic experiences typically involve social interactions with important others (e.g., friends, family, and loved ones; Wildschut et al., 2006). Although previous social bonds may be broken due to changes in social settings, nostalgia can re-ignite symbolic and meaningful social relationships (Sedikides et al., 2004, 2008). Furthermore, experimentally induced nostalgia strengthens one's sense of social connectedness, ranging from close others (Reid et al., 2023; Wildschut et al., 2006) and ingroups (Abakoumkin et al., 2017), to marginalized (Turner et al., 2012, 2018) or unfamiliar (Zhou et al., 2012) outgroups.

Social connectedness is likely to instigate technology exploration. Technological exploration refers to intentions or behaviours to acquire knowledge about features and applications of novel technology (Maruping & Magni, 2012; Nambisan et al., 1999). By integrating and validating the self (Crocker et al., 2008; Kumashiro & Sedikides, 2005), social connectedness serves as a starting block for exploration (Dang & Liu, 2023; Feeney & Collins, 2019) and the consequent acquisition of new experiences (Ryan & Deci, 2017). A pertinent experiential domain is technological innovation. Indeed, social connectedness galvanizes interest in interacting with robots (Dang & Liu, 2024).

By fostering appreciation for the advantages of technological features or applications, technology exploration predicts greater endorsement of innovative technology. Technology exploration can take various forms, including direct interaction, reading or watching demonstrations, and learning from others' experiences. Through exploration, individuals enhance their comprehension of how the technology functions and its potential benefits (Magni et al., 2010; Maruping & Magni, 2012). That is, technology exploration equips individuals with the necessary knowledge to make informed decisions regarding the acceptance or rejection of a technology. Once people are familiar with a technology and understand its value, they are more inclined to embrace it and incorporate it into their daily routines (Boudreau & Robey, 2005; Rogers & Muller, 2006).

Inhibitory pathway via Scepticism about change: Technology uncertainty as the missing link

Nostalgia is past-oriented and bolsters scepticism about change. In nostalgizing, the individual derives a somewhat idealized portrait of their past, relishes it, regards it as a safe haven, and, to some extent, wishes to dwell on it (Batcho, 1998; Fleury et al., 2021). As such, nostalgizing may involve viewing changes with scepticism, "an attitude of doubt or a disposition to incredulity either in general or toward a particular object" (Webster's Ninth New Collegiate Dictionary, 1986, p. 1103). The link between nostalgia and scepticism might be particularly strong in reference to AI. Its prototypical features, inventiveness and future direction, are frequently accompanied by concern that their progression will surpass uncontrollably the capacities of the human mind (Dang & Liu, 2022a; Morewedge, 2022).

Scepticism about change may increase uncertainty about the complexities and applications of technology (Whitmarsh, 2011). Technology uncertainty refers to the perceived inability to accurately predict the trajectory of technology or fully understand its consequences (Ragatz et al., 2002; Song & Montoya-Weiss, 2001). Innovative technology, like AI, introduces new tools and ways of thinking, and scepticism about change may lead people to feel uncertain whether these changes bring threats or opportunities. For example, due to doubts about societal changes that ChatGPT will bring about, more than 30,000 experts have publicly issued a call for a moratorium on AI experiments pending assurance about AI's potential development and outcomes (Future of Life Institute, 2023).

Technology uncertainty is a major barrier to accepting innovative technology (De Freitas et al., 2023; Jahanmir & Cavadas, 2018; Mani & Chouk, 2018). People value predictability and certainty and are averse to uncertainty (Dweck, 2017; Fiske, 2004). In the domain of technology, technology uncertainty engenders unfavourable responses. For example, perceived uncertainty associated with AI reduces people's trust in it (Liu, 2021; Lukyanenko et al., 2022), whereas perceived predictability of robots enhances human–robot coordination in task completion (Mayer et al., 2013).

Extended dual-pathway model of nostalgia and responses to innovative technology

We propose an extended dual-pathway model (Figure 1). It proposes that two opposing mechanisms account for the influence of nostalgia on responses to innovative (AI) technology. First, nostalgia-induced social connectedness augments technology exploration, which, in turn, conduces to favourability toward technological innovation. Second, nostalgia-induced scepticism about change enhances technology uncertainty, which, in turn, reduces favourability toward technological innovation. These two pathways, if equally strong, might cancel each other out, leading to no overall effect of nostalgia on responses to innovative technology. Given that the literature does not speak to the relative strength of the opposing pathways, we were agnostic about the direction of nostalgia's total effect on responses to innovative technology.

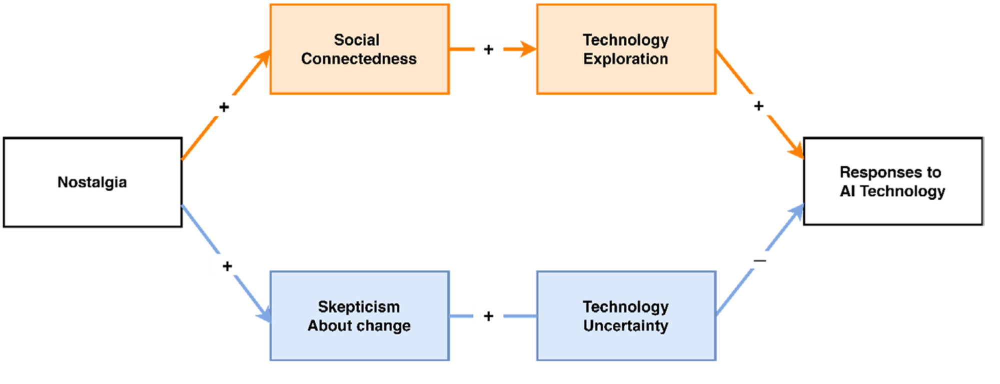

FIGURE 1 A model of opposing pathways linking nostalgia with responses to innovative technology.

OVERVIEW

We evaluated the extended model in three experiments. In Experiment 1, we induced nostalgia and tested the full model including both the excitatory and inhibitory pathways (Figure 1). In Experiment 2, to provide causal evidence for the excitatory pathway, we manipulated social connectedness and tested whether it augments favourable responses to innovative technology via increased technology exploration (top path, Figure 1). In Experiment 3, to provide causal evidence for the inhibitory pathway, we manipulated scepticism about change and tested whether it reduces favourable responses to innovative technology via increased technology uncertainty (bottom path, Figure 1). Additionally, to find out if the dual-pathway model applies to AI products regardless of how innovative they are, we investigated responses to a broader spectrum of AI, including ChatGPT, AI avatars, and companion robots.

We report how we determined our sample size, data exclusions, manipulations, and measures, and follow Journal Article Reporting Standards (Kazak, 2018). We preregistered all design and analysis plans: Experiment 1 (https://tinyurl.com/24xucj74), Experiment 2 (https://tinyurl.com/yshkrce4), Experiment 3 (https://tinyurl.com/vpewy92c). We made all data available (https://tinyurl.com/mrhsz35m). Also, we provided stimulus materials and demographic characteristics of the samples in Appendix S1. We reported all studies, measures, manipulations, and data/participant exclusions.

