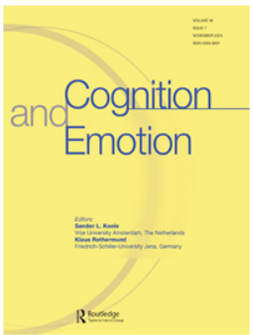

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A pandemic-related affect gap in risky decisions for self and others

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ABSTRACT

The early stages of the COVID-19 pandemic exposed large portions of the global populations to increased daily stressors. Research on risky choice in medical contexts suggests that affect-rich choice options promote less-advantageous decision strategies compared with affect-poor options, causing an "affect gap" in decision making. The current experiments (total $N = 437$, age range: 21–82) sought to test whether negative pandemic-related affect would lower expected-value (EV) maximisation within individuals. In Experiment 1, participants indicated how much they would be willing to pay to avoid specific pandemic experiences (e.g. "not being able to gather in groups"), and then chose among pairs of risky prospects that involved pandemic experiences or subjectively-equivalent monetary losses. EV maximising was lower for pandemic experiences than for equivalent monetary losses. Experiment 2 replicated this finding, and further demonstrated a moderating role of decision perspective. EV maximising was greater in decisions made for another person than in decisions made for oneself. These findings highlight potential strategies for boosting decision making under affect-rich real-world conditions.

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Aging; emotion; COVID-19; decision making; self-distancing

In addition to the primary threat of illness and death, a host of secondary pandemic-related experiences – social isolation, altered work and leisure routines, and uncertainty about the economic and political future – made everyday life during the COVID-19 pandemic stressful for people around the world. At the same time, individuals were forced to make risky decisions for themselves and others (e.g. their families, their communities). Does negative affect related to adverse experiences such as COVID-19 impact people's ability to make good choices? Do these effects depend on the decision maker's age or other individual difference variables? These questions have received little study to date, although large literatures have examined the role of affect in decision making in general (e.g. Finucane et al., 2000; Loewenstein et al., 2001), and the impact of COVID-19 on risk taking behaviours in particular (e.g. Da Silva Castanheira et al., 2021; Li, 2023; Tsai & Zeng, 2021). We conducted two experiments during the early months of the COVID-19 pandemic to assess how negative pandemic-related thoughts affected decisions for self (Exp. 1 & 2) and others (Exp. 2). Before describing the study in detail, we will briefly review relevant prior literature on affect, decision making, and aging.

The affect gap in risky choice

Laboratory studies have shown that affect-rich outcomes elicit less adaptive decisions than affect-poor outcomes (Pachur et al., 2013, 2014; Popovic et al., 2019; Rottenstreich & Hsee, 2001; Suter et al., 2015, 2016). For example, Pachur et al. (2014) presented Swiss university students with affect-rich scenarios (e.g. hypothetical medication side effects such as memory loss and diarrhea). First, participants indicated how much they would be willing to pay to avoid these outcomes. Each participant's willingness-to-pay (WTP) responses were then used to construct participant-specific affect-rich and affect-poor

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choice pairs, the former involving affect-rich prospects (medication side effects) and the latter involving subjectively-equivalent affect-poor prospects (monetary losses). Analyses of choice patterns revealed an "affect gap", such that in affect-rich vs. affect-poor decisions, participants were less likely to maximise the expected value (EV) of the chosen option, and were more likely to rely on simple decision heuristics that prioritised outcomes over probabilities.[1]

Extrapolating from existing laboratory findings on the affect gap, one might expect that affect-rich real-world situations beyond the medical domain should also produce reductions in EV maximising. The COVID-19 pandemic, with its widespread effects on nearly all aspects of daily life, offered a naturalistic context for testing this prediction. Given its collective impact, the pandemic context also allowed us to examine whether making decisions for other people (vs. for oneself) promotes adaptive decision making in affect-rich settings.

Risky choice for self and others

Research on interpersonal decision making (also referred to as proxy, social, or surrogate decision making; Polman & Wu, 2020) has been concerned with systematic deviations between decisions people make for themselves versus for others. Possible sources of such deviations include the significance of the decision, the decision maker's intent (e.g. egocentric vs. benevolent), their empathy and accountability, and the relationship between the decision maker and the other person (Tunney & Ziegler, 2015). In the domain of risky choice, a meta-analysis of 71 studies identified robust differences between personal and interpersonal decisions (Polman & Wu, 2020), with decisions for others being slightly riskier on average than decisions for self. However, this meta-analysis did not examine how decision perspective influences EV maximising, or whether adopting an interpersonal decision perspective modulates the influence of affect on risky choice. For example, decisions for others might be "more rational" (i.e. EV-maximising) than decisions for self (Popovic et al., 2019, p. 390), if emotional engagement decreases with increasing psychological distance.

To investigate this question, Popovic et al. (2019) used Pachur et al.'s (2014) affect-gap paradigm by comparing affect-rich and affect-poor choices that participants made either for themselves or for another person. Similar to prior studies, Popovic et al.'s study demonstrated an affect gap, such that affect-rich choices elicited less pre-decisional information search, simpler decision strategies, and lower rates of EV maximising than affect-poor choices. Critically, the affect gap was not significantly different in decisions for self vs. others. However, Popovic et al.'s samples were limited to younger-adult university students, and the affect-rich choices always involved medical side effects. No studies have examined how decision perspective influences the affect gap for non-student populations – for example, those who are older, less educated, or less numerate – or for affect-rich choices outside the medical domain.

Adult age as a modulator of affect and decision making

A large body of literature suggests that the affect gap in risky choice may be sensitive to age differences in affective and cognitive processes. Age-related declines in fluid cognition (e.g. processing speed, executive control, and working memory; Braver & West, 2008) may impact risky choice by reducing the efficiency with which decision makers integrate outcomes and probabilities. Laboratory studies have shown that, compared to younger adults, older adults use less information in gambling tasks (Weller et al., 2019), are less sensitive to the expected value of risky financial options (O'Brien & Hess, 2020; Pachur et al., 2017), and are more strongly affected by the complexity of choice options (Zilker et al., 2020).

With respect to affective processes, older age is associated with greater emotional positivity and stability (for a review, see Charles & Carstensen, 2010). Remarkably, this age difference persisted even during the COVID-19 pandemic. In large U.S. studies conducted during the early months of COVID-19, older adults reported better mental health (Bruine De Bruin, 2021), and more positive and less negative emotions (Carstensen et al., 2020), compared with younger adults. Older adults also demonstrate greater prosociality (Mayr & Freund, 2020). For example, older adults make more generous choices than younger adults in behavioral-economics tasks (Sparrow et al., 2021), report spending more time volunteering and helping others (Serrat et al., 2020), and reported greater adherence to COVID-19 public-health directives that helped protect other people (Cutler et al., 2021). Age differences in prosociality could also influence interpersonal decision making.

