AMERICAN PSYCHOLOGICAL ASSOCIATION

Psychology and Aging

ISSN: 0882-7974

https://doi.org/10.1037/pag0000847

Moderators of Curiosity and Information Seeking in Younger and Older Adults

Liyana T. Swirsky and Julia Spaniol
Department of Psychology, Toronto Metropolitan University

The present study examined age differences in the influence of informational value cues on curiosity and information seeking. In two experiments, younger and older adults (total $N = 514$) rated their curiosity about content before having the opportunity to seek out more information. Experiment 1 examined the impact of social value on curiosity and information seeking about trivia. Online popularity metrics served as social value cues. Metric visibility increased engagement with high-popularity information for older adults, whereas it decreased engagement with low-popularity information for younger adults. Experiment 2 examined the impact of practical value on curiosity and information seeking about science facts. Personal and collective practical value were highlighted by linking the information to the domains of medicine and the environment, respectively. Patterns of curiosity and information seeking revealed greater sensitivity to collective practical value in older than younger adults. In both experiments, the relationship between curiosity and information seeking was stronger in older adults than in younger adults. Overall, these findings suggest that age differences in motivational priorities may lead to age differences in curiosity and information seeking. In addition to highlighting strategies for fostering curiosity in older learners, these findings may also inform digital literacy interventions aimed at reducing engagement with clickbait and misinformation.

Public Significance Statement
This study shows that curiosity has a stronger effect on information seeking in older adults than in younger adults, suggesting that curiosity may gain importance with age. Older adults are particularly likely to seek out information that they perceive as being popular with others, or as holding societal relevance. These findings highlight practical strategies for sparking curiosity and mobilizing information search in older adults.

Keywords: epistemic curiosity, intrinsic motivation, information seeking, information search

Supplemental materials: https://doi.org/10.1037/pag0000847.supp

Liyana T. Swirsky https://orcid.org/0000-0002-4857-1684
Julia Spaniol https://orcid.org/0000-0003-1793-0899

Findings contained in this article were presented at the Toronto Area Memory Group 2023 Meeting. Preregistrations, synthesized data, analysis code, and study materials are available on the Open Science Framework repository at https://osf.io/wxbsm/ for Experiment 1 and https://osf.io/xw5f8/ for Experiment 2.

This work was supported by the Canada Excellence Research Chairs, Government of Canada (No. 950-232332 awarded to Julia Spaniol) and by the Natural Sciences and Engineering Research Council of Canada (CGSD3-548064-2020 awarded to Liyana T. Swirsky).

Liyana T. Swirsky played a lead role in conceptualization, data curation, formal analysis, investigation, methodology, project administration, software, visualization, and writing–original draft and a supporting role in funding acquisition. Julia Spaniol played a lead role in funding acquisition, supervision, and writing–review and editing and a supporting role in conceptualization and project administration.

Correspondence concerning this article should be addressed to Liyana T. Swirsky, Department of Psychology, Toronto Metropolitan University, 350 Victoria Street, Toronto, ON M5B 2K3, Canada. Email: lswirsky@torontomu.ca

Epistemic curiosity—the desire for knowledge—is experienced across the lifespan and can support healthy aging by contributing to lifelong learning (McGillivray et al., 2015), increasing longevity (Swan & Carmelli, 1996) and fostering meaningful social interactions (Kashdan et al., 2011). Due to curiosity's role in adaptive aging (Sakaki et al., 2018), it is important to uncover factors that drive curiosity in adulthood. Curiosity is often conceptualized as a purely intrinsic construct, absent of external drivers. Modern scientists and early philosophers alike converge on a definition of epistemic curiosity that hinges on its noninstrumental nature (Berlyne, 1950; Loewenstein, 1994). Contrary to this dominant viewpoint, the recently proposed rational model of curiosity (Dubey & Griffiths 2020a) suggests that curiosity serves to maximize cumulative knowledge value. In this view, curiosity is partly determined by the instrumental value of information. Studies testing predictions from the rational model of curiosity in younger adults have identified extrinsic factors that influence curiosity, such as future value (Dubey & Griffiths 2020a), social value (Dubey et al., 2021), and practical value (Dubey et al., 2022). Considering that motivational priorities shift across adulthood (e.g., Brandtstädter et al., 2010; Carstensen et al., 1999),

curiosity may be guided by different types of informational value in older adults versus younger adults. The present study investigated this question with a specific focus on social and practical value.

Aging and Curiosity

Despite empirical evidence for reduced trait-level curiosity in aging (Kashdan et al., 2009; Robinson et al., 2017), studies indicate that older adults have an equivalent (Galli et al., 2018; McGillivray et al., 2015) or even greater (Chu & Fung, 2022; Swirsky et al., 2021; Swirsky & Spaniol, 2023) capacity for state-level curiosity. States of curiosity have been linked to cognitive benefits in adults such as improved memory for interesting information (Galli et al., 2018; McGillivray et al., 2015; L. T. Swirsky et al., 2021) and even for unrelated information encountered during states of curiosity (Gruber et al., 2014). These memory benefits may be larger in older adults than in younger adults. For example, a recent study reported greater enhancement of recognition memory for interesting trivia in older than younger adults (Swirsky & Spaniol, 2023).

Curiosity is also an important driver of information-seeking behavior across the lifespan (Gottlieb et al., 2013). Information seeking is critical for learning, social engagement, and decision making (Kelly & Sharot, 2021). However, information seeking preferences and strategies differ between younger and older adults (Fastrich et al., 2024; Hertwig et al., 2021; Spreng & Turner, 2021). Sparking curiosity may be a way to stimulate information seeking in older adults, who tend to show a greater preference for exploitation of prior knowledge over exploration of new information relative to younger adults (Spreng & Turner, 2021) and who may differ in their metacognitive approach to instrumental (Hertwig et al., 2021) and noninstrumental (Fastrich et al., 2024) information seeking.

Beyond cognitive benefits, curiosity has also been linked to lower mortality (Swan & Carmelli, 1996), and to better emotional and physical health in older adults due its influence on dopaminergic and noradrenergic brain systems (Sakaki et al., 2018). However, despite the functional importance of curiosity for healthy aging, there is limited prior research on age differences in moderators of curiosity.

Factors That Influence Curiosity in Younger Adults

According to the rational model of curiosity, individuals are most curious about information that offers the most value (Dubey & Griffiths, 2020a, 2020b). In addition to relying on their own knowledge base (Wade & Kidd, 2019), younger adults have been demonstrated to compute informational value from external cues related to future relevance (Dubey & Griffiths, 2020a), social popularity (Dubey et al., 2021), and practical usefulness (Dubey et al., 2022).

Social Value and Curiosity

Online platforms are rife with indicators of popularity. Visible metrics of popularity include page views, shares, comments, reposts, upvotes, and likes. Popularity cues can provide both intended user-generated information (e.g., ratings) or unintended user-generated information (e.g., number of clicks). Intended popularity cues offer a crowdsourced evaluation of information and thus can shape how other users evaluate information prior to engagement (Haim et al., 2018). According to a recent review (Haim et al., 2018), intended popularity metrics influence user impressions by offering cues to relevance. While positive popularity metrics signal social endorsement of information (e.g., upvotes, likes), negative indicators of popularity (e.g., downvotes, dislikes) signal disapproval (Lee et al., 2022). However, negative indicators are becoming obsolete and are no longer visible on standard platforms such as https://Reddit.com and https://Youtube.com. In their absence, users often interpret a lack of positive indicators (i.e., low number of upvotes or likes) as a lack of social endorsement, assuming equal view count (Tseng et al., 2023). As such, differences in positive popularity metrics (high vs. low) convey differences in social value.

Only one study has investigated the effect of positive popularity metrics on curiosity (Dubey et al., 2021), reporting that the presence of these metrics guides the perception of informational value, curiosity, and subsequent information seeking in younger adults. Participants were less curious about low-popularity information when popularity metrics were visible, compared with when they were not visible (Dubey et al., 2021). This difference in curiosity was also related to a difference in subsequent information search. By contrast, participants showed similar levels of curiosity and information seeking for high-popularity information regardless of whether popularity metrics were visible. Dubey et al. (2021) concluded that younger adults use low-popularity metrics as cues for disengaging attention.

Social value is likely also important for older adults' curiosity, but we expected that the specific impact of popularity metrics would differ for younger and older adults. Research in the domains of attention and memory has revealed an age-related positivity effect—a greater preference for positive over negative information in older versus younger adults (Reed et al., 2014). The age-related positivity effect has typically been explained with socioemotional selectivity theory (Carstensen et al., 1999), which posits that shrinking time horizons prompt older adults to prioritize emotional well-being by selectively attending to positive information. However, the age-related positivity effect has not been tested in the context of curiosity and information search. Extrapolating to these domains, older adults may be more sensitive to popularity metrics in the context of high-popularity information (positively evaluated information) than in the context of low-popularity information (negatively evaluated information). Such a pattern in older adults would contrast with the one documented in younger adults, whose curiosity and information search are uniquely sensitive to low-popularity metrics. Separately, value-directed selectivity theory (Castel, 2007) proposes a bias in older adults for high-value information, regardless of whether value is real or hypothetical (Knowlton & Castel, 2022). Dovetailing with predictions from socioemotional selectivity theory, value-directed selectivity predicts that older adults should be biased toward information associated with high social metric values.

Practical Value and Curiosity

Perhaps not surprisingly, evidence suggests that students are more eager to learn when they perceive the material to have practical value (Alexander et al., 1995; Murayama et al., 2019). Indeed, highlighting the applied value of new discoveries can make scientific topics more interesting and engaging to the public (Nosek & Bar-Anan, 2012). This is especially true if learners identify the value of learning the material themselves. For example, curiosity can be boosted by utility-value interventions. In these interventions, students are responsible for describing the utility value in otherwise dry material,

by generating a connection between the new content and their own lives (Hulleman & Harackiewicz, 2021).

