Individual Differences in Fear and Self-Distancing Predict Information Processing via Problem Construal

Lewend Mayiwar[1]*, Thorvald Hærem[1], Adrian Furnham[1]

[1] Department of Leadership and Organizational Behaviour,

BI Norwegian Business School, Oslo, Norway

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Author Note

Lewend Mayiwar https://orcid.org/0000-0003-1404-4779

Thorvald Hærem https://orcid.org/0000-0002-7176-4599

Adrian Furnham https://orcid.org/0000-0001-7545-8532

*Correspondence concerning this article should be addressed to Lewend Mayiwar.
Email: lewend.mayiwar@bi.no / lewend.m@hotmail.com
Phone: +47 922 188 68
Address: Nydalsveien 37, 0484 Oslo, Norway

Abstract

In two preregistered online studies (N_{Total} = 984; Prolific), we examined how individual differences in fear and self-distancing predict information processing in decision-making involving risk in a business scenario. Dispositional fear was positively related to urgent and affective intuitive processing and negatively related to analytical processing. Self-distancing was positively related to analytical processing. These relations occurred indirectly via problem construal. Dispositional fear predicted less concrete problem construal, which in turn predicted more urgent intuitive processing and less analytical processing. In contrast, habitual self-distancing predicted more concrete problem construal, which in turn predicted more analytical processing and less urgent intuitive processing. Overall, these findings suggest that, in contrast to emotionally regulated decision-makers, fearful decision-makers' tendency to construe problems less concretely (i.e., more abstractly) might hinder their ability to concretize and analyze problems involving risk.

Keywords: fear; judgment and decision making; self-distancing; intuition; deliberation; risk

1. Introduction

Emotions are mental tools that have evolved to deal with different problems (Trope et al., 2020). Fear alarms us about potential danger and serves to protect us. However, fear can also trigger abstract ruminative thoughts (Watkins, 2008; Watkins & Roberts, 2020) that are "unlikely to provide a solid basis for the implementation of concrete steps for coping with the problem" (Borkovec et al., 1998, p. 566).

Building on dual-process theories, we examine how decision-makers' problem construal (i.e., the concreteness of mental imagery) drives the relation between dispositional fear and intuitive and analytical processing. We hypothesized that dispositional fear reduces the concreteness of the problem construal (mental imagery), thereby increasing intuitive processing and decreasing analytical processing.

If such changes in information processing are driven by fearful individuals' maladaptive coping with distressing problems, then we should expect the opposite pattern among emotionally regulated individuals. Thus, we hypothesized that habitual self-distancing (a tactic that belongs to the adaptive reappraisal strategy) (Kross & Ayduk, 2017) predicts greater analytical processing through more concrete construal. Overall, the current study provides new insight into the emotional and cognitive antecedents of information processing commonly assumed in dual-process theories.

We begin by integrating neurocognitive research with dual-process models of information processing to discuss how fear and emotion regulation might be related to intuition and analysis. Next, we draw on clinical and psychopathological research to discuss how these associations might be driven by problem construal (i.e., concrete vs. abstract mental imagery).

1.1. Fear

Fear and anxiety are negative high-arousal emotions triggered by the threat of harm. While similar in many ways, these two emotions also have important differences. Fear has been defined as a response to an immediate and clear threat, and anxiety as a response to a distant and ambiguous threat (e.g., LeDoux & Pine, 2016). Fear and anxiety also differ behaviorally and neurologically (for a brief review see Mayiwar & Björklund, 2023).[1]

Neuroscientists suggest that there are two different components of the brain regulating fear and anxiety. It has been argued that the central nucleus of the amygdala is responsible for fear responses to specific stimuli, while the bed nucleus of the stria terminalis mediates longer-lasting anxiety responses that can occur without a specific fear-provoking stimulus (Davis et al., 1997). Moreover, researchers have hypothesized that threat-related information activates a fear-specific system (Öhman & Mineka, 2001). Consistent with this hypothesis, Tipples (2011) found that individual differences in fear, specifically, and not other traits such as trait anxiety, anger, distress, activity, or sociability, demonstrated a unique and strong association with increased overestimation for threatening and fearful expressions.

Thus, we reasoned that dispositionally fearful individuals would be particularly attuned to the negative information in the decision-making problem used in this study (which involved looming threats of job losses). Finally, the close connection between fear and the amygdala is important because the amygdala plays a key role in shaping cognitive processes. Amygdala activation is thought to trigger changes in cognitive processing that correspond to greater

[1] Although the distinction between fear and anxiety is an ongoing debate (e.g., Daniel-Watanabe & Fletcher, 2021; Mobbs et al., 2019).

intuitive processing (particularly urgent, impulsive processing) and lower analytical processing (Arnsten, 2009; Johnson et al., 2020).