For example, compared with younger adults, older adults may be more invested in other people's well-being, thus showing reduced differentiation between decisions for self vs. others (e.g. Pornpattananangkul et al., 2018).

In summary, age is a potential modulator of the affect gap in risky choice in general, and in the COVID-19 context in particular. Age-related deficits in fluid cognition may reduce older adults' EV maximising, even in affect-poor contexts; age differences in emotional experience may influence the degree to which pandemic-related thoughts induce negative affect; and age differences in prosocial orientation may impact the role of decision perspective (choosing for oneself vs. for others) on decision processes and outcomes.

The current study

Although a "medical-monetary" affect gap in risky choice has been repeatedly demonstrated in highly educated younger adults (e.g. Pachur et al., 2014; Popovic et al., 2019; Suter et al., 2015, 2016), the degree to which the affect gap generalises to other decision domains, to decisions for others, and to other populations is still unclear. The current study aimed to address these issues as follows. First, we hypothesised that the affective context of the COVID-19 pandemic – a real-world event that caused significant hardship to people around the world – would elicit a drop in EV maximising similar to the one previously reported for hypothetical medical decisions (Experiment 1). Second, we explored the influence of decision perspective by comparing choices made for self vs. others (Experiment 2). Here, we made no directional prediction given the mixed findings in previous studies. Third, given the evidence for age differences in fluid cognition and in affective processes, we investigated the role of adult age in the affect gap in both experiments. Whereas we treated age as an exploratory factor in Experiment 1, we made specific predictions in Experiment 2, as described in detail below. We also recruited samples that were more geographically and demographically diverse than those used in most previous studies.

Experiment 1

In Experiment 1, we used the affect-gap paradigm introduced by Pachur et al. (2014, Experiment 1), but we replaced medication side effects with descriptions of common worries related to the COVID-19 pandemic. We predicted that the proportion of EV-maximising choices would be lower for pandemic-related experiences than for monetary losses. In addition to age, we also explored covariates of potential interest. These included gender, a factor that has sometimes been linked to differences in risk taking (e.g. Mata et al., 2016), as well as education and income, variables likely associated with differential vulnerability to impacts of COVID-19. We also assessed numeracy, a variable linked to adaptive reasoning and decision making (Pachur & Galesic, 2013; Peters, 2012). Health status served as a proxy for COVID-19 vulnerability. Finally, we explored the role of COVID-19 incidence in participants' home states and provinces, which might moderate their affective responses to pandemic-related experiences.

Method

The experiment was preregistered as part of a larger study prior to data collection (https://osf.io/ufyhq). Here we report the first three of the five experimental tasks that participants completed: 1. Willingness-to pay, referred to as monetary evaluation in the pre-registration; 2. Choice, referred to as risky choice in the pre-registration; and 3. Affective ratings, referred to as affective evaluation in the pre-registration. Two additional unrelated tasks (risk perception, altruistic decision making), designed to address a separate set of research questions, will be reported elsewhere. De-identified data and analysis code for Experiment 1 can be accessed at https://osf.io/hvgs4/.

Participants

An a-priori power analysis with G*Power 3.1.9.4 (Faul et al., 2007) indicated that at least 135 participants would be needed to achieve a power of 80% to detect a medium-sized interaction ($\eta_p^2 = 0.07$) of age group (younger, middle-aged, and older adults) and decision domain (pandemic vs. monetary) on the dependent measures in a mixed analysis of variance (ANOVA). We increased this number to 150 (i.e. 50 participants per age bracket) to be conservative. In addition, we report multilevel modelling analyses of trial-level data that may provide greater statistical power than mixed ANOVAs (Quené & Van Den Bergh, 2004).

Data collection for Experiment 1 took place in June 2020. Participants were residents of Canada and the

United States. They were recruited from Amazon MTurk via CloudResearch (Litman et al., 2017), and directed via anonymous link to the study which was hosted on the Qualtrics platform (Qualtrics, Provo, UT).

To qualify for the study, participants had to have an MTurk Human Intelligence Task approval rate of at least 70, be proficient in English, and have at least 12 years of education. Recruitment was stratified by gender and age group (younger, 21–39; middle-aged, 40–59; older, 60+), but note that age was used as a continuous predictor in all analyses. Participants received $4 USD in compensation for completing the study, which lasted approximately 30 min. All participants provided informed consent, and all study procedures were approved by the Research Ethics Board at Toronto Metropolitan University. The final sample in Experiment 1 included 150 participants, ranging in age from 21 to 79, whose characteristics are shown in Table 1. One participant had only 9 years of education, but excluding this participant did not change the pattern of results so we retained them.

Data from 7 additional participants were excluded because they gave an incorrect response to an attention-check question (3 participants) or because they provided repeated nonsensical responses (e.g. "$1999999" in the willingness-to-pay task) indicative of noncompliance with the task instructions (4 participants).

Table 1. Demographic characteristics of participants.

Characteristic	Experiment 1 (N = 150) M (SD)	Experiment 2 (N = 287) M (SD)
Age	47.99 (14.35)	47.35 (15.09)
Years of education	16.11 (2.20)	15.49 (2.24)
Berlin Numeracy Test	1.45 (1.30)	1.36 (1.27)
	n (%)	n (%)
Age group		
21–39	52 (34.7)	104 (36.2)
40–59	48 (32.0)	102 (35.5)
60+	50 (33.3)	81 (28.2)
Gender		
Male	82 (45.3)	127 (44.3)
Female	68 (54.7)	158 (55.1)
Other	0 (0)	1 (0.3)
Prefer not to answer	0 (0)	1 (0.3)
Annual household income		
Less than $10,000	3 (2.0)	16 (5.5)
$10,000–$29,999	25 (16.7)	63 (22.0)
$30,000–$49,999	37 (24.7)	59 (20.6)
$50,000–$69,999	23 (15.3)	51 (17.8)
$70,000–$89,000	20 (13.3)	41 (14.3)
$90,000–$109,999	14 (9.3)	27 (9.4)
Over $110,000	24 (16.0)	27 (9.4)
Prefer not to answer	4 (2.7)	3 (1.1)
Country of residence		
Canada	1 (0.7)	6 (2.1)
U.S.	149 (99.3)	281 (97.9)
Prefer not to answer	0	1 (0.4)
Ethnic background		
African American or Black		28 (9.7)
Arab or West Asian		1 (0.3)
Chinese		1 (0.3)
Filipino		1 (0.3)
Japanese		0 (0)
Korean		2 (0.7)
Latin American		1 (0.3)
South Asian		4 (1.5)
Southeast Asian		3 (1.2)
White/European/ Caucasian		232 (80.8)
Multiple		8 (2.8)
Other		1 (0.3)
Prefer not to answer		1 (0.3)

Design and materials

Similar to prior studies on the affect gap in risky choice (e.g. Pachur et al., 2014; Popovic et al., 2019), the experiment included 3 tasks: willingness-to-pay, choice, and affective ratings. The choice and affective-ratings tasks included choice domain (pandemic vs. monetary) as a within-subjects factor.