Even when the practical value of information is highlighted externally, the benefits to younger adult engagement are still apparent. A recent study tested how practical value influences curiosity in younger adults (Dubey et al., 2022). In this study, younger adults read scientific articles about fruit flies. The articles differed with respect to the practical value attached to fruit fly research. The high personal value article discussed how studying fruit flies can drive advancements in modern medicine. The high collective value article discussed how fruit flies are useful for the environment. The low value article discussed the contribution of fruit fly research to understanding insect reproduction. Curiosity and subsequent information seeking were greatest for information with high personal value, followed by high collective value, followed by low practical value (Dubey et al., 2022).

Younger adults' interest in, and search for, information with high personal value is consistent with the self-reference effect (Symons & Johnson, 1997). The self-reference effect describes the finding that self-relevant information is prioritized in attention and memory. Although the self-reference effect is preserved in older adults (Gutchess et al., 2007), older adults are also more prosocial than younger adults, demonstrating greater concern for the public good (for reviews, see Mayr & Freund, 2020; Sparrow et al., 2021). For example, Freund and Blanchard-Fields (2014, Study 1) reported greater endorsement of environmental values—a marker of prosociality—among older versus younger adults. Psychological theories of lifespan development attribute age-related growth in prosociality to age-related increases in ego-transcendent goals (Brandtstädter et al., 2010), generativity (Erikson, 1982), or socioemotional selectivity (Carstensen et al., 1999). While no prior studies have examined how prosociality shapes curiosity, we expected that older adults would be more sensitive to collective value than younger adults, and that this difference would lead to age differences in curiosity and information seeking for information with high collective value.

The Present Study

The experiments in the present study focused on age differences in moderators of epistemic curiosity, guided by a perspective that views curiosity as a rational computation that accounts for different sources of informational value (Dubey & Griffiths, 2020a, 2020b). We explored factors that have been shown to affect younger adults' valuation of information, as well as their curiosity and subsequent information seeking. Experiment 1 examined age differences in the influence of social value (i.e., popularity; Dubey et al., 2021) on curiosity. Experiment 2 examined age differences in the influence of practical value on curiosity (Dubey et al., 2022). As in Dubey et al. (2022), the stimuli used for both experiments include noninstrumental, arcane topics that younger and older adults are likely to have little prior knowledge about. Guided by the literature on motivational selectivity in aging (i.e., value-directed biases in cognition and greater preference for positive over negative information in older versus younger adults; Knowlton & Castel, 2022; Reed et al., 2014; L. T. Swirsky & Spaniol, 2019) and by evidence for an age-related increase in prosociality (Mayr & Freund, 2020; Sparrow et al., 2021), we expected older and younger adults to differ in terms of how cues to social and practical value would shape their curiosity and subsequent information seeking behavior.

Experiment 1

The goal of Experiment 1 was to test the effect of social value on curiosity and information seeking. Using real-world trivia stimuli sourced from the subreddit "Explain like I'm five" on https://Reddit.com, participants rated their curiosity and confidence in knowing the answer for Reddit questions for which they could or could not see the associated upvote count (as in Dubey et al., 2021). Predictions for Experiment 1 were as follows: Replicating Dubey et al. (2021), we predicted that younger adults would be influenced by low-popularity cues (i.e., low social value), expressing lower curiosity and engaging in less information search for the same information when popularity cues were present versus absent. In contrast, we predicted that older adults would be influenced by high-popularity cues (i.e., high social value), expressing greater curiosity and engaging in more information seeking when cues were present versus absent.

Method

Participants

Adult participants from Canada and the United States were recruited from MTurk via CloudResearch. A sample size of 180 was determined a priori based on a power analysis using G-Power (Faul et al., 2007), requiring a power of at least 0.80 to detect a medium-sized interaction ($f \geq .25$; $\eta_p^2 = .06$) of two between-subjects factors, assuming an α error probability of .05 and a correlation among levels of the within-subjects factor of .50 or higher. Based on results of the power analysis, 211 participants were recruited to account for potential exclusions, half of whom were aged 18–35 and the other half were 60 or older. Participants who did not pass instructional manipulation checks ($n = 2$) and those who demonstrated no variability in their ratings ($n = 7$) were excluded and replaced. Therefore, a total of 202 participants were retained (see Table 1) including 101 younger adults (aged 18–35 years; 75.25% White; 9.90% Black; 6.93% Latin American; 4.95% East Asian; 1.98% West Asian; 0.99% Indigenous) and 101 older adults (aged 60 or older; 89.11% White; 2.97% Black; 1.98% Latin American; 3.96% East Asian; 0.99% West Asian; 0.99% Indigenous).

Materials

Materials were 20 questions and answers from the subreddit "Explain Like I'm Five" (see Supplemental Table S1; Dubey et al., 2021), including 10 low-popularity items and 10 high-popularity items (low-upvote range = 4–99; high-upvote range = 41,000–86,900). The same stimuli were used in the upvote-visible and control conditions. An example of a high-popularity question is, "If ants love sugar, and bees make honey, why aren't bee hives constantly attacked by ants?" An example of a low-popularity question is, "How is adenosine triphosphate used as energy in our bodies?"

Participants completed a series of background measures assessing trait perceptual curiosity (i.e., the tendency to seek out novel sensory experiences; Perceptual Curiosity Scale, Collins et al., 2004; $\alpha = .86$; Specific subscale $\alpha = .78$; Diversive subscale $\alpha = .76$), epistemic curiosity (i.e., the tendency to seek out new knowledge; Epistemic Curiosity Scale, Litman & Spielberger, 2003; $\alpha = .83$; I-type subscale $\alpha = .73$; D-type subscale $\alpha = .81$),

Table 1
Sample Characteristics and Age Differences in the Two Experiments

	Experiment 1			Experiment 2		
	Younger	Older	Difference	Younger	Older	Difference
Characteristic	*M (SD)*	*M (SD)*	*t*	*M (SD)*	*M (SD)*	*t*
N	101	101		156	156	
N (female)	51	51		78	78	
Age range, years	19–34	61–89		19–34	61–84	
Age, years	27.50 (3.62)	69.38 (5.93)		26.19 (3.45)	67.36 (5.76)	
Education, years	16.09 (2.14)	16.62 (4.20)	−1.79	15.32 (2.04)	16.14 (4.08)	−2.24*
Mill Hill	19.35 (5.16)	23.74 (5.55)	−6.30***	18.43 (4.93)	23.05 (5.39)	−7.88***
PCS	31.71 (5.58)	31.95 (5.40)	−1.82	30.20 (5.31)	31.02 (5.24)	−4.36***
ECS	30.80 (6.23)	28.50 (7.11)	3.49**	29.33 (5.93)	27.67 (6.90)	−2.28*
DASS-21						
Depression	6.87 (7.17)	2.90 (3.53)	4.64***	6.54 (6.83)	2.82 (4.19)	5.80***
Anxiety	4.96 (5.81)	2.24 (3.82)	3.82***	4.72 (5.53)	2.17 (3.71)	4.78***
Stress	7.18 (6.83)	3.55 (4.72)	4.26***	6.84 (6.50)	3.45 (4.58)	5.32***
PANAS						
Positive affect	29.79 (8.46)	35.08 (7.50)	−4.46***	28.37 (10.46)	34.06 (7.28)	−5.57***
Negative affect	15.04 (7.11)	11.48 (3.84)	3.93**	14.32 (7.15)	11.15 (3.73)	4.91***

Note. *t* value refers to the two-tailed test for age group differences, equal variances not assumed. Negative *t* values indicate smaller means for younger adults. PCS = Perceptual Curiosity Scale; ECS = Epistemic Curiosity Scale; DASS-21 = Depression, Anxiety, and Stress Scale 21; PANAS = Positive Negative Affective Schedule.
* $p < .05$. ** $p < .01$. *** $p < .001$.

verbal intelligence (Mill Hill Vocabulary Scale; Raven, 1958; α = .84), and measures of current mood (Positive and Negative Affect Schedule, Watson et al., 1988; Positive subscale α = .93; Negative subscale α = .94) and recent negative affect (Depression, Anxiety, and Stress Scales 21, Lovibond & Lovibond, 1995; Depression subscale α = .94; Anxiety subscale α = .89; Stress subscale α = .91). Descriptive statistics for these measures are reported in Table 1, and the correlation matrix is provided in Supplemental Table S2. All tasks were programmed in PsychoPy v2022.2.4 (Peirce et al., 2019) and hosted on Pavlovia (Open Science Tools, Nottingham, U.K.).

Procedure

The study used a 2 (age group: younger, older) × 2 (condition: control, upvote visible) × 2 (popularity: low upvote, high upvote) mixed design with repeated measures on the last factor. Half of each age group was randomly assigned to either the control or the upvote-visible condition. The experiment consisted of two phases (see Figure 1). In the first phase, participants viewed and made judgments about 20 questions (10 low popularity, 10 high popularity). In the upvote-visible condition, each question was paired with its corresponding upvote count, which indicated the number of online users that had endorsed the question heading. Participants were told that each question was viewed by the same number of online users, and thus upvote counts were a sign of active endorsement rather than simply differences in the number of views. To ensure that participants understood the meaning of the upvote count, they had to correctly answer a multiple-choice comprehension question after the instructions before proceeding with the task. Participants were told that upvotes were made by members of their own social reference group (i.e., similarly aged individuals). In the control condition, upvote counts were not visible.