Finally, while we focus on fear in the current study, it is worth noting that in the judgment and decision-making literature, studies rarely distinguish between fear and anxiety, but refer to them interchangeably. Wake et al. (2020) noted in their meta-analysis that "Although applied and theoretical models vary in how they treat the constructs of fear and anxiety […] in the risk taking literature these constructs are not clearly distinguished methodologically or empirically." (p. 3). In addition, Wake et al. (2020) found no significant difference in risk-taking between studies using the conceptualization of "fear" and those using the conceptualization of "anxiety".

1.2. Fear, Emotion Regulation, and Information Processing

Dispositionally fearful people show an increased bias towards threat-related information (MacLeod & Mathews, 1988; Mathews & MacLeod, 1994; Mogg et al., 1997), have a low tolerance for uncertainty (Dugas et al., 1998), are more sensitive and aversive to options with negative consequences (Maner & Schmidt, 2006), and make less risky decisions due to their risk aversion (Wake et al., 2020). Fear is also associated with indecisiveness and other decisional difficulties (Lauderdale & Oakes, 2021; Rassin & Muris, 2005).

While fear has been extensively studied in judgment and decision-making, particularly in the domain of risk and uncertainty (Wake et al., 2020), its relation to intuitive and analytical processing has received relatively little empirical attention.

Dual-process theories distinguish between two types of reasoning (Evans & Stanovich, 2013): an intuitive type that is quick, effortless, and based on heuristics, and an analytical type that is slow, effortful, and based on careful analysis. People's general preference for intuitive

processing has been associated with various psychological and behavioral phenomena, such as errors and biases in judgment and decision-making (Bakken et al., forthcoming; Gilovich et al., 2002; Kahneman, 2003; Mahoney et al., 2011; Shiloh et al., 2002), conspiracy beliefs (Barron et al., 2018), susceptibility to misinformation (Lazarević et al., 2021), prosociality and morality (Liang et al., 2021), stereotyping (Trent & King, 2013), ingroup bias (Kołeczek et al., 2022), and even criminal behavior (McClanahan et al., 2019). Intuition has also been hailed as an adaptive tool in settings that involve limited time and information (Bakken et al., forthcoming; Gigerenzer, 2000; Klein, 2015; Klein & Crandall, 1995).

Researchers recognize emotion as an integral element in the intuition-analysis duality (e.g., Dane & Pratt, 2007; George & Dane, 2016; Hodgkinson et al., 2008; Hodgkinson & Sadler-Smith, 2018; Lerner et al., 2015; Simon, 1987; Sinclair et al., 2010; Tiedens & Linton, 2001). According to neurocognitive research, in threatening situations, the brain shifts into a state that facilitates the development of rapid defense mechanisms (Hermans et al., 2011). Fear can alter chemical changes in the brain, causing an increase in stress hormones (Rodrigues et al., 2009). These stress hormones disrupt the prefrontal cortex, a region of the brain that regulates controlled and deliberate processing (Arnsten, 2009; Johnson et al., 2020).

Moreover, the amygdala is hyperactive in dispositionally fearful individuals (Davis, 1992) and plays a key role in generating loss aversion (De Martino et al., 2006, 2010)—a bias related to intuitive processing. Overall, these neurological changes effectively correspond to lower analytical processing and greater intuitive processing (Hodgkinson & Sadler-Smith, 2018; Lieberman, 2007).

While empirical evidence on the relation between fear and information processing is sparse, a small number of empirical studies suggest a negative relation between fear and

analytical processing. Dispositionally fearful people make conclusions based on few observations (Bensi & Giusberti, 2007), are less likely to seek out information (Soane et al., 2015), and exhibit poor performance on tasks that require analytical processing (Shields et al., 2016; Zhang et al., 2020). Moreover, both intuitive processing and dispositional fear predict lower working memory capacity (Fletcher et al., 2011; MacLeod & Donnellan, 1993).

Meanwhile, a growing line of research shows that adaptive emotion-regulation strategies like reappraisal (both trait-level and situational) predict the opposite neural changes. Reappraisal is a commonly used strategy of emotion regulation that involves changing one's interpretation of a situation or stimulus to reduce its emotional impact. It has been associated with reduced activation in the amygdala and increased activation in the prefrontal cortex (Drabant et al., 2009; Goldin et al., 2008). Reappraisal has also been associated with a reduction in subjective and physiological experiences from gains and losses in risky decision-making (Heilman et al., 2010; Miu & Crişan, 2011; Sokol-Hessner et al., 2009, 2013; Yang et al., 2013).