In the willingness-to-pay task, participants viewed 14 pandemic-related experiences (see Figure 1) and indicated how much they would be willing to pay (in $ USD) to avoid each experience for the next year. In a pilot study with 152 MTurk participants, none of whom went on to participate in the current experiments, we had administered the willingness-to-pay task with 20 pandemic-related experiences. The current experiment used the 14 experiences that had received the highest median willingness-to-pay responses in the pilot study.

Procedure

Willingness-to-pay (WTP). We told participants that they would see a list of experiences that many people have had during the COVID-19 pandemic. For each of these experiences, we asked participants to indicate how much they would be willing to pay to avoid the experience for the entire next year. Participants entered the amounts (in USD) by typing into a text box. The presentation order of the 14 experiences was randomised for each participant.

Choice. We asked participants to imagine that the pandemic had been mostly brought under control, but that there was still a chance of some negative experiences over the next year. Participants were told that they would be presented with hypothetical

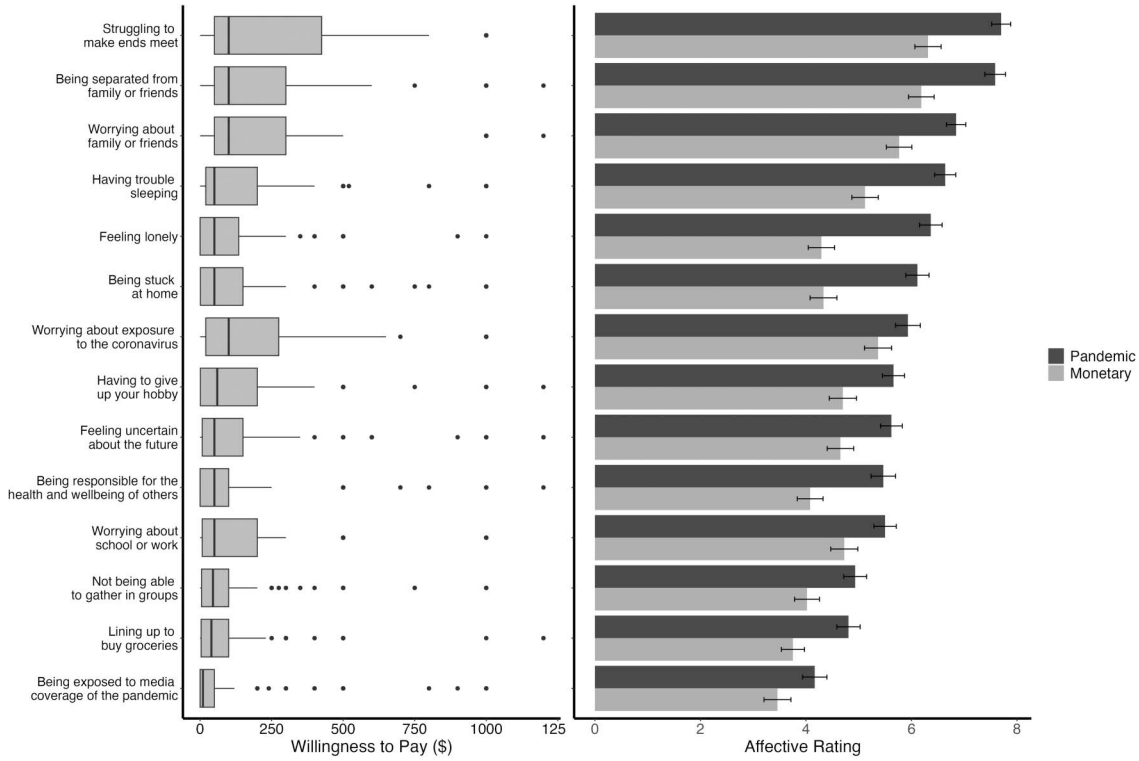

Figure 1. Willingness to pay and affective ratings in Experiment 1.

choices, and that for each of these choices they should select the option they realistically preferred. Participants viewed examples and had to answer two comprehension questions before beginning the choice trials. There were 14 choice pairs (see Appendix A1), each of which was presented once in the pandemic domain and once in the monetary domain, for a total of 28 choice trials. The presentation order of the trials was randomised for each participant.

Following Pachur et al.'s (2014) methodology, each choice was constructed so that the option with the higher median WTP (based on the pilot study) had a lower probability than the option with the lower median WTP. The probabilities ranged from 1% to 100%. The monetary version of each choice pair varied across participants because each pandemic experience was replaced by the participant's response from the WTP task. For example, a participant may have indicated that they would pay $150 to avoid worrying about exposure to the coronavirus for the next year and $50 to avoid worrying about school or work. For this participant, the choice between "a 1% chance of worry about exposure to the coronavirus" and "a 30% chance of worrying about school or work" in the pandemic version would have been replaced with the choice between "a 1% chance of losing $150" and "a 30% chance of losing $50" in the monetary version.

Affective ratings. To check whether pandemic-related experiences were indeed more affect-rich than monetary losses, we also collected affective ratings. We told participants that they would again see a list of experiences and financial losses. For each of these experiences, we asked participants to rate how upset the experience would make them feel on a scale of 1 (not upset at all) to 10 (extremely upset). Participants provided affective ratings for each of the 14 pandemic-related experiences as well as their subjective monetary equivalents (e.g. loss of $150). Experiences and financial losses were presented in random intermixed order, with an attention-check question appearing in a random position within the list ("Attention check! Please choose 9").

After an unrelated task,[2] participants completed the 4-item Berlin Numeracy Test (BNT; Cokely et al., 2012) with an attention-check question inserted

("Please enter the current year"). Next, participants played an unrelated game[3] before completing a demographic and health questionnaire. At the end of the study, participants received a study debriefing and a completion code that enabled them to claim their compensation for the study.

Data analysis

WTP responses were extremely positively skewed (skewness = 19.07), so we analysed log-transformed WTP responses (i.e. ln(WTP + 1)) using mixed-effects linear regression (random intercept only because there were no Level 1 predictors) with the Level 2 predictor age (mean-centered). For the analysis of EV maximising, responses in the choice task were classified according to whether the participant chose the option with the higher EV (the product of the probability and the subjective monetary value). Choice trials in which both options had the same EV, for example because the participant had assigned a monetary value of $0 to both outcomes, were excluded from the analysis. Using the lme4 package in R (Bates et al., 2015), we analysed binary trial outcomes (0 = lower-EV option chosen; 1 = higher-EV option chosen) using a multilevel logistic regression model (random intercept only) with trials nested within subjects, and the Level 2 predictors domain (pandemic, monetary) and age (mean-centered), as well as the Domain x Age interaction. Affective ratings were modelled using mixed-effects linear regression (random intercept only) with the Level 2 predictors domain, age (mean-centered), and the Domain x Age interaction.