On each trial, participants viewed one question and rated their curiosity and confidence. In addition, participants rated the perceived popularity of the question as a manipulation check for the popularity metric manipulation (i.e., upvote level; high, low). All three rating scales were presented as sliders ranging from 0% to 100%, labeled "Not at all" to "Extremely." Participants were instructed that the left side of the slider indicated no curiosity/confidence/popularity, whereas the right side indicated high curiosity/confidence/popularity. Question order was randomized for each participant.

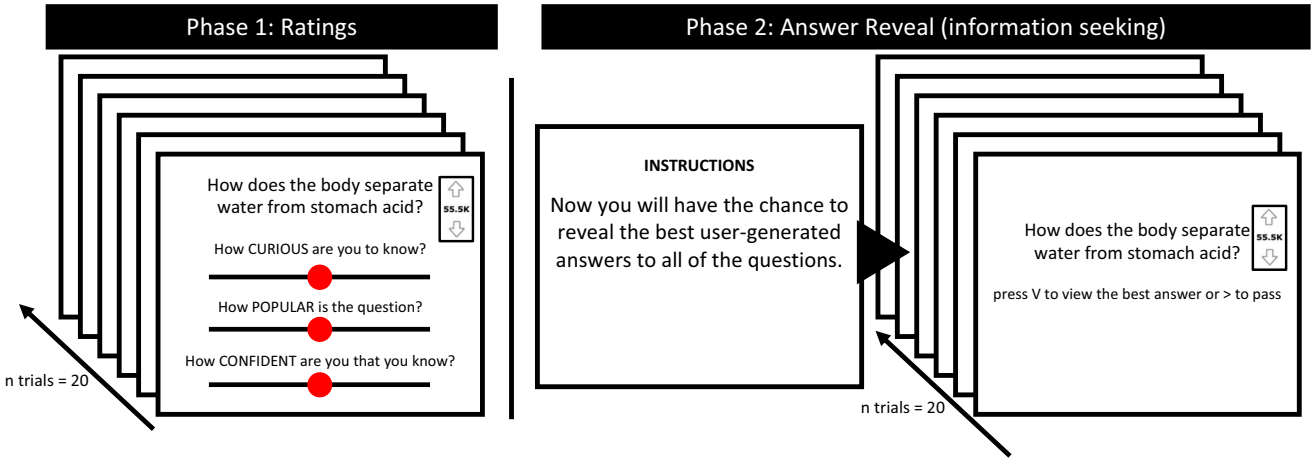
In Phase 2, participants viewed the questions again and decided whether they wanted to reveal the answer. In the upvote-visible condition, participants saw the upvotes again in Phase 2, whereas in the control condition, participants did not see the upvotes. As in Dubey et al. (2021), participants were explicitly instructed that answers were the best user-generated response to the question, rather than the factually correct answer. Questions were presented one-by-one in a random order. Answers were shown after the corresponding question if participants chose to reveal them and the task was self-paced.

Transparency and Openness

Experimental methods, planned analyses, and hypotheses were preregistered using the AsPredicted template and uploaded to the Open Science Framework Repository along with synthesized deidentified data, code for analyses, and stimuli used in experimental tasks (https://osf.io/wxbsm/). We report how we determined our sample size, made decisions about data exclusions, and designed the experiment. The study received approval from the Toronto Metropolitan University Research Ethics Board (project title: Determinants of Curiosity; protocol number: 2022-237). Data collection took place across the month of October 2022.

Figure 1

Schematics of Tasks in Experiment 1



Note. A depiction of the tasks in the upvote-visible condition, in which the upvote count was shown in the upper-right corner of the task screen alongside each question. In the control condition, the tasks were identical except that no upvote count was shown at any time during the task. Rating scales appeared one-by-one on the same screen as participants provided each rating (i.e., only the curiosity scale was visible until the participant made a curiosity rating, then the popularity scale appeared, and finally the confidence scale appeared once the participant made a popularity rating). Anchors for the rating scales were labeled "Not at all" on the far left and "Extremely" on the far right for all three. See the online article for the color version of this figure.

Results

For each participant, ratings were rescaled from 0% to 100% to 0 to 1. Curiosity ratings and confidence ratings from Phase 1 were mean-centered within subjects (i.e., each participant's mean scores were subtracted from their raw scores), and used as predictors in the information seeking analyses (see Dubey et al., 2021; Kang et al., 2009). Distributional plots of curiosity and confidence ratings are reported in the Supplemental Figure S1. Whether or not participants revealed the answer to a question in Phase 2 was coded as a binary outcome (0 = no, 1 = yes). All statistical analyses were carried out in R Version 2022.12.0 + 353 (R Core Team, 2020).

Mixed Model Analyses

Mixed-effects models were estimated with participant identifier and question identifier as random intercepts to account for repeated observations within participants and within trivia questions. To control for Type 1 error inflation, we also included random slopes for all predictors that varied within participants (i.e., upvote level, curiosity) and within questions (i.e., age, condition, curiosity). For consistency and compliance with the maximal model approach, (Bates et al., 2015) we report results from maximal models with all random effects. However, some maximal models that converged led to singular model fits. In these cases, we verified that results were robust to removal of random slope parameters associated with a variance of 0.

All models with information seeking as the dependent variable included confidence ratings (linear and quadratic terms) as covariate predictors to account for the well-documented relationship between curiosity and confidence (e.g., Dubey & Griffiths, 2020a; Metcalfe et al., 2020), since curiosity tends to be highest about information for which we have moderate-to-high prior knowledge, and thus moderate-to-high confidence in knowing the answer (Wade & Kidd, 2019). Background measures with significant age differences (Mill Hill, Epistemic Curiosity Scale, Depression, Anxiety, and Stress Scales 21, Positive and Negative Affect Schedule; see Table 1) were also included as covariate predictors in all models. However, when confidence or background variables were not significant predictors, they were dropped from the model along with any nonsignificant interaction terms to improve model fit and to facilitate model convergence. Generalized linear mixed models were used for continuous outcomes, and logistic mixed models were used for binary outcomes. Models were estimated using the glmer and lmer functions of the lme4 package (Bates et al., 2015), p values for model coefficients were estimated using the lmerTest package (Kuznetsova et al., 2017), and fixed effects and interactions were tested using the analysis of variance function from the car package (Fox & Weisberg, 2019) and were reported as Wald chi-square tests. For ease of interpretation, fixed-effects coefficients for logistic mixed models were exponentiated to calculate odds ratios (Murayama et al., 2014).

Manipulation Check

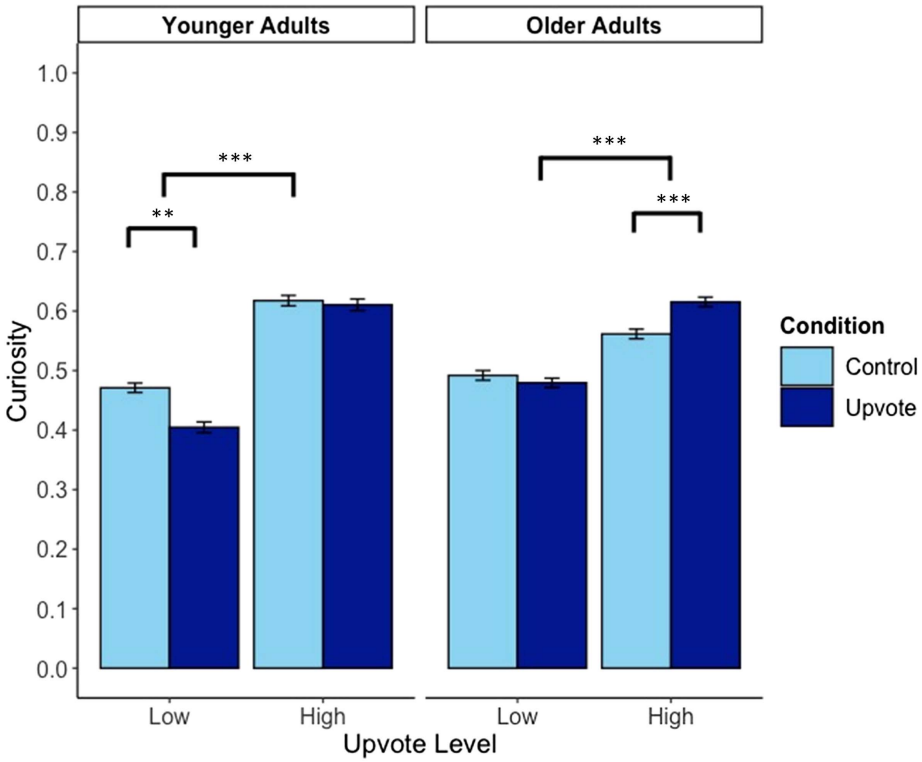
To verify that the popularity manipulation was successful, we regressed trial-level popularity ratings on age group, condition, upvote level, and all interaction terms (see Supplemental Figure S2). Results confirmed that both age groups rated high-popularity content as more popular than low-popularity content across conditions. More detailed results are reported in the Supplemental Material.

Age Differences in the Effect of Popularity on Curiosity

First, we examined age differences in the effect of upvote visibility (condition: control, upvote-visible) on the relationship between popularity (upvote level: low, high) and curiosity. To test the effect of popularity metrics on curiosity in younger and older adults, we regressed trial-level curiosity ratings on age group, condition, upvote

Figure 2

Age Differences in Curiosity Ratings According to Condition and Popularity



Note. See the online article for the color version of this figure.
** $p < .01$. *** $p < .001$.

level, and all interaction terms (see Figure 2). There was a main effect of upvote level, Wald $\chi^2(1) = 107.26$, $p < .001$, such that participants were more curious about high-upvote content ($M = 0.62$, $SD = 0.21$) than low-upvote content ($M = 0.46$, $SD = 0.19$). This effect was qualified by an Age × Upvote Level × Condition interaction, Wald $\chi^2(1) = 4.86$, $p < .05$. Replicating prior work (Dubey et al., 2021), younger adults were significantly less curious about low-upvote content in the upvote-visible condition than in the control condition, with no difference for high-upvote content across the conditions. Consistent with our hypothesis of a value-directed selectivity bias in older adults, the opposite was true for older adults, who showed no difference across conditions for low-upvote content, but were significantly more curious about high-upvote content in the upvote-visible condition relative to the control condition. No other main effects or interactions were significance.