EXPERIMENT 1

In Experiment 1, we tested the full extended dual-pathway model (Figure 1), operationalizing responses to innovative technology as both support for research on ChatGPT and adoption of ChatGPT. ChatGPT is a recently released large language model that can interact conversationally with users and is expected to have far-reaching scientific, social, and societal consequences (Sallam, 2023; Van Dis et al., 2023; Wang et al., 2023). We induced general nostalgia rather than nostalgia for a specific past technology. The latter is rather narrow, involving longing for a particular technological artefact or system that was once prevalent but is no longer in common use. The former, however, has a broader remit, encompassing a diverse range of memories, experiences, and focal objects.

Method

Participants

We used a web-based Monte Carlo power analysis app (Schoemann et al., 2017) to arrive at the sample size required to estimate each of two serial pathways (nostalgia → social connectedness → technology exploration → responses to ChatGPT; nostalgia → scepticism about change → technology uncertainty → responses to ChatGPT). The app allows two parallel mediators or two serial mediators, but not two parallel serial pathways. Therefore, we ran two power analyses, computing the sample size required to estimate each of two serial pathways. Based on prior research (Dang et al., 2024), $N = 226$ and $N = 308$ would provide 80% power at $\alpha = .05$ (see Appendix S1 for parameters) to detect the two pathways, respectively. As this was the first test of the full extended model, we aimed for high power, recruiting 800 Chinese participants via Credamo for 5CNY (0.75USD). Those who failed an attention check were automatically excluded by Credamo. After excluding one participant who wrote nonsense in the nostalgia induction task, the final sample comprised 799 participants (504 women, 295 men; $M_{age} = 30.00$ years, $SD_{age} = 8.36$ years). We randomly assigned them either to the nostalgia ($n = 408$) or control ($n = 391$) condition.

Procedure and materials

Nostalgia manipulation

We induced nostalgia using the Event Reflection Task (Sedikides et al., 2015). Participants recalled either a nostalgic event (nostalgia condition) or an ordinary event (control condition) from their past, reflected on it, summarized it in a few keywords, and described it briefly. Next, they completed a 3-item manipulation check (Wildschut et al., 2006; e.g., "Right now, I am feeling quite nostalgic"; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .95$).

Social connectedness

We measured this variable with four items (Dang et al., 2024; e.g., "connected to loved ones"; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .90$) preceded by the stem "Thinking about this event makes me feel …."

Scepticism about change

We measured this variable with four items (Dang et al., 2024; e.g., "… makes me unsure that change is good"; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .90$) preceded by the stem "Thinking about this event makes me feel …".

Technology exploration

We presented participants with a description to familiarize them with natural language processing (ChatGPT). We then measured technology exploration in regard to ChatGPT with three items adapted from Nambisan et al. (1999; e.g., "I intend to spend time and effort in exploring ChatGPT for potential applications"; 1 = *strongly disagree*, 7 = *strongly agree*). We averaged responses ($\alpha = .71$).

Technology uncertainty

We measured technology uncertainty in regard to ChatGPT with three items adapted from Song and Montoya-Weiss (2001; e.g., "Changes in ChatGPT are very unpredictable"; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .92$).

Support for research on ChatGPT

We measured this variable with three items (Dang et al., 2024; e.g., "To what extent do you support increasing state funding for research on ChatGPT"; 1 = *not at all*, 7 = *very much*; $\alpha = .74$).

Adoption of ChatGPT

We presented participants with six contexts wherein either ChatGPT or real persons could be used (Sallam, 2023; e.g., checking the format or grammar of an academic paper and writing a medical note). Participants indicated which of the two (ChatGPT or real persons) they would like to use in each context. We coded their choices: ChatGPT = 1, real persons = 0. The total number of contexts where participants adopted ChatGPT constituted the relevant index (range = 0–6).[1]

Results

Nostalgia manipulation check

Participants in the nostalgia condition ($M = 6.11$, $SD = 0.70$) felt more nostalgic than those in the control condition ($M = 3.95$, $SD = 1.69$), $F(1, 797) = 568.36$, $p < .001$, $\eta^2 = .416$, 90% CI [.376, .454].[2] The manipulation was effective.

[1]A one-sample Kolmogorov–Smirnov test showed that the number of ChatGPT choices ($M = 3.08$, Variance = 3.36) did not follow a Poisson distribution, $p = .036$.

[2]We report 90% confidence intervals (CI) for eta squared, because the F test is one-sided (Steiger, 2004).

TABLE 1 Descriptive statistics and zero-order correlations among variables in experiments 1–3.

	Experiment 1 (N=799)							Experiment 2 (N=297)				Experiment 3 (N=300)			
Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**2**	**4**	**6**	**7**	**3**	**5**	**6**	**7**
1. Nostalgia															
2. Connectedness	.46***														
3. Scepticism	.19***	−.08*													
4. Exploration	−.02	.14***	−.07*					.23***							
5. Uncertainty	.03	−.03	.31***	−.05								.21**			
6. Support	−.05	.19***	−.25***	.49***	−.22***			.19**	.65***			−.23***	−.26***		
7. Adoption	−.06	.16***	−.26***	.22***	−.18***	.50***		.24***	.30***	.42***		−.18**	−.17**	.33***	
8. Gender	.04	−.02	.02	−.05	−.05	−.11**	−.09*	−.08	−.07	−.10	−.07	−.08	−.04	.02	.12*
9. Age	−.05	.10**	−.15***	.05	−.01	.22***	.37***	.05	.00	.06	−.04	.03	.05	−.02	.05
10. Education	−.01	.00	−.01	.08*	−.07*	.03	−.08*	−.04	−.16**	−.06	−.08	.08	−.01	.00	.07
M	0.51	4.87	3.79	5.99	4.37	5.41	3.09	0.49	3.85	3.28	1.74	0.50	4.07	4.06	2.79
SD	0.50	1.44	1.48	0.77	1.62	0.92	1.83	0.50	1.60	1.40	1.37	0.50	1.22	1.29	1.69

Note: In Experiment 1, nostalgia: nostalgia condition = 1, control condition = 0. In Experiment 2, connectedness: high social-connectedness condition = 1, low social-connectedness condition = 0. In Experiment 3, scepticism: high scepticism condition = 1, low scepticism condition = 0. Gender: 0 = men, 1 = women. Education: 1 = less than a middle school graduate, 2 = middle school graduate, 3 = high school graduate, 4 = some college (no degree), 5 = undergraduate degree, 6 = Master's degree, and 7 = doctoral degree.

*p < .05. **p < .01. ***p < .001.