For all dependent variables, we also explored models with the following covariates: gender, years of education, numeracy, income, health problems, and mean-centered cumulative COVID-19 incidence in the participant's home state or province at the time of data collection. Only one covariate was included at a time. For the analyses of WTP and affective ratings, *p*-values for fixed-effect estimates were obtained using the Satterthwaite method implemented by the lmerTest package (Kuznetsova et al., 2017).

The analyses departed from the pre-registered analysis plan as follows. We originally did not plan to submit WTP responses to a statistical analysis, but to merely report descriptive statistics. We also originally planned to analyze the affective rating and choice data first by running a mixed ANOVA with age group as a categorical predictor, and then by running multilevel models, with trials nested within subjects, using age as a continuous predictor. Since these analyses were redundant and yielded similar results, we report only the multilevel models.

Results

Separately for each pandemic experience, Figure 1 shows WTP responses (upper left panel) and affective ratings (upper right panel). Figure 2 shows EV maximising (i.e. the proportion of higher-EV choices) in the choice task.

Willingness to pay

Age was a significant predictor, B = −0.02, *SE* = 0.01, $t(148) = 2.41$, $p = .02$, such that higher age was associated with lower willingness to pay. None of the covariates or their interactions with age was statistically significant.

Choice

The multilevel logistic regression model of EV maximising revealed a significant main effect of domain, B = −0.74, *SE* = 0.08, *OR* = 0.48, $z = 9.24$, $p < .001$, such that the likelihood of choosing the higher-expected value option was lower in the pandemic domain than in the monetary domain. The effect of age was nonsignificant, B < −0.01, *SE* = 0.01, *OR* = 1.00, $z = 0.34$, $p = 0.72$, as was the Age x Domain interaction, B = −0.01, *SE* = 0.01, *OR* = 1.00, $z = 0.82$, $p = 0.41$.

When numeracy was added to the model, its effect was significant, B = 0.25, *SE* = 0.07, *OR* = 1.28, $z = 3.75$, $p < 0.001$, as was the Domain x Numeracy interaction, B = -.21, *SE* = 0.06, *OR* = 0.81, $z = 3.35$, $p < 0.001$. Given the significant interaction, the main effect of numeracy reflected the simple main effect of numeracy in the monetary domain, such that higher numeracy was associated with choosing the higher-EV option. Reverse-coding the domain variable revealed that the effect of numeracy was nonsignificant in the pandemic domain, B = 0.034, *SE* = 0.06, *OR* = 1.03, $z = 0.59$, $p = 0.56$. The inclusion of the numeracy covariate did not affect the pattern of results for age, domain, or the Age x Domain interaction.

Similarly, when COVID-19 incidence was added to the model, its effect was significant, B = 0.07, *SE* = 0.03, *OR* = 1.08, $z = 9.30$, $p < 0.001$, such that living in a state or province with higher COVID-19 incidence

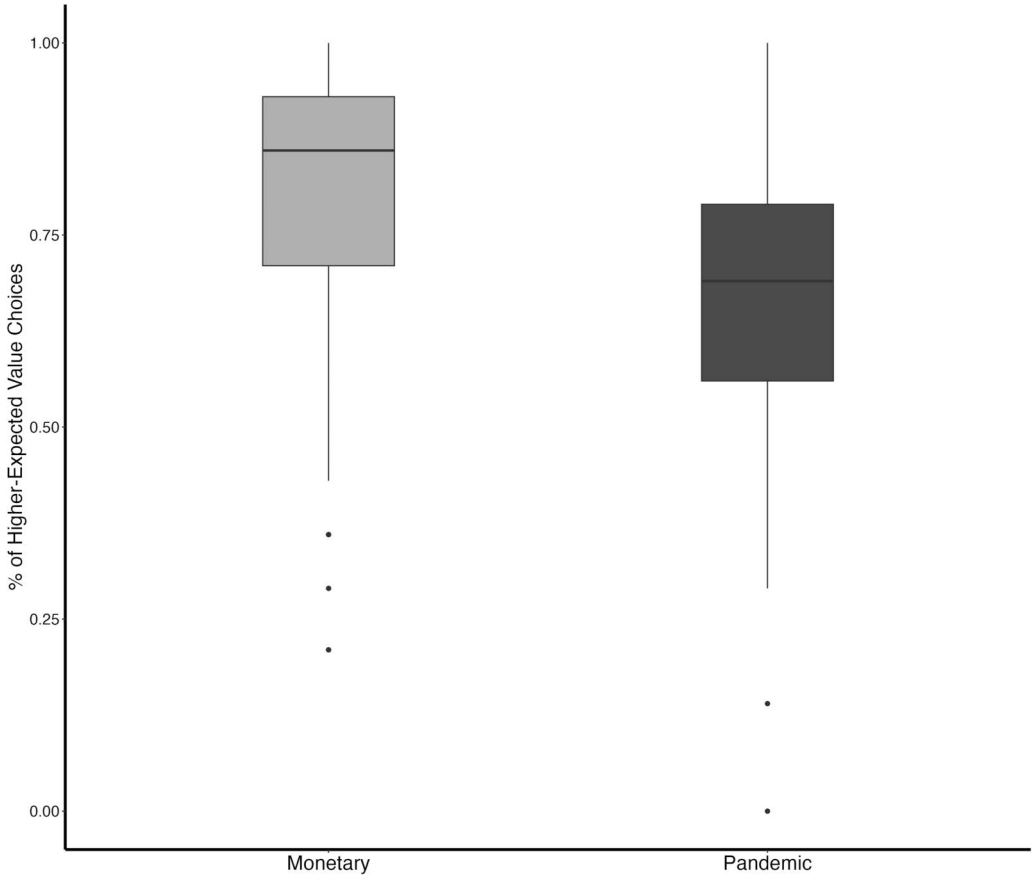

Figure 2. EV-maximising choices in Experiment 1.

was associated with greater likelihood of choosing the higher-EV option. There were no significant interactions of this covariate with age or domain, and including the covariate did not change the pattern of results for these predictors. No other covariates reached statistical significance.

Affective ratings

The analysis of affective ratings revealed an Age x Domain interaction, $B = 0.032$, $SE = 0.01$, $t(4048) = 5.80$, $p < .001$. In the monetary domain, older age was associated with lower affective ratings (i.e. being less upset), $B = -0.03$, $SE = 0.01$, $t(179) = 2.98$, $p = .003$. Reverse-coding the domain variable revealed that the effect of age was nonsignificant in the pandemic domain, $B = 0.004$, $SE = 0.01$, $t(179) = .52$, $p = .61$. There was also a significant effect of domain. Because age was mean-centered, the coefficient for domain, $B = 1.18$, $SE = .08$, $t(4048) = 14.95$, $p < .001$, indicated that for a participant at the mean age of 48 years, affect ratings were estimated to be higher in the pandemic domain than in the monetary domain. None of the covariates reached statistical significance.