Age Differences in Information Seeking

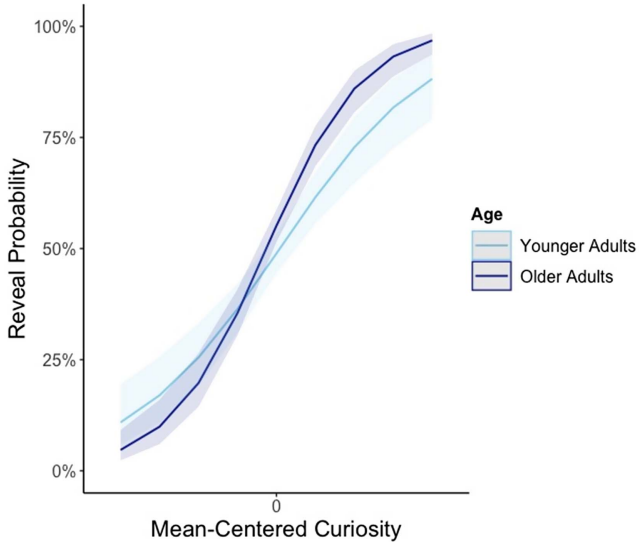
To examine the influence of curiosity, popularity metric level, and metric visibility on information seeking in younger and older adults, we regressed trial-level answer reveal outcomes (yes, no) on age group, curiosity, upvote level, and condition. There was a main effect of upvote level, Wald $\chi^2(1) = 10.41$, $p < .01$, such that participants were more likely to reveal answers to high-upvote content than low-upvote content ($OR = 1.43$), regardless of whether they could see upvote counts. There was also a main effect of age group, Wald $\chi^2(1) = 6.05$, $p < .05$, such that younger adults were less likely to reveal answers than older adults ($OR = 0.93$). Additionally, there was a main effect of curiosity (see Figure 3), Wald $\chi^2(1) = 75.70$, $p < .001$, such that greater curiosity increased the likelihood of answer reveal for all participants across upvote level and condition ($OR = 13.33$). Critically, these effects were qualified by an Age × Curiosity interaction, Wald $\chi^2(1) = 8.87$, $p < .001$, indicating that the effect of curiosity on likelihood of answer reveal was stronger in older adults ($OR = 55.87$) than in younger adults ($OR = 13.09$). No other main effects or interactions reached significance. In line with the preregistered analysis plan, results from a mediation analysis are reported in the Supplemental Table S3 and Figure S3 to explore whether the influence of popularity on information seeking was mediated via curiosity.

Discussion

Social value, as conveyed by popularity metrics, had different effects on curiosity in younger and older adults. Younger adults were less curious about low-popularity content when they could see popularity metrics (upvote-visible condition) versus when they could not (control condition). By contrast, older adults were more curious about high-popularity content in the upvote-visible condition versus the control condition. Additionally, popularity metric visibility influenced information-seeking behavior in both age groups, but more so in older adults. These findings are

Figure 3

Age Differences in Answer Reveal Probability According to Curiosity



Note. Curiosity ratings were within-cluster mean-centered. See the online article for the color version of this figure.

consistent with predictions from socioemotional selectivity theory and value-directed selectivity, as older adults exhibited a bias for information attached to high social value, while younger adults avoided information associated with low social value. Furthermore, findings of stronger curiosity-related information seeking behavior in older adults may have practical implications in domains such as education, health care, and fraud prevention (see General Discussion section).

Experiment 2

The objective of Experiment 2 was to assess age differences in the effect of practical value on curiosity and information seeking. Using a paradigm similar to the one introduced by Dubey et al. (2022), participants viewed short articles of differing practical value to see whether older adults' curiosity was similarly sensitive to the practical implications of information as younger adults. Older adults' and younger adults' curiosity was measured for topics covered in articles designed specifically to vary in terms of their practical value level (high, low) and scope of relevance (personal, societal). Accordingly, participants were presented with articles on biology (low personal, low societal), the environment (low personal, high societal), or medicine (high personal, low societal; Dubey et al., 2022). In line with Dubey et al. (2022), we expected that younger adults would be most curious after reading about a scientific topic of high personal value (medicine), followed by a topic of high societal value (the environment), followed by a topic of low practical value (biology). By contrast, due to increasing prosociality across the lifespan (Mayr & Freund, 2020; Sparrow et al., 2021), we expected that older adults would be most curious after reading about a topic of high societal value, followed by a topic of high personal value, followed by a topic of low practical value.

Method

Participants

As in Experiment 1, adult participants from Canada and the United States were recruited from MTurk via CloudResearch. An a priori sample size of 251 was determined based on a power analysis using G-Power (Faul et al., 2007), requiring a power of at least 0.95 to detect a medium-sized interaction ($f \geq .25$; $\eta_p^2 = .06$) of two between-subjects factors, assuming an α error probability of .05 and a numerator *df* of 2 ($df = [3 - 1] \times [2 - 1]$). Based on the results of the power analysis, 316 participants were recruited to account for potential exclusions. Participants who did not pass instructional manipulation checks ($n = 4$) were excluded from the analyses and replaced. Therefore, the final sample consisted of 312 participants (see Table 1), including 156 younger adults (aged 18–35 years; 76.92% White; 7.05% Black; 7.05% Latin American; 3.85% East Asian; 3.21% West Asian; 1.92% Indigenous) and 156 older adults (aged 60 or older; 89.74% White; 3.85% Black; 1.92% Latin American; 1.92% East Asian; 1.28% West Asian; 1.28% Indigenous).

Materials

The materials included three short articles about fruit flies, each modified to highlight a different domain of practical value (adapted from Dubey et al., 2022; see Supplemental Material). The biology article described interesting information from research on fruit fly reproduction and was designed to be of low practical value. Articles for the other two domains of application were designed to be of high practical value, either for individuals or for society. The environment article described how fruit flies could benefit the environment (high societal relevance). The medicine article described how fruit flies could be used for human medicine (high personal relevance). The medicine article differed for the two age groups, using age group specific language to ensure personal relevance. Articles were matched for length, general content, and style (Dubey et al., 2022), and the practical value manipulation was embedded into the framing of the closing two sentence of each article. In the biology article, the closing sentences read,

> For these reasons, it is no surprise that many scientists are fascinated by the humble fruit fly. "Fruit flies are very complex creatures, and we are only just starting to understand their fascinating biology," one scientist said about fruit flies.

In the environment article, the closing sentences read,

> Researchers are starting to uncover how fruit flies can help engineer new solutions for saving the environment. "It won't help our generation, but future generations will benefit from the continued study of fruit flies and waste management," one environmental biologist said about fruit flies.

In the medicine article, the closing sentences read,

> The United States has an aging population that suffers from serious neurological disorders, which is a widespread concern. [Younger version: "We have to find a way to prevent these cognitive defects, and fruit flies may be our best hope to help the current generation of young adults that will be affected by these diseases later,"] OR [Older version: "We have to find a way to deal with these cognitive defects, and fruit flies may be our best hope to help the current generation of older adults that are at risk or already affected by these diseases now,"] one neurobiologist said about fruit flies.

Participants completed the same battery of background measures as in Experiment 1 (see Table 1). Tasks were programmed and hosted on Qualtrics (Qualtrics, Provo, UT).

Procedure

The experiment consisted of two phases (see Figure 4) and used a 2 (age group: younger, older) × 3 (condition: biology, environment, medicine) between-subjects design. Participants read a short article based on the condition to which they had been randomly assigned (biology, environment, medicine). Before reading the article, participants were shown the general topic: (a) the science of fruit fly reproduction, (b) the importance of fruit flies for the environment, or (c) the importance of fruit flies for medical research. As a baseline measure, participants provided judgments about their confidence in their knowledge about the topic, their curiosity about the topic, and the perceived usefulness of the topic. After reading the article, they were prompted once again to rate their knowledge confidence, curiosity, and perceived usefulness. Participants also rated their level of surprise to learn the information, as well as the level of societal versus personal relevance of the article as a manipulation check. All ratings were made on a scale of 1–7.

In Phase 2, participants had the opportunity to learn more about fruit flies by revealing concealed fruit-fly facts. This allowed us to explore to what extent articles differing in practical value sparked a desire for more knowledge about a general subject (i.e., exploratory information search; Marchionini, 2006). Participants had the option to reveal up to 10 concealed fruit-fly facts, which were labeled with arbitrary numbers from 0 to 100 (e.g., fruit fly fact No. 52) and presented to participants in a random order. Following Phase 2, participants provided demographic and health-related information and completed questionnaires assessing mood and trait curiosity.

Transparency and Openness

As in Experiment 1, methods, planned analyses, and hypotheses were preregistered using the AsPredicted template and uploaded to the Open Science Framework Repository along with synthesized deidentified data, code for analyses, and task stimuli (https://osf.io/wxbsm/). The study received approval from the Toronto Metropolitan University Research Ethics Board (project title: Determinants of Curiosity; protocol number: 2022-237) with data collection conducted across the month of October 2022.

Results

Results from background measure scales are described in Table 1 and the correlation matrix are available in the Supplemental Table S4. For each participant, change scores were computed for raw curiosity, knowledge confidence, and perceived usefulness ratings from Phase 1. Considering that the practical value condition was manipulated between-subjects, change scores were used to account for differences in baseline levels of curiosity and knowledge for the general topic, as well as the effect of the practical value manipulation (which could only be assessed postarticle). Fact reveal count was taken as a proportion of the total possible ($n = 10$). All statistical analyses were carried out in R Version 2022.12.0 + 353 (R Core Team, 2020).