Here, we focus on a particular tactic of reappraisal known as self-distancing (Kross & Ayduk, 2017). This tactic has received growing interest due to its notable effectiveness in downregulating negative emotions (Powers & LaBar, 2019). Some studies have also shown that it plays an important role in decision-making (Gainsburg et al., 2022; Kross et al., 2017; Mayiwar & Björklund, 2021).

1.3. Problem Construal

The literature points to problem construal as a likely mechanism underlying the relation between dispositional fear and information processing, as well as habitual self-distancing and information processing. By problem construal, we refer to the degree to which a decision-maker mentally represents a problem in terms of its concrete aspects. Problem construal, or mental

imagery, plays an important role in decisions under risk (Leiserowitz, 2005; MacGregor et al., 2000; Shiv & Huber, 2000; Slovic et al., 1998; Traczyk et al., 2015; Västfjäll & Slovic, 2013; Zaleskiewicz et al., 2023).

1.3.1. Fear and Problem Construal

Decision-making scholars have linked emotions like fear with more concrete construal. For instance, the influential risk-as-feelings hypothesis (Loewenstein et al., 2001) posits that fear increases risk perception through an increase in vividness.

However, an extensive body of literature outside the field of judgment and decision-making has demonstrated that fearful individuals engage in more abstract construal (Moran & Eyal, 2022), particularly in the form of repetitive thinking or rumination (Watkins, 2008; Watkins & Roberts, 2020). Abstract ruminative processing has also been associated with indecisiveness and impaired problem-solving (Di Schiena et al., 2013; Watkins, 2008). As suggested by Watkins (2008), rumination, which is characterized by abstract processing, reduces sensitivity and responsiveness to contextual cues, such as potential rewards and risks, due to their tendency towards abstract and internal preoccupation. Moreover, studies have shown that concrete imagery-based interventions can reduce emotional distress (Schaich et al., 2013; Skodzik et al., 2017).

1.3.2. Problem Construal and Information Processing

It is unclear how differences in problem construal relate to information processing. Raue et al. (2015) found that classic framing effects in risky choice problems only emerged among decision-makers who adopted a concrete (psychologically proximal) construal of problems. Raue and colleagues reasoned that a concrete construal might trigger intuitive processing, and thereby render decision-makers more susceptible to framing biases. This reasoning is consistent with

Mukherjee's (2010) dual system model of decision-making under risk, "the way [a problem] is construed influences the relative involvement of one system or the other [...] decision problems that are contextualized [...] are likely to have higher affective involvement." (p. 246).

Indeed, dual process theorists have conceptualized intuition as a mode of processing characterized by a concrete, vivid, and contextualized representation (e.g., Epstein, 2003; Loewenstein, 1996) and analysis as a mode of processing characterized by an abstract and decontextualized representation (e.g., Stanovich & West, 2000).

In contrast, others view concrete construal as an adaptive and necessary component of analytical processing. Neck and Manz (1992) proposed concrete mental imagery as a key factor that facilitates task performance. Furthermore, mental simulation—a specific aspect of concrete and vivid mental imagery—is a key stage in the recognition-primed decision model (Klein, 2015; Klein & Crandall, 1995). Klein emphasized the importance of mental simulation in naturalistic decision-making, suggesting that people use mental simulation to diagnose a situation and to generate and evaluate courses of action.

This notion overlaps with Kahneman and Tversky's (1981) simulation heuristic, which refers to how decision-makers generate mental models before deciding how to act. According to Kahneman and Tversky (1981), the mental simulation heuristic provides several key functions: generating predictions, assessing event probabilities, generating conditional probabilities, assessing causality, and generating counterfactual assessments. Finally, Taylor et al. (1998) argued that concrete mental simulation provides valuable information, noting that experts use it as a resource to solve complex problems.

2. Transparency Statement

The studies reported here were approved by the Norwegian Center for Research Data (reference: 510951) and received ethical approval from the BI Ethical Review Board at BI Norwegian Business School (reference: 002a) before data collection. We report how we determined the sample size, all data exclusions, all manipulations, all measures in this study, and all deviations from the preregistrations (Simmons et al., 2012). Participants in each study provided their consent to participate. We performed all analyses in RStudio1.4.1106 (RStudio Team, 2022). Although we preregistered one-tailed *p*-values for our directional hypotheses, we used two-tailed tests throughout.