Discussion

In line with our pre-registered hypothesis, the results of Experiment 1 revealed an affect gap in risky choice. Participants were significantly less likely to make EV-maximising choices in decisions about affect-rich pandemic-related scenarios than in decisions about affect-poor monetary losses. To our knowledge, this is the first demonstration that thinking about common COVID-19 related experiences such as social isolation and economic uncertainty has a negative impact on EV maximising within individuals. This finding also suggests that the affect gap for negatively-valenced outcomes is a robust phenomenon

that generalises beyond the narrow sample demographics and decision domains included in previous studies (e.g. Pachur et al., 2014; Popovic et al., 2019; Suter et al., 2016). Whether similar effects would be seen for other classes of collective events (e.g. national sports teams' wins and losses; economic upswings and downswings; major weather events) is an interesting question for future research. A discussion of the findings regarding age and other covariates is provided in the General Discussion.

Experiment 2

The aim of Experiment 2 was to replicate the findings of Experiment 1, and to examine the impact of decision perspective – whether participants made decisions for themselves or for another person. Given the mixed results of prior studies on decisions for others involving risk (for a meta-analysis, see Polman & Wu, 2020), we made no specific prediction regarding the direction of the effect of perspective on EV maximising for pandemic-related and monetary outcomes. Based on the evidence for greater prosociality in older vs. younger adults (Mayr & Freund, 2020; Sparrow et al., 2021), as well as weaker self-other discrepancies in risky financial choice (e.g. Pornpattananangkul et al., 2018), we expected a smaller effect of decision perspective on decision making in older adults. In addition, we predicted that higher age would be associated with smaller effects of affective context on both affect ratings and EV maximising.[4]

Method

The experiment was preregistered as part of a larger study prior to data collection (https://osf.io/6umk9). Similar to Experiment 1, we report three of the five experimental tasks that participants completed (willingness-to-pay, choice, and affective ratings). The other tasks (risk perception, altruistic decision making) tested separate hypotheses and will be reported in a separate article. Deidentified data and analysis code for Experiment 2 can be accessed at https://osf.io/hvgs4/.

Participants

Data collection for Experiment 2 took place in August 2020. Recruitment methods and eligibility criteria were identical to those in Experiment 1. Participants received $5 for completing the study. Participants who had taken part in Experiment 1 were not eligible to participate in Experiment 2. The final sample included 287 participants, ranging in age from 21 to 82, whose characteristics are shown in Table 1. Data from 14 additional participants were excluded because they opted to withdraw their data at the end of the study (4 participants), gave an incorrect response to an attention-check question (7 participants), or gave nonsensical responses (3 participants).

Design, materials, and procedure

Experiment 2 had a mixed factorial design with decision perspective (self vs. other) manipulated between-subjects, and domain (pandemic vs. monetary) manipulated within-subjects. For participants in the "self" condition, the procedure was identical to that of Experiment 1. For participants in the "other" condition, the task instructions differed as follows. In the WTP task, we told participants in the "other" condition that they would see a list of experiences that many people have had during the COVID-19 pandemic. For each of these experiences, we asked participants to indicate how much a stranger, identified by the initials "T.C.", would be willing to pay to avoid the experience for the entire next year. Participants were told that "T.C. lives in your neighborhood and is approximately the same age as you". In the choice task, participants in the "other" condition were asked to select the option for T.C. that they believed T.C. would realistically prefer. Finally, in the affective-ratings task, participants in the "other" condition rated how upset the experience or financial loss would make T.C. feel.

Data analysis

Analyses followed the same approach as in Experiment 1, but they included the between-subjects predictor decision perspective (0 = self; 1 = other), as well as its interactions with domain (0 = monetary; 1 = pandemic) and age. We again log-transformed WTP responses before analysis given their extreme positive skew (skewness = 19.23). In addition to the covariates tested in Experiment 1, we also tested race/ethnicity (dichotomised as White vs. Non-White due to the small number of participants in many racial/ethnic categories, see Table 1). All departures from the preregistered analysis plan were identical to those in Experiment 1.

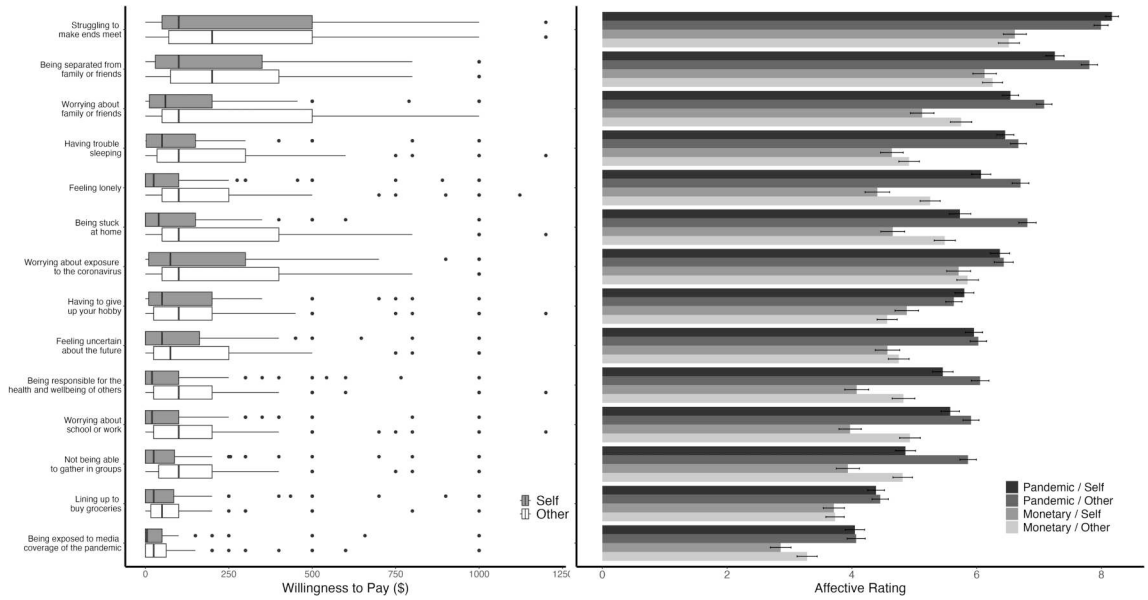

Figure 3. Willingness to pay and affective ratings in Experiment 2.

Results

Separately for each pandemic experience, Figure 3 shows descriptive statistics for WTP responses (upper left panel) and affective ratings (upper right panel). Figure 4 shows EV maximising (i.e. the proportion of higher-EV choices) in the choice task.