Manipulation Check

To confirm that the articles elicited different levels of personal and societal practical relevance, we regressed relevance ratings on age group and condition (see Supplemental Figure S4 and Table S5). Results confirmed that the value manipulation was successful. Participants rated the medicine article as highest in personal relevance, the environment article as highest in societal relevance, and the biology article as lowest in both personal and societal relevance. More detailed results are reported in the Supplemental Material.

Age Differences in Perceived Usefulness and Curiosity Across Conditions

To explore whether there were age differences in effect of practical value condition on increases in perceived usefulness and curiosity, change scores for both ratings were regressed separately on age group and condition. As in Experiment 1, we included baseline confidence and background measures with significant age differences (education, vocabulary, trait curiosity, current mood, recent negative affect; see Table 1) as covariate predictors. The decision about whether to retain nonsignificant covariates depended on model fit indices and model convergence in favor of model parsimony.

Perceived Usefulness. There was a main effect of condition, Wald $\chi^2(2) = 90.11$, $p < .001$, such that participants' usefulness ratings increased more after reading the environment and medicine articles ($M = 1.13$, $SD = 1.41$) than after reading the biology article ($M = 0.44$, $SD = 1.00$). This effect was qualified by an Age × Condition interaction, Wald $\chi^2(2) = 7.05$, $p < .01$ (see Figure 5a).

Figure 4
Schematics of Tasks From Experiment 2

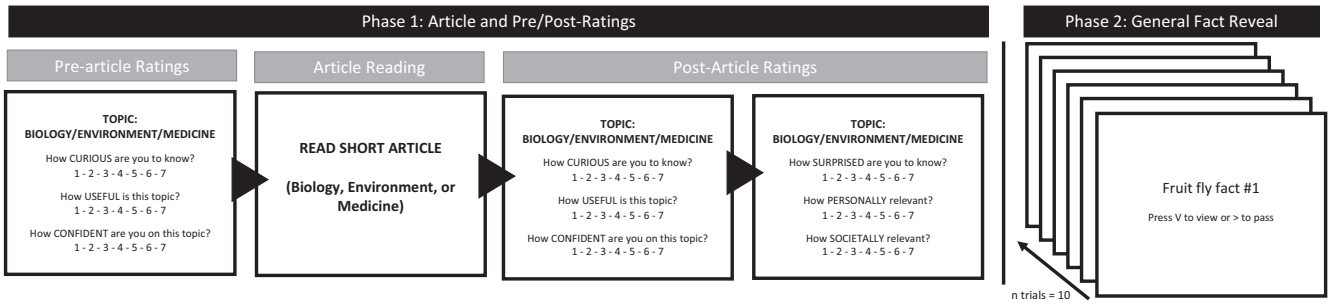
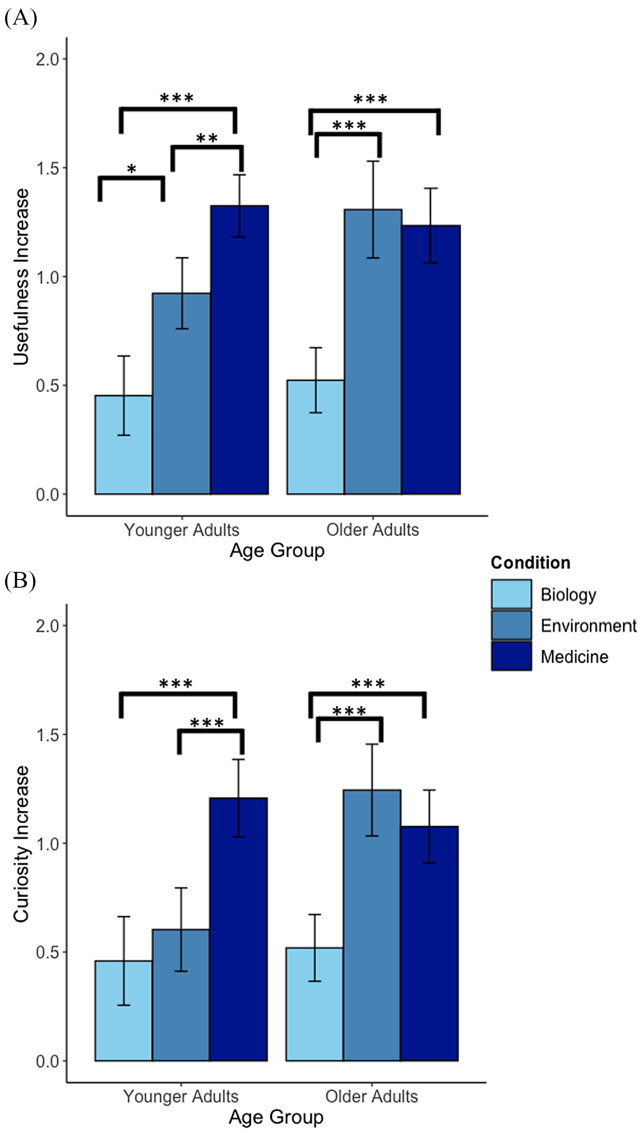


Figure 5

Age Differences in Effect of Condition on Changes in Perceive Usefulness and Curiosity



Note. See the online article for the color version of this figure.
* $p < .05$. ** $p < .01$. *** $p < .001$.

For younger adults, perceived usefulness ratings increased most after the medicine article ($M = 1.32$, $SD = 0.64$), followed by the environment article ($M = 0.83$, $SD = 0.66$), followed by the biology article ($M = 0.45$, $SD = 0.68$). For older adults, perceived usefulness ratings increased significantly more after reading the environment and medicine articles (environment: $M = 1.29$, $SD = 0.95$; medicine: $M = 1.22$, $SD = 0.71$) relative to the biology article ($M = 0.50$, $SD = 0.62$); no significant difference emerged between the first two article types. Additional results related to perceived usefulness can be found in the Supplemental Figure S5.

Curiosity. Similar to perceived usefulness, there was a main effect of condition, Wald $\chi^2(2) = 47.39$, $p < .001$, such that participants' curiosity ratings increased more after reading high-value articles ($M = 1.14$, $SD = 1.41$) than after reading the low-value control article ($M = 0.44$, $SD = 1.55$). Again, this effect was qualified by an Age × Condition interaction, Wald $\chi^2(2) = 8.39$, $p < .01$ (see Figure 5b). Younger adults were most curious after reading the medicine article ($M = 1.21$, $SD = 1.23$) relative to the environment and biology articles (environment: $M = 0.46$, $SD = 1.37$; biology: $M = 0.60$, $SD = 1.41$). Older adults were significantly more curious about the environment and medicine articles (environment: $M = 1.24$, $SD = 1.49$; medicine: $M = 1.08$, $SD = 1.15$) than the biology article ($M = 0.52$, $SD = 1.11$).

Relationship Between Curiosity and Perceived Usefulness. To explore whether there were age differences in the relationship between change in curiosity and change in perceived usefulness, we regressed curiosity change scores on usefulness change scores and age group (see Figure 6). There was a main effect of usefulness, such that curiosity was positively correlated with usefulness ($r = .33$, $p < .01$). However, an Age × Usefulness interaction revealed that the strength of the relationship was significantly stronger in older adults ($r = .37$; $p < .01$) than younger adults ($r = .29$; $p < .01$).

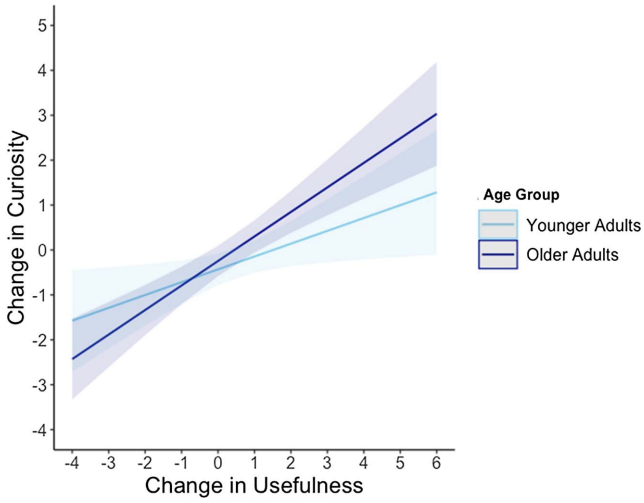
Age Differences in Information Seeking

To examine the influence of practical value and curiosity on information seeking in younger and older adults, we regressed the proportion of facts revealed on age group, condition (see Figure 7), and curiosity (see Figure 8). Because of the relationship between usefulness and curiosity reported above, we also included perceived usefulness in the model to control for its contribution.

There was a main effect of condition, Wald $\chi^2(2) = 2.49$, $p < .05$, such that participants revealed more facts after reading the environment or medicine articles (environment: $M = 4.76$, $SD = 3.42$, medicine: $M = 5.03$, $SD = 3.72$) than after reading the biology article ($M = 3.82$, $SD = 3.24$). There was also a main effect of age, Wald $\chi^2(2) = 1.97$, $p < .05$, such that older adults ($M = 5.15$,

Figure 6

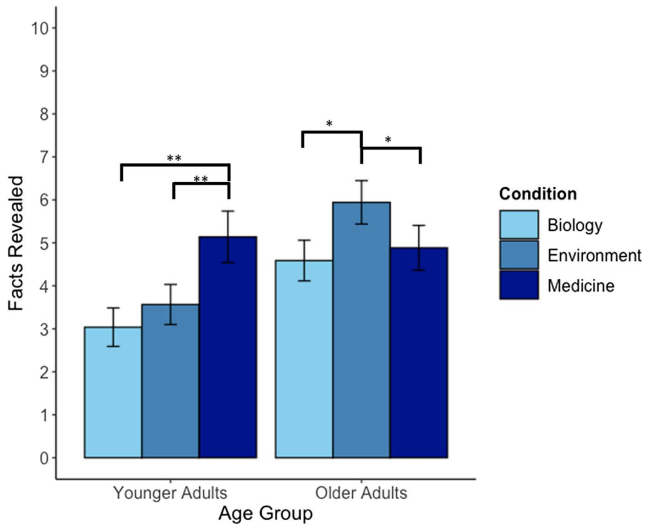
Relationship Between Change in Perceived Usefulness and Change in Curiosity as a Function of Age Group in Experiment 2



Note. See the online article for the color version of this figure.