Effects of nostalgia

Nostalgic participants ($M = 5.52$, $SD = 1.03$) reported higher social connectedness than controls ($M = 4.20$, $SD = 1.49$), $F(1, 797) = 215.14$, $p < .001$, $\eta^2 = .213$, 90% CI [.173, .252]. Additionally, nostalgic participants ($M = 4.06$ $SD = 1.46$) reported greater scepticism about change than controls ($M = 3.51$, $SD = 1.44$), $F(1, 797) = 28.46$, $p < .001$, $\eta^2 = .034$, 90% CI [.017, .058]. Furthermore, nostalgic and control participants did not differ significantly on technology exploration ($M_{\text{nostalgia}} = 5.97$, $SD = 0.80$ vs. $M_{control} = 6.00$, $SD = 0.72$; $F(1, 797) = 0.20$, $p = .652$, $\eta^2 < .001$), technology uncertainty ($M_{\text{nostalgia}} = 4.42$, $SD = 1.56$ vs. $M_{control} = 4.32$, $SD = 1.68$; $F(1, 797) = 0.83$, $p = .363$, $\eta^2 = .001$), support for research on ChatGPT ($M_{\text{nostalgia}} = 5.36$, $SD = 0.92$ vs. $M_{control} = 5.45$, $SD = 0.91$; $F(1, 797) = 1.86$, $p = .174$, $\eta^2 = .002$), or adoption of ChatGPT ($M_{\text{nostalgia}} = 2.98$, $SD = 1.89$ vs. $M_{control} = 3.20$, $SD = 1.76$; $F(1, 797) = 2.92$, $p = .088$, $\eta^2 = .004$).

There was a number of significant zero-order correlations between the variables of interest and the demographic characteristics of the sample (Table 1). We therefore re-ran the above analyses, including gender, age, and education as covariates. The results remained unchanged. Hence, we opted to exclude these three demographic variables from further analyses.

Mediation analysis

Table 1 shows descriptive statistics and intercorrelations. To test the hypothesized excitatory and inhibitory pathways underlying the effect of nostalgia on support for research on ChatGPT, we specified a saturated model (Figure 2a) using Mplus. We report path coefficients in Table 2. Nostalgia increased social connectedness and scepticism about change. Social connectedness positively predicted technology exploration but not technology uncertainty. Scepticism about change positively predicted technology uncertainty but not technology exploration. Technology exploration positively predicted, whereas technology uncertainty negatively predicted, support for research on ChatGPT. The excitatory (via social connectedness and technology exploration) and inhibitory (via scepticism about change and technology uncertainty) pathways were significant, but opposite in direction. When controlling for all indirect effects, the direct effect of nostalgia on support for research on ChatGPT was negative. This mediation model accounted for 31.9% of the variance in support for research on ChatGPT ($R^2 = .319$).

We specified a similar saturated model on adoption of ChatGPT (Figure 2b and Table 2). Nostalgia increased greater social connectedness and scepticism about change. Social connectedness positively predicted technology exploration but not technology uncertainty. Scepticism about change positively predicted technology uncertainty but not technology exploration. Technology exploration positively predicted, but technology uncertainty negatively predicted, adoption of ChatGPT. The excitatory (via social connectedness and technology exploration) and inhibitory (via scepticism about change and technology uncertainty) pathways were significant, but directionally opposite. When controlling for all indirect effects, the direct effect of nostalgia on adoption of ChatGPT was negative. This mediation model accounted for 13.7% of the variance in adoption of ChatGPT ($R^2 = .137$).

Discussion

The results were consistent with the extended dual-pathway model. Nostalgia advanced favourable responses to ChatGPT via greater social connectedness, which positively predicted technology exploration. At the same time, nostalgia reduced favourable responses to ChatGPT via greater scepticism about change, which positively predicted technology uncertainty. Notably, although the total effect of nostalgia on technology exploration (technology uncertainty) was not significant (Table 1), the indirect effect via social connectedness (scepticism about change) was so. Likewise, the total effects of nostalgia

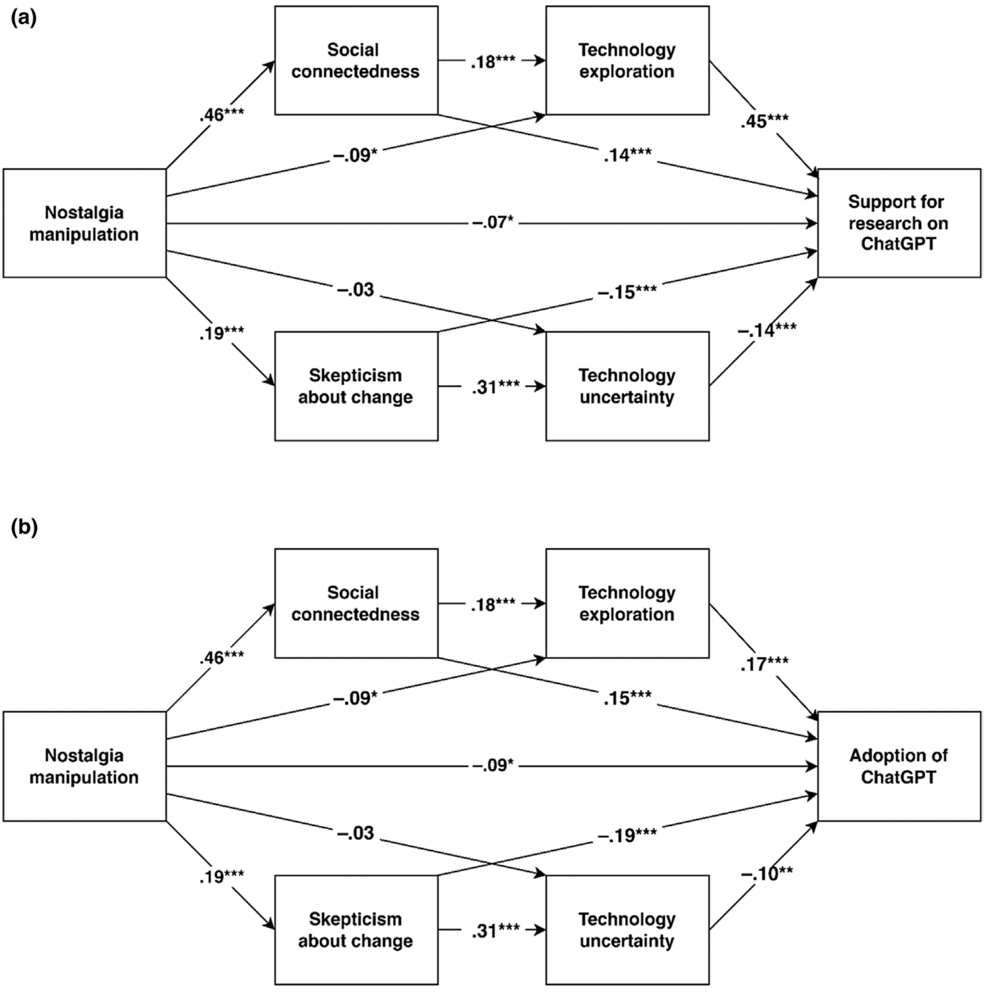

FIGURE 2 Effects of nostalgia on (a) support for research on ChatGPT and (b) adoption of ChatGPT in Experiment 1. Nostalgia manipulation: Nostalgia = 1, control = 0. Coefficients are fully standardized. To enhance figure clarity, we omitted correlations between the error variances of social connectedness and scepticism, and of technology exploration and technology uncertainty (Table 2). We also omitted the paths from social connectedness to technology uncertainty and from scepticism about change to technology exploration (ps > .232; Table 2). *p < .05. **p < .01. ***p < .001.