We preregistered our studies on the Open Science Framework before data collection. Preregistrations (and deviations from preregistrations), data, R code, codebooks, and materials are available at https://osf.io/52jwz.

3. Overview

In Study 1, we predicted that dispositional fear would be positively associated with a concrete problem construal. We had no prediction about emotion regulation but included it as a control variable. However, after completing data collection for the first study, we discovered that, contrary to our initial hypotheses, dispositional fear was associated with a less concrete problem construal and concrete problem construal was negatively related with intuitive processing and positively related with analytical processing. Moreover, in Study 1, we found that emotion regulation via self-distancing demonstrated the opposite pattern of associations. Thus, in Study 2, we revised our hypotheses concerning the relationship between dispositional fear and problem construal and the relationship between problem construal and information processing and added hypotheses for self-distancing.

a) dispositional fear was associated with an abstract problem construal and b) emotion regulation via self-distancing with a concrete problem construal and analytical processing. Thus, in Study 2, we revised our hypothesis concerning dispositional fear and added hypotheses for self-distancing. We hypothesized that dispositional fear would be associated with more intuitive processing through less concrete construal (i.e., more abstract construal), whereas habitual self-distancing would be associated with greater analytical processing through more concrete construal.

4. Study 1

We preregistered the study before data collection (https://osf.io/c2mk4).

4.1. Method

4.1.1. Participants

We estimated our sample size based on a Monte Carlo power analysis for the hypothesized indirect associations (Schoemann et al., 2017). The power analysis (mediators = 2, *rs* = .2, 1 - β = .80, α = .05) indicated that we needed approximately 400 participants. To further increase power and account for possible data exclusions, we recruited a total of 500 participants from Prolific (247 males, 249 females, five other/prefer not to answer; M_{age}= 40.36, SD_{age}= 14.31).

Participants were able to take part in the study if they were native/fluent English speakers, resided in the UK, were above 18 years old, had an approval rate of at least 98%, and had completed at least 50 submissions. Participants were paid £1.63 for the roughly 13-minute-long study. We did not ask participants about their racial/cultural identification to comply with local guidelines.

For our final analyses, we excluded participants if they 1) reported low English proficiency, 2) reported not being serious about filling in the survey, 3) completed the survey in under two minutes, 4) failed a bot check, and 5) failed a comprehension check. All exclusion criteria were preregistered. This resulted in a final sample of 483 participants.

4.1.2. Measures

After consenting to participate in the study, participants first completed measures of dispositional fear and habitual self-distancing. Next, they completed a risky choice problem. Following the decision problem, they completed an in-situ information processing scale and indicated their level of arousal and valence that they experienced during their decision-making. Finally, they provided demographic information.

4.1.2.1. Dispositional Fear.[2] Dispositional fear was measured using the 12-item version of the Fear Survey Schedule-II (FSS-II; Bernstein & Allen, 1969; Geer, 1965). The scale measures specific fears, such as fear of negative evaluation and fear of animals, and correlates with generalized anxiety (Goetsch et al., 1987). Example items include "I fear being criticized," "I feel uneasy around people in authority," and "I'm afraid of snakes." Responses were measured on a 7-point Likert scale (1 = *no fear*, 7 = *terror*).

[2] We also measured trait anger ($\alpha = .85$) using a scale developed by Lerner and Keltner (2001), predicting that fear would be more strongly related to intuitive processing than anger. Anger was not significantly related to any of the dependent variables. The scale has been used in previous studies examining risky judgment and decision making.

The scale has been used in previous studies in the decision-making literature (Lerner & Keltner, 2001; Mayiwar & Björklund, 2021; van Dijke et al., 2018). Following these studies, we treated it as a unidimensional scale. The scale demonstrated strong reliability (α = .85).

4.1.2.2. Habitual Self-Distancing. We used the Temporal Distancing Questionnaire (Bruehlman-Senecal et al., 2016) to measure participants' general tendency to regulate negative emotions like fear via self-distancing. Responses were measured on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). Example items include "I focus on how my feelings about the event may change with time," and "I think about how small the event is in the bigger picture of my life." The scale demonstrated strong reliability (α = .86).

4.1.2.3. Information Processing. We measured participants' use of intuitive and analytical processing during the risky choice problem using a validated self-report scale developed by Bakken et al. (in preparation). The scale can be accessed on the OSF page.