Willingness to pay

Older age was associated with lower WTP, B = −0.02, $SE = 0.01$, $t(284) = 4.14$, $p < .001$. The "other" perspective was associated with higher WTP than the "self" perspective, B = 1.06, $SE = 0.07$, $t(284) = 6.23$, $p < .001$. The Age x Perspective interaction was nonsignificant, B = 0.01, $SE = 0.01$, $t(283) = 1.30$, $p = .20$.

The only significant covariate was income, B = 0.14, $SE = 0.05$, $t(280) = 2.74$, $p = .01$, such that higher income was associated with higher WTP. The effects of age and perspective remained significant after including this covariate, and the Age x Income and Perspective x Income interactions were nonsignificant, $ps > .05$.

Choice

There was a significant effect of domain, B = −0.99, $SE = 0.08$, $OR = 0.37$, $z = 11.79$, $p < .001$, indicating that the likelihood of choosing the higher-EV option was lower in the pandemic domain than in the monetary domain. There was also a significant effect of decision perspective, B = 0.39, $SE = 0.13$, $OR = 1.48$, $z = 3.11$, $p = .002$, such that the likelihood of choosing the higher-EV option was greater in the "other" perspective than in the "self" perspective. The effect of age was nonsignificant, as were all two-way interactions, $ps \geq .30$. A model with the 3-way interaction of age, domain, and decision perspective failed to converge.

When numeracy was added to the model that included the two-way interactions named above, the model also failed to converge. When those interactions were removed, the revised model converged and there was a significant Domain x Numeracy interaction, B = −0.14, $SE = 0.05$, $OR = 0.87$, $z = 2.82$, $p = .005$. The simple main effect of numeracy was significant in the monetary domain, B = 0.28, $SE = 0.05$, $OR = 1.32$, $z = 5.42$, $p < .001$, suggesting that higher numeracy was associated with a greater likelihood of choosing the higher-EV option. Reverse-coding the domain variable revealed that the simple main effect of numeracy was also significant in the pandemic domain, although it was weaker than in the monetary domain, B = 0.13, $SE = 0.04$, $OR = 1.14$, $z = 3.12$, $p = .002$. The inclusion of the numeracy covariate did not affect the pattern of results for age,

domain, or decision perspective. No other covariates were statistically significant.

Affective ratings

The analysis of affective ratings revealed a significant three-way interaction of age, domain, and decision perspective, B = −0.02, *SE* = 0.01, *t*(7745) = 2.35, *p* = .02. Because age was mean-centered, the coefficients for domain and perspective within this three-way interaction model represent the effects of domain and perspective for a participant at the mean age of 47 years. In the "self" perspective, there was a simple main effect of domain, B = 1.26, *SE* = 0.08, *t*(7745) = 15.97, *p* < .001, indicating that affect ratings were higher in the pandemic domain than in the monetary domain. The same pattern was observed in the "other" perspective, B = 1.18, *SE* = 0.08, *t*(7745) = 15.03, *p* < .001. We also estimated simple main effects of perspective within each domain. In the monetary domain, the effect of perspective was significant, B = 0.44, *SE* = 0.18, *t*(346) = 2.46, *p* = .01, indicating that affect ratings were higher in the "other" perspective than in the "self" perspective. In the pandemic domain, the effect of perspective was weaker, B = 0.35, *SE* = 0.18, *t*(346) = 1.97, *p* = .05.

Finally, we examined the simple effects of age at each level of perspective and domain via reverse-coding. In the "self" perspective, there was an Age x Domain interaction, B = 0.03, *SE* = 0.01, *t*(7745) = 5.15, *p* < .001. In the monetary domain, the simple main effect of age was significant, B = −0.04, *SE* = 0.01, *t*(346) = 5.15, *p* < .001, such that older age was associated with lower affective ratings (i.e. being less upset). In contrast, the age effect was weaker in the pandemic domain, B = −0.02, *SE* = .01, *t*(346) = 1.96, *p* = .05. In the "other" perspective, the Age x Domain interaction was not significant, B = 0.01, *SE* = 0.01, *t*(7745) = 1.96, *p* = .05.

There were two significant covariates. The first was gender, B = −0.41, *SE* = 0.17, *t*(280) = 2.37, *p* = .02, such that men gave lower affective ratings than women. The second significant covariate was numeracy, B = −0.16, *SE* = 0.07, *t*(282) = 2.39, *p* = .02, such

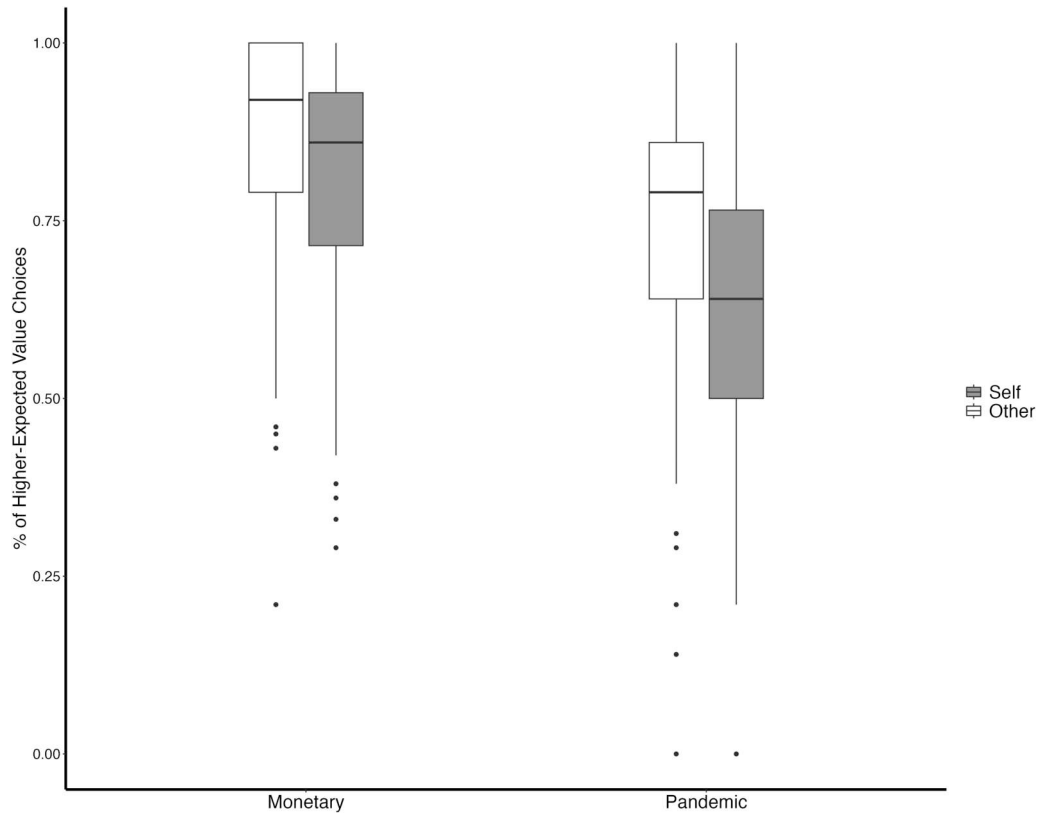

Figure 4. EV-maximising choices in Experiment 2.

that higher numeracy was associated with lower affective ratings. Neither gender nor numeracy interacted with other predictors, and the inclusion of these covariates into the model did not change the overall pattern of results.