on responses to ChatGPT were not significant, yet both serial pathways were so. These findings correspond to the notion that significant indirect effects can occur in the absence of significant total effects. There are three common explanations for such a results pattern (Hayes, 2009; Kenny & Judd, 2014; Rucker et al., 2011). First, Kenny and Judd (2014) showed that the test of the total effect can have "dramatically less" (p. 335) power than the test of the indirect effect. To explain this power anomaly, they used the metaphor of throwing a ball a certain distance in one throw (analogous to the total effect) or in two throws (analogous to an indirect effect via a mediator): "It might be very hard to throw a ball 70 m in one throw. However, it is a lot easier to throw the ball 70 m in two throws" (p. 338). This metaphor can be extended to our case of serial mediation (i.e., covering the distance in three throws). Second, a total effect may not be significant due to the operation of opposing intervening processes that cancel out each other. Experiment 1 provided evidence for such opposing serial pathways, as hypothesized (Figure 1). Third, the total effect may not be significant due to the operation of unmeasured processes; that is, the model may be incomplete. In Experiment 1, the residual direct effects of nostalgia on

TABLE 2 Tests of direct and indirect paths in Experiment 1.

	Outcome = support for research on ChatGPT					Outcome = adoption of ChatGPT				
Path	***b***	**95% CI**	***SE***	***p***	***b****	***b***	**95% CI**	***SE***	***p***	***b****
Direct path										
Nostalgia → Connectedness	1.32	[1.15, 1.50]	0.09	<.001	.46	1.32	[1.15, 1.50]	0.09	<.001	.46
Nostalgia → Scepticism	0.55	[0.35, 0.75]	0.10	<.001	.19	0.55	[0.35, 0.75]	0.10	<.001	.19
Nostalgia → Exploration	−0.13	[−0.26, −0.01]	0.06	.032	−.09	−0.13	[−0.26, −0.01]	0.06	.032	−.09
Nostalgia → Uncertainty	−0.10	[−0.35, 0.15]	0.13	.417	−.03	−0.10	[−0.35, 0.15]	0.13	.417	−.03
Nostalgia → Outcome	−0.14	[−0.26, −0.01]	0.06	.029	−.07	−0.33	[−0.60, −0.05]	0.14	.021	−.09
Connectedness → Exploration	0.09	[0.05, 0.13]	0.02	<.001	.18	0.09	[0.05, 0.13]	0.02	<.001	.18
Connectedness → Uncertainty	0.01	[−0.07, 0.10]	0.04	.740	.01	0.01	[−0.07, 0.10]	0.04	.740	.01
Connectedness → Outcome	0.09	[0.05, 0.13]	0.02	<.001	.14	0.20	[0.10, 0.29]	0.05	<.001	.15
Scepticism → Exploration	−0.02	[−0.06, 0.01]	0.02	.232	−.04	−0.02	[−0.06, 0.01]	0.02	.232	−.04
Scepticism → Uncertainty	0.34	[0.27, 0.42]	0.04	<.001	.31	0.34	[0.27, 0.42]	0.04	<.001	.31
Scepticism → Outcome	−0.09	[−0.13, −0.05]	0.02	<.001	−.15	−0.24	[−0.33, −0.15]	0.04	<.001	−.19
Exploration → Outcome	0.54	[0.47, 0.61]	0.04	<.001	.45	0.42	[0.26, 0.57]	0.08	<.001	.17
Uncertainty →Outcome	−0.08	[−0.12, −0.05]	0.02	<.001	−.14	−0.12	[−0.19, −0.04]	0.04	.003	−.10
Connectedness ←→ Scepticism	−0.36	[−0.49, −0.23]	0.07	<.001	−.19	−0.36	[−0.49, −0.23]	0.07	<.001	−.19
Exploration ←→ Uncertainty	−0.03	[−0.11, 0.05]	0.04	.413	−.03	−0.03	[−0.11, 0.05]	0.04	.413	−.03
Indirect path										
Nostalgia → Connectedness → Outcome	0.12	[0.06, 0.19]	0.03	<.001		0.26	[0.12, 0.40]	0.07	<.001	
Nostalgia → Connectedness → Exploration	0.12	[0.06, 0.19]	0.03	<.001		0.12	[0.06, 0.19]	0.03	<.001	
Nostalgia → Connectedness → Uncertainty	0.02	[−0.10, 0.14]	0.06	.757		0.02	[−0.10, 0.14]	0.06	.756	
Nostalgia → Scepticism → Outcome	−0.05	[−0.09, −0.03]	0.02	<.001		−0.13	[−0.20, −0.06]	0.04	<.001	
Nostalgia → Scepticism → Exploration	−0.01	[−0.04, 0.01]	0.01	.295		−0.01	[−0.04, 0.01]	0.01	.295	
Nostalgia → Scepticism → Uncertainty	0.19	[0.12, 0.28]	0.04	<.001		0.19	[0.12, 0.28]	0.04	<.001	
Nostalgia → Exploration → Outcome	−0.07	[−0.13, 0.00]	0.03	.036		−0.06	[−0.11, 0.00]	0.03	.049	
Nostalgia → Uncertainty → Outcome	0.01	[0.00, 0.03]	0.01	.432		0.01	[−0.02, 0.04]	0.02	.464	

TABLE 2 (Continued)

Path	Outcome = support for research on ChatGPT					Outcome = adoption of ChatGPT				
	b	95% CI	*SE*	*p*	*b**	*b*	95% CI	*SE*	*p*	*b**
Nostalgia → Connectedness → Exploration → Outcome	0.07	[0.03, 0.11]	0.02	<.001		0.05	[0.02, 0.08]	0.02	.002	
Nostalgia → Scepticism → Exploration → Outcome	−0.01	[−0.02, 0.00]	0.01	.310		−0.01	[−0.02, 0.01]	0.01	.310	
Nostalgia → Connectedness → Uncertainty → Outcome	−0.00	[−0.01, 0.01]	0.01	.763		−0.00	[−0.02, 0.02]	0.01	.774	
Nostalgia → Scepticism → Uncertainty → Outcome	−0.02	[−0.03, −0.01]	0.01	.001		−0.02	[−0.04, −0.004]	0.01	.019	

technology exploration and responses to ChatGPT were negative and statistically significant, suggesting the operation of one or more additional inhibitory processes.

Developing further the model is an important task for future research. This does not take away from the fact that Experiment 1 findings successfully replicated and extended the dual-pathway model introduced by Dang et al. (2024). Nevertheless, Experiment 1 employed a measurement-of-mediation design and, as such, could not establish the direction of causation between social connectedness/scepticism about change and responses to technology. Therefore, in the tradition of an experimental-causal-chain approach (Spencer et al., 2005), we manipulated social connectedness in Experiment 2 and scepticism about change in Experiment 3.