Figure 7

Differences in Effect of Condition on General Information Seeking

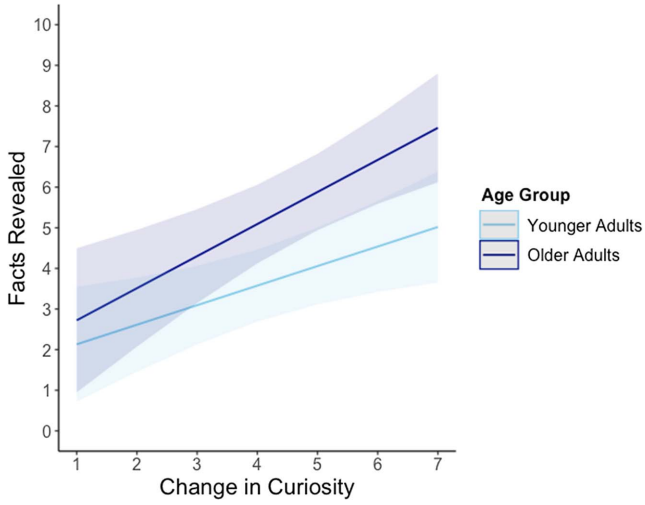


Note. See the online article for the color version of this figure.
* $p < .05$. ** $p < .01$.

SD = 3.48) revealed more facts overall than younger adults (*M* = 3.92, *SD* = 3.51). However, a significant Age × Condition interaction, Wald $\chi^2(2) = 15.68$, $p < .01$, indicated that these effects were driven by the medicine article for younger adults and by the environment article for older adults. Younger adults revealed significantly more facts in the medicine condition relative to the other two conditions, whereas older adults revealed significantly more facts in the environment condition relative to the other two conditions. Older adults' information seeking was thus guided by societal value, whereas younger adults' information seeking was guided by personal value.

Figure 8

Age Differences in the Relationship Between Curiosity and General Information Seeking



Note. See the online article for the color version of this figure.

In addition to the main effects of condition and age group described above, there was also a main effect of curiosity, Wald $\chi^2(2) = 12.73$, $p < .001$, such that greater increases in curiosity predicted a greater number of facts revealed for all participants across conditions ($B = 0.15$, $SE = .03$, $p < .01$). These effects were qualified by an Age × Curiosity interaction, Wald $\chi^2(2) = 5.37$, $p < .01$, indicating that the effect of curiosity on the number of facts revealed was stronger in older adults, $B = .25$, $SE = .03$, $p < .001$, than in younger adults, $B = .10$, $SE = .02$, $p < .001$. No other main effects or interactions reached significance. Consistent with the preregistered analysis plan, results from a mediation analysis are reported in the Supplemental Table S6 and Figure S6 to explore whether the influence of practical value condition on information seeking was mediated via curiosity.

Discussion

As in Experiment 1, curiosity predicted information seeking more strongly in older adults than in younger adults in Experiment 2. Moreover, practical value differentially influenced curiosity, perceived usefulness, and information seeking in younger and older adults. For younger adults, curiosity and perceived usefulness were most sensitive to personal practical value. For older adults, curiosity and perceived usefulness were equally sensitive to societal and personal practical value. Information search showed a similar pattern, except that there was an advantage for societal value (over personal value) for older adults. Overall, these findings are consistent with the literature on the self-reference effect (Gutchess et al., 2007) and on age differences in prosociality and concern for the common good (Mayr & Freund, 2020). In settings where information is important but has the potential to elicit negative emotions (e.g., health care), older adults may be more likely to engage, rather than avoid, if the collective relevance of information is highlighted explicitly.

General Discussion

In two experiments, we uncovered age differences in factors influencing curiosity as well as age differences in the degree to which curiosity guides information seeking. Younger adults' curiosity was guided by visible indicators of low popularity and perceived self-relevance of information. Older adults' curiosity was guided by visible indicators of high popularity and perceived personal or collective relevance of information. Although curiosity was related to information seeking in both age groups, the relationship was stronger in older adults than younger adults. This was true regardless of whether information gathering was specific (i.e., revealing particular answers to curiosity-inducing trivia; Experiment 1) or exploratory (i.e., revealing new information related to the general curiosity-inducing topic; Experiment 2).

Age Differences in Curiosity About Information With Social Value

In Experiment 1, the finding that older adults engaged more with information of high social value is consistent with socioemotional and value-directed selectivity theories (Carstensen & DeLiema, 2018; Castel, 2007). Similarly, younger adults' sensitivity to low social value in curiosity and information seeking is consistent with the well-documented negativity bias common in adolescence and early adulthood (Baumeister et al., 2001). It appears that younger

adults use social value as a cue for what not to engage with, whereas older adults use it as cue for what to engage with. This age-related reversal may also reflect younger adults' motivation to avoid social disapproval and manage their reputation (Garcia et al., 2017) and older adults' motivation to feel socially connected in the face of decreasing opportunities for in-person interaction (i.e., social compensation hypothesis; Zywica & Danowski, 2008). By disengaging from information evaluated poorly by peers, younger adults are at less risk themselves of poor social evaluation by proxy (Wang et al., 2011). For older adults, engaging with information that many others have endorsed allows indirect social links to form (Sheldon et al., 2021). However, age differences in social motives represent just one of several potential explanations of the results of Experiment 1. Another possible explanation relates to the salience of low versus high upvote counts. Low upvote counts may be more salient to younger adults who have more experience on Reddit.com, where content is often sorted by popularity by default, so that high-popularity content is the norm. By contrast, high upvote counts may be more salient to older adults who are not as experienced with Reddit.com, and may therefore be even more likely to employ a value-directed selectivity heuristic (Castel, 2007). Future work should aim to disentangle these mechanisms, for example, by collecting self-report data from participants and by contrasting social value cues (e.g., upvotes, likes, and shares) with other types of value cues (e.g., points).

Age Differences in Curiosity About Information With Practical Value

A key finding in Experiment 2 was that, for older adults, curiosity-driven information seeking was especially sensitive to the collective relevance of information—a finding broadly in line with the idea that older adults are more prosocial than younger adults (Mayr & Freund, 2020). Interestingly, generativity (the goal of providing for future generations) is thought to peak in midlife (McAdams et al., 1993), and altruism may show decline in advanced older age (i.e., >70 years; Sparrow et al., 2021). We used an extreme age group design that did not include middle-aged adults, but our older adult sample was relatively young ($M = 67$ years). In future work, it would be worthwhile to explore effects of personal and collective value on curiosity and information seeking in continuous lifespan samples covering a broader age range.

Age Differences in the Link Between Curiosity and Information Seeking

In both experiments, the relationship between curiosity and information seeking was stronger in older adults than in younger adults. This finding dovetails with recent evidence that memory is more sensitive to socioemotional incentives in older adults than in younger adults (L. T. Swirsky et al., 2023). For example, a recent study showed that recognition memory performance benefitted more from curiosity in older than in younger adults (Swirsky & Spaniol, 2023). Critically, curiosity not only motivated information seeking for the answer to the curiosity-inducing question (Experiment 1), but also sparked more general information seeking about a broad topic (Experiment 2). In younger adults, these effects were attenuated, particularly in the case of more general information seeking in Experiment 2. While surprising, given well-documented reductions in curiosity-like traits across the lifespan (e.g., openness, Kashdan et al., 2009; sensation seeking, Lawton et al., 1992), a larger effect of curiosity on information seeking is compatible with the reward-learning perspective of curiosity and knowledge acquisition (Murayama, 2022; Murayama et al., 2019). This framework predicts that curiosity-driven knowledge seeking becomes reinforced and strengthened with knowledge acquisition over the lifespan. The observation that older adults show greater state curiosity and information seeking than younger adults also challenges dominant theoretical frameworks of cognitive aging, which traditionally focus on age-related cognitive decline. The current findings suggest that cognitive disengagement in older adults may reflect a mismatch between their priorities and the information that is available, rather than a cognitive deficit. This selective engagement account is consistent with lifespan theories of motivation, which suggest that older adults reserve resources for tasks and actions they deem meaningful (Hess, 2014) or which align with their goals (Carstensen et al., 1999). While such an account would add nuance to cognitive deficits models of aging, longitudinal studies are needed for a rigorous test of the idea that curiosity-driven information seeking increases with age.

The powerful influence of curiosity on older adults' information seeking may be a double-edged sword. In some cases, curiosity may be harnessed to foster continuous learning and cognitive engagement in older adulthood when motivation to engage with new information is otherwise low (Hertwig et al., 2021; Spreng & Turner, 2021; Stine-Morrow & Manavbasi, 2022). However, in other cases, curiosity may lead older adults to engage more readily with clickbait and misinformation, especially if positive popularity metrics are visible. These findings suggest that information can be optimized to elicit curiosity and support information gathering in older adults, but that digital literacy interventions are necessary to ensure older adults can discriminate credible information from fake news or fraudulent lures (Grimes et al., 2010).