Discussion

As predicted, Experiment 2 replicated the Experiment 1 finding of reduced EV maximising for pandemic-related versus subjectively-matched monetary outcomes. Furthermore, EV maximising was higher in participants who made choices on behalf of another person than in participants who made choices for themselves, consistent with the idea that self-distancing enhances reasoning and adaptive decision making (e.g. Grossmann et al., 2021). However, participants in the "other" conditions still showed a significant affect gap in EV maximising, suggesting that a self-distanced decision perspective may not be enough to override the impact of affect on participants' choices. As in Experiment 1, we also observed effects of age and other covariates, discussed below.

General discussion

The goal of this pre-registered study was to test whether the affect gap – systematic deviations between affect-rich and affect-poor risky decisions – would generalise beyond the decision domains and populations examined in prior laboratory studies (e.g. Pachur et al., 2014; Popovic et al., 2019; Suter et al., 2015, 2016). Across two online experiments, conducted in mid-2020 during the first wave of the COVID-19 pandemic, we compared risky decisions for affect-rich pandemic-related experiences that had become highly familiar to most people (e.g. "not being able to gather in groups"), and affect-poor monetary losses that were individually matched on subjective value. Both experiments revealed a robust affect gap, such that EV maximising was lower in the pandemic domain than in the monetary domain. We also found that EV maximising was higher for choices made for another person, compared to choices made for oneself. Finally, we examined potential influences of age and other individual-difference variables. Age was not a significant moderator of EV maximising or of the affect gap, but higher numeracy was associated with higher EV maximising, especially in the monetary domain. We discuss each of these findings in turn.

The affect gap may generalise to real-world contexts

Previous studies of the affect gap in risky choice focused primarily on identifying how cognitive processes differ for affect-rich and affect-poor choices. For example, Pachur et al. (2014) used computational modelling and process tracing to demonstrate that decision makers rely on EV to guide their choices in affect-poor contexts. In contrast, in affect-rich contexts, the same decision makers tend to employ simple heuristics that neglect probabilities (e.g. minimax). The current study bypassed questions about cognitive mechanisms and instead focused on questions of ecological validity and generalizability – issues that are critical for assessing the real-world impact of laboratory findings. One important insight from the current data is that the affect gap extends beyond the medical domain, which had been the primary focus of previous studies (but see Pachur et al.'s [2014] Study 2, which used vacation choices eliciting positive affect). In the current study, we presented participants with a variety of negative experiences that were common during the first wave of the COVID-19 pandemic. These experiences encompassed financial, social, and health-related worries, as well as minor inconveniences of daily living. Although the experiences elicited a range of affective evaluations, all were highly familiar and personally relevant.

The finding of a robust affect gap in the current study suggests that this phenomenon is not limited to novel or highly fear-inducing scenarios. In future research, it would be important to extend the investigation of the affect gap to more ecologically valid, consequential decisions in domains such as healthcare, financial planning, or consumer choice, and to situations in which probabilities are not described but learned from experience (see also Popovic et al., 2019, Study 2).

The role of decision perspective

In Experiment 2, we introduced a between-subjects manipulation of decision perspective, such that participants made decisions either for themselves ("self" condition) or for another person ("other" condition). The proportion of higher-EV choices was higher for participants in the "other" condition than for those in the "self" condition, but this effect was similar for both pandemic-related and monetary domains.

Thus, although adopting another person's perspective had a positive effect on decisions overall, it did not close the affect gap. This finding aligns with that of Popovic et al. (2019), who also observed no difference in the affect gap as a function of decision perspective. However, the results of the two studies differ in two important respects.

First, in Popovic et al.'s study, both WTPs and affective ratings were lower in the "other" condition than in the "self" condition, whereas we observed the opposite pattern in the current study. A possible explanation for this discrepancy relates to differences in the types of outcomes presented to participants. In Popovic et al.'s study, participants evaluated hypothetical medication side effects (e.g. memory loss, itching), which would affect only the person taking the medication. In contrast, in the current study, participants evaluated pandemic-related experiences (e.g. not being able to gather in groups) that had collective relevance. The collective nature of pandemic-related aversive events may have encouraged empathic concern for the recipient of the choice in the "other" condition, driving up both WTPs and affective ratings.

Second, Popovic et al. found no differences in EV maximising between "self" and "other" conditions, whereas in our study, EV maximising was higher overall in the "other" than in the "self" condition. It is possible that participants in the "other" condition adopted a "benevolent" perspective (Tunney & Ziegler, 2015) in which their choices reflected what they thought the recipient should do, rather than what they themselves would do. Alternatively, participants in the "other" condition may have been motivated by accountability concerns, and leaned more heavily into EV maximisation as a defensible strategy. To distinguish between these hypotheses, it could be useful to manipulate decision perspective within-subjects, possibly in combination with a think-aloud protocol. Regardless of the specific mechanism, the finding of greater EV maximisation in the "other" condition holds practical interest and contributes to a growing body of empirical evidence on the benefits of taking other people's perspective (e.g. Grossmann et al., 2021).

The role of age, numeracy, and other covariates

Older age was associated with lower WTP to avoid pandemic-related outcomes, and with lower affective ratings for monetary losses. The former finding is puzzling at first glance, given that older age is a risk factor for severe illness from COVID-19. However, most of the pandemic-related experiences in the current study were related to economic and social consequences of the pandemic (e.g. "struggling to make ends meet" or "being separated from family and friends"). Older age may be associated with greater resilience against these types of threats thanks to a combination of life-cycle factors (e.g. higher financial security with age; Hays & Sullivan, 2022) and socioemotional factors (e.g. greater emotional stability with age; Carstensen et al., 2020). Age differences in financial security may also lead to different appraisals of the gravity of monetary losses, as reflected in affective ratings. Critically, age did not moderate the affect gap in risky choice, providing further evidence of the robustness of this effect. This finding also indicates that the affect gap may not be sensitive to age-variant factors such as fluid cognitive abilities or world knowledge (Braver & West, 2008).