EXPERIMENT 2

Social connectedness can serve as a platform for exploration of technology, contributing to technology acceptance (Boudreau & Robey, 2005; Rogers & Muller, 2006). We hypothesized in Experiment 2 that social connectedness would strengthen the favourability of responses to AI technology via stronger intention to explore AI technology. We operationalized responses to AI in terms of support for research on AI avatars and behavioural choice of adopting AI avatars. AI avatars are digital representations of persons (Vallis et al., 2024) and have been used in entertainment, advertising, gaming, communication, and business.

Method

Participants

The key effect of interest is the indirect effect of social connectedness via technology exploration. We used the web-based MedPower app (Kenny, 2017) to estimate the sample size required to observe an indirect effect of manipulated social connectedness on responses to AI avatars via technology exploration. We specified small-to-medium relations (rs = .20) between social connectedness and technology exploration, and between technology exploration and responses to AI avatars, as well as a small direct association (r = .10) of social connectedness with responses to AI avatars. Relying on these correlation coefficients and $\alpha = .05$, an N of 269 would provide 80% power for our two-condition experiment. We recruited 300 UK Prolific workers for 1 GBP (1.39 USD). Three failed an attention check (completing two simple arithmetic calculations). The final sample comprised 297 participants (141 women, 156 men; $M_{age} = 36.95$ years, $SD_{age} = 13.22$ years). We randomly assigned them to the high ($n = 145$) or low ($n = 152$) social-connectedness condition.

Procedure and materials

Social connectedness

We manipulated social connectedness after Bastian and Haslam (2010). In the high social-connectedness condition, participants recalled times when they felt they belonged with other people. In the low social-connectedness condition, they recalled times when they felt very lonely, excluded by others, or disconnected from others. The manipulation check followed. Participants viewed the stem “At this moment, I feel…” and then responded to five items, adding “warm” to the four Experiment 1 items (1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .98$).

Technology exploration

We presented participants with a description of AI avatars (what AI avatars are, how they are applied). We then assessed technology exploration with the same three items (Nambisan et al., 1999) as in Experiment 1, but in regard to AI avatars (e.g., "I intend to spend time and effort in exploring AI avatar for potential applications"; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .94$).

Support for research on AI avatars

We measured this variable with three items, as in Experiment 1 (e.g., "To what extent do you support the use of taxpayer money for research on AI avatars?"; 1 = *not at all*, 7 = *very much*; $\alpha = .87$).

Adoption of AI avatars

Similar to the corresponding Experiment 1 measure, we presented participants with six image pairs. Each pair consisted of a photograph and an avatar generated from that photograph. Participants imagined they were the person in the photograph, and indicated whether they would like to use a photograph or an AI avatar in six contexts (e.g., communicating with clients online and gaming online), which are prevalent applications of AI avatars (Dilmegani, 2020). We coded participants' choices to use photographs (0) or AI avatars (1). The total number of contexts where participants adopted the avatars constituted the relevant index (range = 0–6).

Results

Social connectedness manipulation check

Participants in the high social-connectedness condition ($M = 5.52$, $SD = 1.30$) felt more socially connected than those in the low social-connectedness condition ($M = 2.03$, $SD = 1.37$), $F(1, 295) = 503.26$, $p < .001$, $\eta^2 = .630$, 90% CI [.578, .672].

Effects of social connectedness

Participants in the high social-connectedness condition ($M = 4.22$, $SD = 1.53$) reported greater technology exploration than those in the low social-connectedness condition ($M = 3.49$, $SD = 1.59$), $F(1, 295) = 16.33$, $p < .001$, $\eta^2 = .052$, 90% CI [.019, .099]. Participants in the high social-connectedness condition ($M = 3.55$, $SD = 1.42$) reported more support for research on AI avatars than their low social-connectedness counterparts ($M = 3.02$, $SD = 1.33$), $F(1, 295) = 10.86$, $p = .001$, $\eta^2 = .035$, 90% CI [.009, .076]. Similarly, participants in the high social-connectedness condition ($M = 2.08$, $SD = 1.49$) were more likely to adopt AI avatars than those in the low social-connectedness condition ($M = 1.41$, $SD = 1.15$), $F(1, 295) = 18.38$, $p < .001$, $\eta^2 = .059$, 90% CI [.023, .107].[3] We repeated the above analyses including gender, age, and education as covariates. The results remained unchanged, and so we excluded these variables from further consideration.

Mediation analyses

We report descriptive statistics and intercorrelations in Table 1. We tested a mediation model on support for research on AI avatars (Figure 3a) using the PROCESS macro (Hayes, 2022). Social connectedness enhanced technology exploration ($b = 0.73$, 95% CI [0.38, 1.09], $SE = 0.18$, $t(295) = 4.04$, $p < .001$,

[3]A one-sample Kolmogorov–Smirnov test indicated that the number of times participants selected an AI avatar ($M = 1.74$, Variance = 1.37) followed a Poisson distribution, $p = .272$. A Poisson regression analysis revealed that participants in the high (vs. low) social connectedness condition were more likely to adopt AI avatars, $b = 0.38$, 95% CI [0.21, 0.56], $SE = 0.09$, $z = 4.32$, $p < .001$, *IRR* (incidence rate ratio) = 1.47.

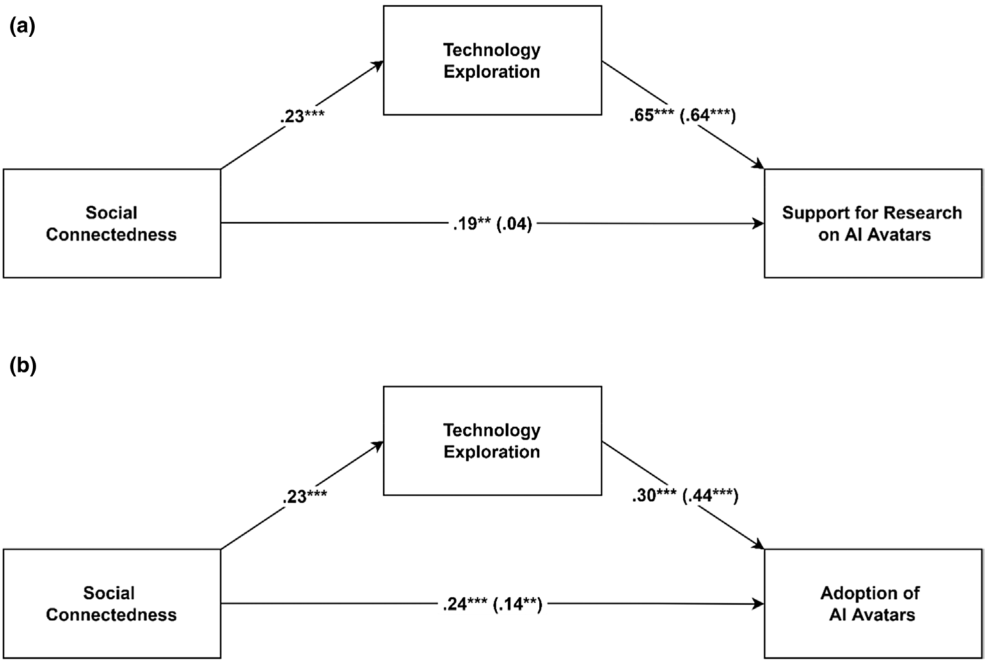

FIGURE 3 Effects of social connectedness on (a) Support for research on and (b) adoption of AI Avatars via technology exploration in Experiment 2. Social connectedness: High social connectedness = 1, low social connectedness = 0. Coefficients are fully standardized. Coefficients in parentheses are associations between variables when social connectedness and technology exploration simultaneously predict responses to AI avatars. $^{**}p < .01$. $^{***}p < .001$.