Limitations

There were some notable limitations in the present study. First, younger adults in Experiment 1 may have been more familiar with https://Reddit.com (and therefore, the concept of upvote counts as popularity metrics) than older adults. Most Reddit users are 18–49 years of age (De Candia et al., 2022). Lack of prior exposure may have decreased older adults' belief that upvotes originated from members of their own age group. Even though comprehension questions and manipulation checks revealed no differences in younger and older adults' task performance, it would be interesting in future studies to examine whether the origin of popularity metrics (same vs. different age group) affects curiosity and information seeking.

Second, Experiment 2 used a between-subjects design for the practical value manipulation, and semantic topics were confounded with practical value. It is possible, for example, that younger adults are less interested in environmental topics than older adults for reasons other than practical value (e.g., climate change anxiety; Whitmarsh et al., 2022). Future studies should employ within-subjects comparisons, cover a wider range of topics (i.e., beyond fruit flies), and manipulate practical value within rather than across semantic domains.

Third, in both experiments, the participant samples lacked diversity, particularly in the older age groups. Demographic homogeneity limits the generalizability and applicability of research findings

(Dupree & Kraus, 2022). Future work should aim to replicate these effects using other recruitment approaches (e.g., community-based recruitment, other online platforms) to increase the number of participants from underrepresented groups.

Fourth, we did not collect affective ratings in Experiment 1. Considering that downvotes (a negative social value cue) are becoming obsolete on social media platforms, we focused on the contrast between low and high upvotes. Future studies should incorporate subjective ratings to test whether low and high popularity metrics elicit negative and positive affect, respectively.

Finally, the stimuli used may have lacked ecological validity, insofar as the subject matter related to arcane topics that one would not typically encounter in daily life. While our approach limited the generalizability of the findings to real-world contexts, it enabled us to examine social and practical value separately. Our approach also minimized the influence of prior knowledge, which often differs for younger and older adults. Future work should employ more naturalistic stimuli to explore the connection between social and practical value cues, and should move toward translation in domains such as education and health care. It should be noted that the user-generated stimulus set used in Experiment 1 is more naturalistic than traditional trivia stimuli used in studies of epistemic curiosity (e.g., Kang et al., 2009), and that actual upvote counts were sourced for each question. While the use of real upvote counts added to the realism of the task, we note that the upvote counts were not randomly assigned to the questions. To control for this potential confound, future work should test the effect of social value cues that are both congruent and incongruent with actual question popularity in both age groups.

Conclusion

The present study offers novel insight into factors that influence curiosity in older adults, as well as evidence of a larger role for curiosity in information seeking in aging. Although informational value shapes curiosity in both age groups, younger and older adults differ in what makes them curious and how curiosity drives further engagement in both specific and broad information search. These observations can be leveraged to more effectively spark curiosity and exploration in younger and older learners. Understanding what drives curiosity and information search is also important in the context of digital media literacy interventions for older adults entering online spaces rife with fraud and misinformation (Brashier & Schacter, 2020).

References

Alexander, P. A., Jetton, T. L., & Kulikowich, J. M. (1995). Interrelationship of knowledge, interest, and recall: Assessing a model of domain learning. *Journal of Educational Psychology*, *87*(4), 559–575. https://doi.org/10.1037/0022-0663.87.4.559

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, *5*(4), 323–370. https://doi.org/10.1037/1089-2680.5.4.323

Berlyne, D. E. (1950). Novelty and curiosity as determinants of exploratory behaviour. *British Journal of Psychology*, *41*(1–2), 68–80. https://doi.org/10.1111/j.2044-8295.1950.tb00262.x

Brandtstädter, J., Rothermund, K., Kranz, D., & Kühn, W. (2010). Final decentrations. *European Psychologist*, *15*(2), 152–163. https://doi.org/10.1027/1016-9040/a000019

Brashier, N. M., & Schacter, D. L. (2020). Aging in an era of fake news. *Current Directions in Psychological Science*, *29*(3), 316–323. https://doi.org/10.1177/0963721420915872

Carstensen, L. L., & DeLiema, M. (2018). The positivity effect: A negativity bias in youth fades with age. *Current Opinion in Behavioral Sciences*, *19*, 7–12. https://doi.org/10.1016/j.cobeha.2017.07.009

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously. A theory of socioemotional selectivity. *American Psychologist*, *54*(3), 165–181. https://doi.org/10.1037/0003-066X.54.3.165

Castel, A. D. (2007). The adaptive and strategic use of memory by older adults: Evaluative processing and value-directed remembering. *Psychology of Learning and Motivation*, *48*, 225–270. https://doi.org/10.1016/S0079-7421(07)48006-9

Chu, L., & Fung, H. H. (2022). Age differences in state curiosity: Examining the role of personal relevance. *Gerontology*, *68*(3), 321–329. https://doi.org/10.1159/000516296

Collins, R. P., Litman, J. A., & Spielberger, C. D. (2004). The measurement of perceptual curiosity. *Personality and Individual Differences*, *36*(5), 1127–1141. https://doi.org/10.1016/S0191-8869(03)00205-8

De Candia, S., De Francisci Morales, G., Monti, C., & Bonchi, F. (2022). Social norms on reddit: A demographic analysis. *WebSci '22: Proceedings of the 14th ACM Web Science Conference 2022* (pp. 139–147). Association for Computing Machinery. https://doi.org/10.1145/3501247.3531549

Dubey, R., & Griffiths, T. L. (2020a). Reconciling novelty and complexity through a rational analysis of curiosity. *Psychological Review*, *127*(3), 455–476. https://doi.org/10.1037/rev0000175

Dubey, R., & Griffiths, T. L. (2020b). Understanding exploration in humans and machines by formalizing the function of curiosity. *Current Opinion in Behavioral Sciences*, *35*, 118–124. https://doi.org/10.1016/j.cobeha.2020.07.008

Dubey, R., Griffiths, T. L., & Lombrozo, T. (2022). If it's important, then I'm curious: Increasing perceived usefulness stimulates curiosity. *Cognition*, *226*, Article 105193. https://doi.org/10.1016/j.cognition.2022.105193

Dubey, R., Mehta, H., & Lombrozo, T. (2021). Curiosity is contagious: A social influence intervention to induce curiosity. *Cognitive Science*, *45*(2), Article e12937. https://doi.org/10.1111/cogs.12937

Dupree, C. H., & Kraus, M. W. (2022). Psychological science is not race neutral. *Perspectives on Psychological Science*, *17*(1), 270–275. https://doi.org/10.1177/1745691620979820

Erikson, E. H. (1982). *The life cycle completed*. Norton.

Fastrich, G. M., FitzGibbon, L., Lau, J. K., Aslan, S., Sakaki, M., & Murayama, K. (2024). Adult age differences in noninstrumental information-seeking strategies. *Psychology and Aging*, *39*(3), 313–323. https://doi.org/10.1037/pag0000806

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Fox, J., & Weisberg, S. (2019). *An R companion to applied regression* (3rd ed.). Sage Publications.

Freund, A. M., & Blanchard-Fields, F. (2014). Age-Related differences in altruism across adulthood: Making personal financial gain versus contributing to the public good. *Developmental Psychology*, *50*(4), 1125–1136. https://doi.org/10.1037/a0034491

Galli, G., Sirota, M., Gruber, M. J., Ivanof, B. E., Ganesh, J., Materassi, M., Thorpe, A., Loaiza, V., Cappelletti, M., & Craik, F. I. M. (2018). Learning facts during aging: The benefits of curiosity. *Experimental Aging Research*, *44*(4), 311–328. https://doi.org/10.1080/0361073X.2018.1477355

Garcia, D., Mavrodiev, P., Casati, D., & Schweitzer, F. (2017). Understanding popularity, reputation, and social influence in the

Twitter society. *Policy and Internet*, *9*(3), 343–364. https://doi.org/10.1002/poi3.151

Gottlieb, J., Oudeyer, P. Y., Lopes, M., & Baranes, A. (2013). Information-seeking, curiosity, and attention: Computational and neural mechanisms. *Trends in Cognitive Sciences*, *17*(11), 585–593. https://doi.org/10.1016/j.tics.2013.09.001

Grimes, G. A., Hough, M. G., Mazur, E., & Signorella, M. L. (2010). Older adults' knowledge of internet hazards. *Educational Gerontology*, *36*(3), 173–192. https://doi.org/10.1080/03601270903183065

Gruber, M. J., Gelman, B. D., & Ranganath, C. (2014). States of curiosity modulate hippocampus-dependent learning via the dopaminergic circuit. *Neuron*, *84*(2), 486–496. https://doi.org/10.1016/j.neuron.2014.08.060

Gutchess, A. H., Kensinger, E. A., Yoon, C., & Schacter, D. L. (2007). Ageing and the self-reference effect in memory. *Memory*, *15*(8), 822–837. https://doi.org/10.1080/09658210701701394

Haim, M., Kümpel, A. S., & Brosius, H. B. (2018). Popularity cues in online media: A review of conceptualizations, operationalizations, and general effects. *Studies in Communication| Media*, *7*(2), 186–207. https://doi.org/10.5771/2192-4007-2018-2-58

Hertwig, R., Woike, J. K., & Schupp, J. (2021). Age differences in deliberate ignorance. *Psychology and Aging*, *36*(4), 407–414. https://doi.org/10.1037/pag0000603

Hess, T. M. (2014). Selective engagement of cognitive resources: Motivational influences on older adults' cognitive functioning. *Perspectives on Psychological Science*, *9*(4), 388–407. https://doi.org/10.1177/1745691614527465

Hulleman, C. S., & Harackiewicz, J. M. (2021). The utility-value intervention. In G. M. Walton & A. J. Crum (Eds.), *Handbook of wise interventions: How social psychology can help people change* (pp. 100–125). Guilford Press.