Most other covariates – including gender, education, income, and health status – also failed to contribute significantly to EV maximising in this study. Interestingly however, numeracy was as a significant predictor in both experiments. This finding dovetails with previous reports of positive associations between numeracy and performance in tasks of reasoning and decision making (for a review, see Peters, 2012; for an example in the context of risky choice, see Pachur & Galesic, 2013; but see Olschewski et al., 2023, for evidence that the association is strongly task-dependent). In the current study, numeracy was positively associated with EV maximising in the monetary domain, but this association was absent (Exp. 1) or weaker (Exp. 2) in the pandemic domain. This dissociation lends further support to previous findings of different cognitive processes contributing to choices in affect-rich and affect-poor contexts (e.g. Pachur et al., 2014). A somewhat paradoxical consequence of the dissociation in the relationship between numeracy and EV maximising for affect-rich and affect-poor contexts was that the affect gap was greater among highly-numerate individuals than among less-numerate individuals. This finding suggests that merely boosting numeracy would not be an effective strategy for reducing the affect gap.

In Experiment 1, regional COVID-19 incidence emerged as a surprising moderator of EV maximising,

for both pandemic-related and monetary choices. To explore whether this association might have been an artifact of high rates of COVID-19 in highly-educated urban centres during the first wave of the pandemic, we probed correlations between COVID-19 incidence, income, and education, but we observed no significant associations. Given that the finding did not replicate in Experiment 2, we refrain from drawing strong conclusions about the regional differences observed in Experiment 1.

Limitations and future directions

One limitation of this research is that participants were recruited from MTurk, and that the findings may not generalise to populations other than those represented on this platform (Dupree & Kraus, 2022). However, it should be noted that the samples were considerably more diverse – with respect to age, education, and geographical location – than those of most previous studies on the affect gap in risky choice (but see Pachur & Galesic, 2013). In future work, it would be important to replicate and extend this research with community samples and in settings where affect-rich choices are particularly consequential (e.g. healthcare, financial planning).

The naturalistic quality of the affect-rich prospects used in the current study gave rise to a number of potential limitations. Unlike previous studies on the affect gap, which presented participants with affect-rich prospects that were truly independent of one another (e.g. side effects associated with different medications), the pandemic experiences used in the current study were correlated in the real world (e.g. not being able to gather in groups tended to co-occur with having to line up outside the grocery store during the early pandemic). Although the behavioural patterns in the current study were similar to those of prior studies (e.g. Pachur et al., 2014), it cannot be ruled out that participants might have considered the joint probability of different prospects instead of considering them in isolation.

Another limitation of this study is that affect-poor and affect-rich prospects differed not only in affective tone but also in social content, existential threat, and information format (i.e. verbal vs. numerical). The latter confound was previously addressed in a study by Suter et al. (2016), which showed that the affect gap persisted even when participants saw their own numerical WTP alongside each verbal affect-rich option during the choice task. Suter et al. (2016) also showed that the affect gap emerged within the affect-rich domain when choices were compared as a function of the *degree* of affect they elicited. These findings strongly suggest that the affect gap in decision quality reflects differences in affect, rather than differences in information format or choice domain. Nevertheless, we cannot rule out that differences in information format contributed to the differences in EV maximising for pandemic-related and monetary choices in the current experiments. In future work, it would be useful to control for potential information format effects using Suter et al.'s (2016) approach. Another strategy for reducing confounds would be to focus exclusively on monetary choices, and to induce transient affect by presenting neutral and emotional stimuli immediately prior to each choice (e.g. Sullivan et al., 2021; Wichary et al., 2016).

An important question for future research is whether the current findings could be used to improve decision making in real-world settings. For example, decision makers could be prompted to "translate" affectively-charged outcomes into monetary losses before making a choice, or to adopt another person's perspective before each decision.

Conclusion

This study demonstrates that the affect gap in risky choice, a phenomenon previously demonstrated primarily in younger adults and in the context of high-stakes medical decisions (e.g. Pachur et al., 2014; Popovic et al., 2019; Suter et al., 2016), generalises to middle-aged and older adults and to relatively mundane negative experiences that characterised daily life during the COVID-19 pandemic. An important insight from this work is that taking other people's perspectives can encourage EV maximising even when decision makers face affect-rich choices. Together, these findings highlight the potential of interventions that reduce affect and promote self-distancing for boosting decision making across the adult lifespan.

Notes

1. It is worth noting that the affect gap has been observed in paradigms in which affect is manipulated on a trial-by-trial basis, leading to immediate transient changes in sympathetic arousal associated with the release of norepinephrine (see also Sullivan et al., 2021; Wichary et al., 2016). This approach is distinct from the one used in research on the effects of stress on decision

making, which typically employs stress induction procedures such as the Trier Social Stress Test (Kirschbaum et al., 1993) or the Cold Pressor Test (Hines & Brown, 1936). These procedures are designed to activate the hypothalamic pituitary adrenal axis, leading to a release of cortisol that peaks approximately 20 min post-stressor. Although meta-analytic evidence suggests that stress inductions have a negative effect on EV maximising (Starcke & Brand, 2016), findings vary across studies (e.g. Sokol-Hessner et al., 2016), likely reflecting the complex interactions between time-dependent effects of stress, as well as their interactions with the demands of specific decision-making tasks.

2. This task assessed participants' risk perception using a medical scenario. See https://osf.io/ufyhq for additional details.
3. This task assessed altruism using a modified dictator game. See https://osf.io/ufyhq for additional details.
4. This prediction was based on a preliminary analysis of Study 1 data at the time of the Study 2 preregistration. In the preliminary analysis, we found that affective context effects were reduced with age. A subsequent reanalysis of Study 1 data, after exclusion of invalid responses, failed to support this initial result, thus removing empirical support for this particular Study 2 hypothesis.

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Disclosure statement

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Appendix

Table A1. Choice problems used in Experiments 1 and 2.

Choice problem	Option A	Option B
1	1% chance of worrying about exposure to the coronavirus	30% chance of worrying about school or work
2	10% chance of struggling to make ends meet	50% chance of being responsible for the health and wellbeing of others
3	20% chance of worrying about family and friends	60% chance of lining up to buy groceries
4	25% chance of feeling uncertain about the future	75% chance of being stuck at home
5	30% chance of being separated from family or friends	80% chance of having trouble sleeping
6	40% chance of having to give up your hobby	90% chance of feeling lonely
7	50% chance of being exposed to media coverage of the pandemic	100% chance of not being able to gather in groups
8	100% chance of worrying about school or work	40% chance of being exposed to media coverage of the pandemic
9	90% chance of being responsible for the health and wellbeing of others	10% chance of having to give up your hobby
10	80% chance of lining up to buy groceries	20% chance of being separated from family or friends
11	75% chance of being stuck at home	25% chance of worrying about family and friends
12	60% chance of feeling lonely	5% chance of feeling uncertain about the future
13	85% chance of having trouble sleeping	15% chance of struggling to make ends meet
14	65% chance of not being able to gather in groups	10% chance of worrying about exposure to the coronavirus

Note: Problems are shown in the pandemic version, which was identical for all participants. The monetary version of each problem involved the same probabilities, but the outcomes were replaced by each participant's subjective monetary equivalents from the monetary evaluation task.