$b^* = .23$), which, in turn, positively predicted support for research on AI avatars ($b = 0.56$, 95% CI [0.48, 0.64], $SE = 0.04$, $t(294) = 14.13$, $p < .001$, $b^* = .64$). The indirect effect was significant ($ab = 0.41$, 95% CI [0.21, 0.63]). Controlling for technology exploration, social connectedness did not promote support for research on AI avatars ($b = 0.12$, 95% CI [−0.13, 0.36], $SE = 0.13$, $t(294) = 0.91$, $p = .362$, $b^* = .04$). Technology exploration mediated the effect of social connectedness on support for research on AI avatars, and the residual direct effect was not significant. This mediation model accounted for 42.5% of the variance in support for research on AI avatars ($R^2 = .425$).

We conducted a similar mediation analysis on adoption of AI avatars (Figure 3b). Social connectedness increased technology exploration ($b = 0.73$, 95% CI [0.38, 1.09], $SE = 0.18$, $p < .001$, $b^* = .23$), which, in turn, positively predicted adoption of AI avatars ($b = 0.38$, 95% CI [0.29, 0.47], $SE = 0.04$, $p < .001$, $b^* = .44$). The indirect effect was significant ($ab = 0.28$, 95% CI [0.13, 0.44]). Controlling for technology exploration, social connectedness promoted adoption of AI avatars ($b = 0.38$, 95% CI [0.10, 0.66], $SE = 0.14$, $p = .007$, $b^* = .14$). Technology exploration mediated the effect of social connectedness on adoption of AI avatars, but the residual direct effect remained significant.[4] This mediation model accounted for 24.4% of the variance in adoption of AI avatars ($R^2 = .244$).

Discussion

Social connectedness strengthened support for research on AI avatars and adoption of AI avatars. More importantly, technology exploration accounted, at least in part, for these effects. Experiment 2

[4]In Experiments 2–3, we conducted ancillary mediation analyses on adoption of innovative technology. We specified a Poisson distribution for the dependent variable via the COUNT option in Mplus. Results were virtually identical to those reported.

establishes the causal relationship between social connectedness and technology exploration and supports the hypothesized model (Figure 1).

EXPERIMENT 3

In Experiment 3, we addressed the question of how scepticism about change worsens responses to AI. We proposed that scepticism about change gives way to technology uncertainty, a serious obstacle in accepting innovative technology (Jahanmir & Cavadas, 2018; Mani & Chouk, 2018). We operationalized responses to AI as support for research on companion robots and behavioural choice of adopting companion robots. Companion robots are a type of service robot designed to provide social interaction and assistance to humans in settings where people may need support, such as in homes, healthcare facilities, or educational environments (Robinson et al., 2013; Ruggiero et al., 2022). In accordance with our model (Figure 1), we expected that scepticism about change would decrease the favourability of responses to companion robots via greater technology uncertainty.

Method

Participants

The key effect of interest was the indirect effect of scepticism about change via technology uncertainty. We used the web-based MedPower app (Kenny, 2017) to estimate the sample size required to observe an indirect effect of manipulated scepticism about change on responses to companion robots via technology uncertainty. We specified small-to-medium relations (*r*s = .20) between scepticism about change and technology uncertainty, and between technology uncertainty and responses to companion robots, as well as a small direct association (r = .10) between scepticism about change and responses to companion robots. Relying on these correlation coefficients and $\alpha = .05$, an N of 269 would provide 80% power for our two-condition experiment. We recruited 300 US Prolific workers (175 women, 119 men, 6 unreported; M_{age} = 34.93 years, SD_{age} = 12.94 years) for 1.40USD. No participants were excluded. We randomly assigned them to the high scepticism about change (n = 150) or low scepticism about change (n = 150) condition.

Procedure and materials

Scepticism about change

We manipulated scepticism about change as in Dang et al. (2024, Study 1B). Participants completed an 8-item scepticism scale. In the high scepticism condition, we worded each item with the intent to prompt agreement (e.g., "I *sometimes* fear change, because I will have lost something meaningful to me"; 1 = *strongly disagree*, 7 = *strongly agree*), whereas, in the low scepticism condition, we worded each item intending to prompt disagreement (e.g., "I *always* fear change, because I worry that I might lose something valuable"; 1 = *strongly disagree*, 7 = *strongly agree*). Participants in the high scepticism condition (M = 4.95, SD = 1.10) reported greater agreement than those in the low scepticism condition (M = 3.54, SD = 1.27), $F(1, 298) = 105.71$, $p < .001$, $\eta^2 = .262$, 90% CI [.194, .327]. Next, we provided participants with false feedback indicating that their scepticism score was either at the 68th percentile (high scepticism condition) or the 32nd percentile (low scepticism condition) compared to their peers. Subsequently, participants took at least 2 minutes to record in writing why they were so high/low on scepticism about change. Finally, as a manipulation check, participants responded to three items (i.e., "Right now, I am feeling quite skeptical about change"; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .98$).

Technology uncertainty

We measured technology uncertainty with three items, as in Experiment 1 (Song & Montoya-Weiss, 2001). A sample item is: "The rate (speed and pace) of changes in companion robot technology are very unpredictable" (1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .88$).

Support for research on companion robots

We measured this variable with three items, as in Experiments 1–2 (e.g., "To what extent do you support the use of taxpayer money for research on companion robots?"; 1 = *not at all*, 7 = *very much*; $\alpha = .83$).

Adoption of companion robots

We assessed this variable in terms of contexts as in Experiments 1–2. We presented participants with six contexts involving the possible use of companion robots or real pets (O'Hara, 2019; e.g., playing with a child and working as play partners for children with autism). Participants chose companion robots (coded as 1) or real pets (coded as 0) in each context. The number of contexts where participants adopted companion robots for use was the pertinent index (range = 0–6).

Results

Scepticism about change manipulation check

Participants in the high scepticism condition ($M = 4.43$, $SD = 1.52$) reported greater scepticism about change than those in the low scepticism condition ($M = 2.98$, $SD = 1.64$), $F(1, 298) = 62.92$, $p < .001$, $\eta^2 = .174$, 90% CI [.114, .237]. Thus, the manipulation of scepticism about change was effective.