Kang, M. J., Hsu, M., Krajbich, I. M., Loewenstein, G., McClure, S. M., Wang, J. T. Y., & Camerer, C. F. (2009). The wick in the candle of learning: Epistemic curiosity activates reward circuitry and enhances memory. *Psychological Science*, *20*(8), 963–973. https://doi.org/10.1111/j.1467-9280.2009.02402.x

Kashdan, T. B., Gallagher, M. W., Silvia, P. J., Winterstein, B. P., Breen, W. E., Terhar, D., & Steger, M. F. (2009). The Curiosity and Exploration Inventory–II: Development, factor structure, and psychometrics. *Journal of Research in Personality*, *43*(6), 987–998. https://doi.org/10.1016/j.jrp.2009.04.011

Kashdan, T. B., McKnight, P. E., Fincham, F. D., & Rose, P. (2011). When curiosity breeds intimacy: Taking advantage of intimacy opportunities and transforming boring conversations. *Journal of Personality*, *79*(6), 1369–1402. https://doi.org/10.1111/j.1467-6494.2010.00697.x

Kelly, C. A., & Sharot, T. (2021). Individual differences in information-seeking. *Nature Communications*, *12*(1), Article 7062. https://doi.org/10.1038/s41467-021-27046-5

Knowlton, B. J., & Castel, A. D. (2022). Memory and reward-based learning: A value-directed remembering perspective. *Annual Review of Psychology*, *73*(1), 25–52. https://doi.org/10.1146/annurev-psych-032921-050951

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Lawton, M. P., Kleban, M. H., Rajagopal, D., & Dean, J. (1992). Dimensions of affective experience in three age groups. *Psychology and Aging*, *7*(2), 171–184. https://doi.org/10.1037/0882-7974.7.2.171

Lee, S. M., Thomer, A. K., & Lampe, C. (2022). The use of negative interface cues to change perceptions of online retributive harassment. *Proceedings of the ACM on Human–Computer Interaction*, *6*(CSCW2), 1–23. https://doi.org/10.1145/3555226

Litman, J. A., & Spielberger, C. D. (2003). Measuring epistemic curiosity and its diversive and specific components. *Journal of Personality Assessment*, *80*(1), 75–86. https://doi.org/10.1207/S15327752JPA8001_16

Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, *116*(1), 75–98. https://doi.org/10.1037/0033-2909.116.1.75

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-U

Marchionini, G. (2006). Exploratory search: From finding to understanding. *Communications of the ACM*, *49*(4), 41–46. https://doi.org/10.1145/1121949.1121979

Mayr, U., & Freund, A. M. (2020). Do we become more prosocial as we age, and if so, why? *Current Directions in Psychological Science*, *29*(3), 248–254. https://doi.org/10.1177/0963721420910811

McAdams, D. P., St Aubin, E. D., & Logan, R. L. (1993). Generativity among young, midlife, and older adults. *Psychology and Aging*, *8*(2), 221–230. https://doi.org/10.1037/0882-7974.8.2.221

McGillivray, S., Murayama, K., & Castel, A. D. (2015). Thirst for knowledge: The effects of curiosity and interest on memory in younger and older adults. *Psychology and Aging*, *30*(4), 835–841. https://doi.org/10.1037/a0039801

Metcalfe, J., Schwartz, B. L., & Eich, T. S. (2020). Epistemic curiosity and the region of proximal learning. *Current Opinion in Behavioral Sciences*, *35*, 40–47. https://doi.org/10.1016/j.cobeha.2020.06.007

Murayama, K. (2022). A reward-learning framework of knowledge acquisition: An integrated account of curiosity, interest, and intrinsic–extrinsic rewards. *Psychological Review*, *129*(1), 175–198. https://doi.org/10.1037/rev0000349

Murayama, K., FitzGibbon, L., & Sakaki, M. (2019). Process account of curiosity and interest: A reward-learning perspective. *Educational Psychology Review*, *31*(4), 875–895. https://doi.org/10.1007/s10648-019-09499-9

Murayama, K., Sakaki, M., Yan, V. X., & Smith, G. M. (2014). Type I error inflation in the traditional by-participant analysis to metamemory accuracy: A generalized mixed-effects model perspective. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*(5), 1287–1306. https://doi.org/10.1037/a0036914

Nosek, B. A., & Bar-Anan, Y. (2012). Scientific utopia: I. Opening scientific communication. *Psychological Inquiry*, *23*(3), 217–243. https://doi.org/10.1080/1047840X.2012.692215

Peirce, J., Gray, J. R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., Kastman, E., & Lindeløv, J. K. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior Research Methods*, *51*(1), 195–203. https://doi.org/10.3758/s13428-018-01193-y

R Core Team. (2020). *R core team R: A language and environment for statistical computing*. Foundation for Statistical Computing.

Raven, J. C. (1958). *Guide to using the Mill Hill Vocabulary Scale with the Progressive Matrices Scales*. H. K. Lewis.

Reed, A. E., Chan, L., & Mikels, J. A. (2014). Meta-Analysis of the age-related positivity effect: Age differences in preferences for positive over negative information. *Psychology and Aging*, *29*(1), 1–15. https://doi.org/10.1037/a0035194

Robinson, O. C., Demetre, J. D., & Litman, J. A. (2017). Adult life stage and crisis as predictors of curiosity and authenticity: Testing inferences from Erikson's lifespan theory. *International Journal of Behavioral Development*, *41*(3), 426–431. https://doi.org/10.1177/0165025416645201

Sakaki, M., Yagi, A., & Murayama, K. (2018). Curiosity in old age: A possible key to achieving adaptive aging. *Neuroscience and Biobehavioral Reviews*, *88*, 106–116. https://doi.org/10.1016/j.neubiorev.2018.03.007

Sheldon, P., Antony, M. G., & Ware, L. J. (2021). Baby Boomers' use of Facebook and Instagram: Uses and gratifications theory and contextual

age indicators. *Heliyon*, *7*(4), Article e06670. https://doi.org/10.1016/j.heliyon.2021.e06670

Sparrow, E. P., Swirsky, L. T., Kudus, F., & Spaniol, J. (2021). Aging and altruism: A meta-analysis. *Psychology and Aging*, *36*(1), 49–56. https://doi.org/10.1037/pag0000447

Spreng, R. N., & Turner, G. R. (2021). From exploration to exploitation: A shifting mental mode in late life development. *Trends in Cognitive Sciences*, *25*(12), 1058–1071. https://doi.org/10.1016/j.tics.2021.09.001

Stine-Morrow, E. A., & Manavbasi, I. E. (2022). Beyond "use it or lose it": The impact of engagement on cognitive aging. *Annual Review of Developmental Psychology*, *4*(1), 319–352. https://doi.org/10.1146/annurev-devpsych-121020-030017

Swan, G. E., & Carmelli, D. (1996). Curiosity and mortality in aging adults: A 5-year follow-up of the Western Collaborative Group Study. *Psychology and Aging*, *11*(3), 449–453. https://doi.org/10.1037/0882-7974.11.3.449

Swirsky, L. T., Shulman, A., & Spaniol, J. (2021). The interaction of curiosity and reward on long-term memory in younger and older adults. *Psychology and Aging*, *36*(5), 584–603. https://doi.org/10.1037/pag0000623

Swirsky, L. T., & Spaniol, J. (2019). Cognitive and motivational selectivity in healthy aging. *WIREs Cognitive Science*, *10*(6), Article e1512. https://doi.org/10.1002/wcs.1512

Swirsky, L. T., & Spaniol, J. (2023). Consequences of curiosity for recognition memory in younger and older adults. *Psychonomic Bulletin & Review*. Advance online publication. https://doi.org/10.3758/s13423-023-02414-y

Swirsky, L. T., Sparrow, E. P., Sullivan, M. D., Valenzano, S. L., Chowdhury, S., & Spaniol, J. (2023). Age differences in motivated cognition: A meta-analysis. *The Journals of Gerontology: Series B*, *78*(7), 1169–1181. https://doi.org/10.1093/geronb/gbad049

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. *Psychological Bulletin*, *121*(3), 371–394. https://doi.org/10.1037/0033-2909.121.3.371

Tseng, S. L., Lu, S., Weathers, D., & Grover, V. (2023). How product review voting is influenced by existing votes, consumer involvement, review valence, and review diagnosticity. *Decision Support Systems*, *172*, Article 113981. https://doi.org/10.1016/j.dss.2023.113981

Wade, S., & Kidd, C. (2019). The role of prior knowledge and curiosity in learning. *Psychonomic Bulletin & Review*, *26*(4), 1377–1387. https://doi.org/10.3758/s13423-019-01598-6

Wang, Y., Norcie, G., Komanduri, S., Acquisti, A., Leon, P. G., & Cranor, L. F. (2011). "I regretted the minute I pressed share" a qualitative study of regrets on Facebook. *Proceedings of the seventh symposium on usable privacy and security* (pp. 1–16). https://doi.org/10.1145/2078827.2078841

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.1063

Whitmarsh, L., Player, L., Jiongco, A., James, M., Williams, M., Marks, E., & Kennedy-Williams, P. (2022). Climate anxiety: What predicts it and how is it related to climate action? *Journal of Environmental Psychology*, *83*, Article 101866. https://doi.org/10.1016/j.jenvp.2022.101866

Zywica, J., & Danowski, J. (2008). The faces of Facebookers: Investigating social enhancement and social compensation hypotheses; predicting Facebook™ and offline popularity from sociability and self-esteem, and mapping the meanings of popularity with semantic networks. *Journal of Computer-Mediated Communication*, *14*(1), 1–34. https://doi.org/10.1111/j.1083-6101.2008.01429.x

Received June 2, 2023
Revision received July 16, 2024
Accepted July 23, 2024 ■