Effects of Scepticism about change

Participants in the high scepticism condition ($M = 4.33$, $SD = 1.21$) reported more technology uncertainty than those in the low scepticism condition ($M = 3.81$, $SD = 1.19$), $F(1, 298) = 14.30$, $p < .001$, $\eta^2 = .046$, 90% CI [.015, .090]. Also, participants in the high scepticism condition ($M = 3.76$, $SD = 1.23$) reported less support for research on companion robots than those in the low scepticism condition ($M = 4.36$, $SD = 1.28$), $F(1, 298) = 17.00$, $p < .001$, $\eta^2 = .054$, 90% CI [.020, .100]. Similarly, participants in the high scepticism condition ($M = 2.49$, $SD = 1.59$) were less likely to adopt companion robots than those in the low scepticism condition ($M = 3.09$, $SD = 1.74$), $F(1, 298) = 9.73$, $p = .002$, $\eta^2 = .032$, 90% CI [.007, .071].[5] We repeated these analyses including gender, age, and education as covariates. The results were virtually identical to the reported ones. Hence, we excluded these variables from additional consideration.

Mediation analyses

We report descriptive statistics and intercorrelations in Table 1. We conducted a mediation analysis on support for research on companion robots (Figure 4a) using the PROCESS macro (Hayes, 2022). Scepticism about change enhanced technology uncertainty ($b = 0.52$, 95% CI [0.25, 0.79], $SE = 0.14$, $t(298) = 3.78$, $p < .001$, $b^* = .21$), which in turn negatively predicted support for research on companion robots ($b = -0.23$, 95% CI [−0.34, −0.11], $SE = 0.06$, $t(297) = -3.83$, $p < .001$, $b^* = -.22$). The indirect

[5]A one-sample Kolmogorov–Smirnov test showed that the number of companion-robot choices ($M = 2.79$, Variance = 2.86) followed a Poisson distribution, $p = .150$. A Poisson regression analysis revealed that participants in the high scepticism condition were less likely to adopt companion robots than those in the low scepticism condition, $b = -0.22$, 95% CI [−0.35, −0.08], $SE = .07$, $z = -3.12$, $p = .002$, $IRR = 0.81$.

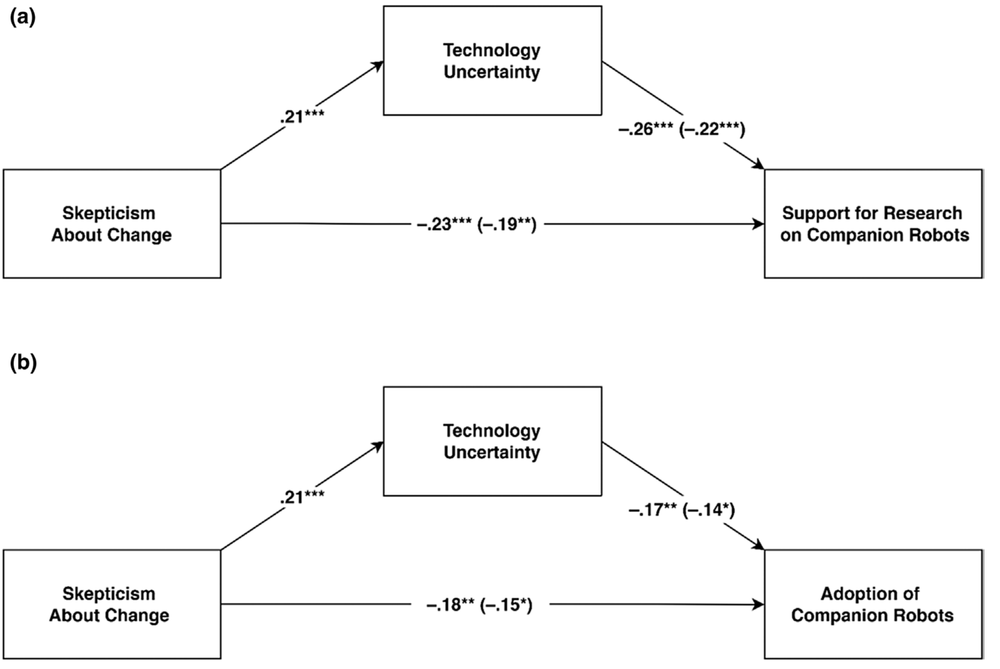

FIGURE 4 Effects of scepticism about change on (a) support for research on and (b) adoption of companion robots via technology uncertainty in Experiment 3. Scepticism about change: High scepticism = 1, low scepticism = 0. Coefficients are fully standardized. Coefficients in parentheses are associations between variables when scepticism about change and technology uncertainty simultaneously predict responses to companion robots. *$p < .05$. **$p < .01$. ***$p < .001$.

effect was significant ($ab = -0.12$, 95% CI [−0.23, −0.03]). Controlling for technology uncertainty, scepticism about change reduced support for research on companion robots ($b = -0.48$, 95% CI [−0.76, −0.19], $SE = 0.15$, $t(297) = -3.30$, $p = .001$, $b^* = -.19$). Technology uncertainty mediated the effect of scepticism about change on support for research on companion robots, but the residual direct effect remained significant. This mediation model accounted for 9.8% of the variance in support for research on companion robots ($R^2 = .098$).

Next, we conducted a similar mediation analysis on adoption of companion robots (Figure 4b). Scepticism about change enhanced technology uncertainty ($b = 0.52$, 95% CI [0.25, 0.79], $SE = 0.14$, $p < .001$ $b^* = .21$), which in turn negatively predicted adoption of companion robots ($b = -0.19$, 95% CI [−0.35, −0.03], $SE = 0.08$, $p = .018$, $b^* = -.14$). The indirect effect was significant ($ab = -0.10$, 95% CI [−0.23, −0.02]). Controlling for technology uncertainty, scepticism about change weakened adoption of AI avatars ($b = -0.50$, 95% CI [−0.88, −0.12], $SE = .20$, $p = .011$, $b^* = -.15$). Technology uncertainty also mediated the effect of scepticism about change on adoption of companion robots, but the residual direct effect remained significant. This mediation model accounted for 5.0% of the variance in adoption of companion robots ($R^2 = .050$).

Discussion

Taken together, scepticism about change reduced support for research on companion robots and adoption of companion robots, and technology uncertainty partially accounted for it. Experiment 3 establishes the causal relationship between scepticism about change and technology uncertainty and supports the hypothesized model (Figure 1).

GENERAL DISCUSSION

Nostalgia is relevant to responses to AI. Consistent with their dual-pathway model, Dang et al. (2024) found that, whereas social connectedness mediated nostalgia's favourable responses, scepticism about change mediated nostalgia's unfavourable responses, to AI. We aimed to deepen understanding of nostalgia's role in responses to AI. Specifically, we wondered how social connectedness influenced favourable responses, and how scepticism about change influenced unfavourable responses. We hypothesized an additional link in each process, leading to the formulation of the extended dual-pathway model. Social connectedness augments technology exploration, which subsequently is associated with favourable responses. Scepticism about change enhances technology uncertainty, which subsequently is associated with unfavourable responses.

In three preregistered experiments, we obtained support for the extended model in samples derived from three cultures (China, UK, USA), while replicating the links specified in the original dual-pathway model (Dang et al., 2024). Moreover, by adding technology exploration and technology uncertainty, we clarified how states—nostalgia-induced social connectedness and scepticism about change—influence responses to a specific target (AI). This extended model enables a more nuanced understanding of the way in which nostalgia and its ensuing processes shape responses to innovative technology. We demonstrated causal effects of nostalgia on social connectedness and scepticism about change, and of social connectedness and scepticism about change on, respectively, technology exploration and technology uncertainty. However, the links from technology exploration and technology uncertainty to responses to AI are correlational. Follow-up studies could test the causal direction of these two final links.

We consider alternative explanations for our findings. One such explanation relates to the potential confounding of the nostalgia manipulation with social connectedness in Experiment 1. Specifically, in the nostalgia condition, we instructed participants that the emotion involves feeling "… fond or sentimental about significant persons in their life, about important events they experienced, or about time periods from their past …" (Appendix S1). Faced with the same issue, Dang et al. (2024, Study 4) addressed this explanation by implementing a pictorial nostalgia induction that made no reference to social relationships. Their findings supported the dual-pathway model. Another alternative explanation is that the influence of social connectedness on technology exploration in Experiment 2 was due to positive affect. Dang et al. (2024, Study 1A; Dang & Liu, 2024, Study 1) reported that, whereas social connectedness elevated positive affect, positive affect did not predict the quality of human-AI relationships and, hence, did not mediate the effect of social connectedness on responses to AI.

Implications

The extended dual-pathway model is generative. It is applicable to other domains of innovative technology (e.g., augmented reality, cloud computing, machine learning) and other settings. By raising social connectedness and subsequently exploration, nostalgia might facilitate knowledge acquisition. Likewise, by increasing scepticism about change and uncertainty, nostalgia might inhibit favourability toward new consumer products (Dimitriadou et al., 2019) or outgroups (Smeekes et al., 2023). These are promising empirical directions.

Our findings replicate and extend the original dual-pathway model (Dang et al., 2024). Cumulative and programmatic research is crucial for evaluating the credibility and refining the precision of results (Nosek et al., 2022). We sought to validate the original dual-pathway model by replicating it using ChatGPT as the focal technological product and a large sample size (Experiment 1). We also tested specific causal pathways within the model, that is, the effect of social connectedness and the influence of scepticism about change on responses to AI technology using specific technological products (AI avatars in Experiment 2 and companion robots in Experiment 3) rather than general AI robots or technology implemented in the original studies (Dang et al., 2024, Studies 1A and 1B). By testing the model with new data and in new contexts, we responded to the call for replication as a standard practice in psychological science (Maxwell et al., 2015; Open Science Collaboration, 2015).

Our research also has practical implications. Social connectedness and technology exploration underlie the positive effect of nostalgia on responses to AI. AI products can be strategically designed to enhance social bonds by connecting individual consumers with their past. For instance, the application Deep Nostalgia enables users to forge a deeper connection with their heritage by animating ancestral images, thereby fostering a sense of closeness and continuity across generations. AI designs that emphasize social connection, such as anthropomorphic interfaces, are likely to enhance nostalgia-induced consumer interest in AI products. Additionally, strategies aimed at mitigating uncertainty regarding technology, such as the development of explainable AI (i.e., AI systems that can explain their decisions in a way humans can understand; Rai, 2020), may reduce nostalgia-induced resistance of AI.

Limitation and future direction

Our research has certain methodological limitations. First, we did not assess individual differences in familiarity with AI. On the one hand, previous user experience with technology predicts technology acceptance (Heerink et., 2006). On the other hand, AI knowledge (i.e., the extent to which individuals have heard, read, or come across information about AI) does not influence attitudes toward AI agents (Dang & Liu, 2022a; Zhou et al., 2024). Nonetheless, future research would benefit from exploring the role of AI-related expertise in the psychological processes addressed by our model. Second, we focused on responses to ChatGPT, AI avatars, and companion robots, all of which are designed to interact with humans based on AI generative models. These technologies focus on replicating human reasoning capabilities but, particularly in the case of AI avatars and companion robots, also replicate human appearance. Future research could separate the two and examine if our model applies equally to technologies that replicate exclusively human reasoning (but not appearance) or appearance (but not reasoning). Third, we introduced AI products, such as AI avatars, in static images, and this may have impeded participants' comprehension of the interactive and dynamic nature of the avatars. Consequently, future research should provide participants with opportunities to engage with AI products prior to reporting their responses to them.

Future work could extend the generalizability of our findings via different methodologies (e.g., longitudinal or momentary ecological assessments), varying operationalizations, and additional cultures. An intriguing direction would involve replicating our findings with a next-generation AI application, namely, digital humans. Digital humans are virtual, AI-powered characters that act like humans. They include a comprehensive set of AI technologies that enable them to understand, respond to, and learn from human inputs (Sung et al., 2022). Digital humans are more humanized than current AI products, as they try to recreate parts of human interaction, such as communication and emotional connection, to approximate real human contact (Silva & Bonetti, 2021). It is plausible that, when it comes to nostalgia's effect on responses to digital humans, the excitatory pathway via social connectedness and technology exploration will dominate the inhibitory pathway via scepticism about change and technology uncertainty.

Although our hypothesized model was supported, we call for future research to expand it. One direction is to explore additional processes underlying the effects of nostalgia on technology acceptance. In Experiment 1, the direct effects of nostalgia on responses to ChatGPT were negative after controlling for the two serial pathways. Similarly, in Experiment 2 (Experiment 3), technology exploration (technology uncertainty) only partially accounted for the effect of social connectedness (scepticism about change) on responses to innovative technology. These significant direct effects merit further theoretical exploration and empirical scrutiny, as they suggest the operation of additional intervening processes not currently included in our model.

Another direction involves identifying factors that moderate the effects of nostalgia. Prior studies indicate that U.S. and U.K. participants have more ambivalent attitudes toward AI technology than their Chinese counterparts (Dang & Liu, 2021, 2022b). Although our model has been validated across these two cultural contexts, the strength of nostalgia's effects on responses to technology may differ. Moreover, whereas generative AI may be seen as a threat to one's job and tangible resources as well as to one's personal identity and uniqueness (Alessandro, Dimitri, et al., 2024), robots designed with human-like reasoning capacities are increasingly viewed as social partners for interaction. Therefore, further investigation is needed to determine whether the effects of nostalgia vary based on the interpretation of AI as threat or a companion.

Conclusion

The implications of nostalgia for the acceptance of innovative technology are nuanced. The emotion involves cherishing the past yet hesitating to embrace a fast-changing future. It promotes social connectedness and, by so doing, encourages technology exploration and ensuing acceptance of technological innovations. At the same time, it conduces to scepticism about change, thereby reducing technology exploration and its acceptance. This duality warrants deeper exploration, with the potential to inform broader understanding of the relation between nostalgia and modernity—between past and future.

AUTHOR CONTRIBUTIONS

Jianning Dang: Conceptualization; methodology; data curation; formal analysis; writing – original draft; writing – review and editing. **Constantine Sedikides:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Tim Wildschut:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Li Liu:** Conceptualization; methodology; supervision; writing – original draft; writing – review and editing; funding acquisition.

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CONFLICT OF INTEREST STATEMENT

There are no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Open Science Framework at https://tinyurl.com/mrhsz35m.

ETHICS STATEMENT

All study participants provided informed consent, and the study design was approved by the appropriate ethics review board.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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