Participants were asked to indicate the extent to which various statements corresponded to how they made their decision (1 = *strongly disagree*, 5 = *strongly agree*). The scale has been used in previous research (Mayiwar & Hærem, 2023). The scale consists of four dimensions.[3] The Rational and Control dimensions measure analytical processing, whereas the Urgency and Affective dimensions measure intuitive processing.

Example items include: "I based the decision on my inner feelings and reactions." (Affective), "It was more important to make a quick decision than to think about all possible

[3] An earlier version of the cognitive processing questionnaire also included a fifth dimension, Knowing, that was conceptually related to both intuitive and analytic processing. We did not include this dimension as we considered it irrelevant for this study (see Bakken & Hærem, 2020).

consequences." (Urgency), "I analyzed all available information in detail." (Rational), "Even if a decision seemed obvious, I took time to think through if I might have overlooked something." (Control).

According to Bakken et al. (in preparation), response time should correlate positively with the analytical scale and negatively with the intuitive scale. Descriptive statistics of the four subscales are shown in Table 1. Response time during the risky choice problem was negatively correlated with the urgency sub-dimension of intuitive processing, and positively with both sub-dimensions of analytical processing. These results are consistent with our preregistered predictions and serve as a validation of the scale. Reliabilities were good overall, except for the affective subscale. We nevertheless proceeded with using the affective scale due to its theoretical importance and our aim to include a comprehensive assessment of intuition.

Table 1

Means, standard deviations, correlations, and scale reliabilities (in bold) among the cognitive processing questionnaire subscales and response time

Variable	*M*	*SD*	1	2	3	4
1. Affective	3.60	0.73	**.57**			
2. Urgency	2.42	0.88	.28**	**.83**		
3. Rational	4.13	0.57	-.12**	-.47**	**.81**	
4. Control	3.81	0.60	-.02	-.39**	.63**	**.76**
5. Response time	43.10	27.71	-.08	-.11*	.11*	.14**

4.1.2.4. Problem Construal. Participants rated the extent to which the scenario in the risky choice problem brought to mind concrete and vivid mental images. This was measured

using a single item: “When you were deciding between the two plans earlier, how concrete and vivid was the situation in your mind?” (1 = *not at all*, 10 = *to a high degree*). We followed previous studies that have used similar single-item measures (Maimaran, 2011; Mayiwar & Björklund, 2023; Traczyk et al., 2015).

4.1.2.5. Arousal and Valence. People might differ in the positivity and negativity of their mental representations of risky scenarios (Zaleskiewicz et al., 2020). We, therefore, controlled for emotional valence, as per our preregistration. We used a slider developed by Betella and Verschure (2016) that included one item measuring valence and one item measuring arousal.

Participants were asked: “Please position the slider in a way that indicates how much pleasure you felt when choosing between the two plans.” One end of the slider was anchored with a sad emoticon (−5) and the other with a happy emoticon (+5). The initial position of each slider was set to zero. We also included an item measuring arousal, participants were asked: “Please position the slider in a way that indicates how aroused you were when choosing between the two plans.” One end of the slider was anchored with a sleepy emoticon (−5) and the other with a wide-awake emoticon (+5).

4.1.2.6. Age and Gender. As per our preregistration, we included age and gender as control variables as both have been associated with preferences for intuitive and analytical processing (e.g., Sladek et al., 2010).

4.1.2.7. Risky Choice Problem

We used a version of the Plant Problem developed by Bazerman (1984), which is modeled on the classic Disease Problem (Kahneman & Tversky, 1979). We selected this particular version of the problem based on its relevance during the data collection period. At that

time, media coverage extensively discussed job layoffs resulting from the pandemic. We believed this topic would have a broader resonance among Prolific users compared to a scenario involving a disease, for instance, which tends to elicit varying viewpoints:

> Imagine that you work for a large car manufacturer in the UK that has recently been hit with a number of economic difficulties, and it appears as if 6000 employees must be laid off immediately. The vice president of production has been exploring alternative ways to avoid this crisis and has developed two plans. As the company's labor relations manager, you must choose a plan today. Choose one of the plans below and proceed to the next page.
>
> Plan A: This plan will save 1 of the 3 plants and 2000 jobs.
>
> Plan B: This plan has a 1/3 probability of saving all 3 plants and all 6000 jobs, but has a 2/3 probability of saving no plants and no jobs.

4.2. Results: Study 1

4.2.1. Correlations

Correlations are shown in Table 2.

Table 2

Means, standard deviations, and correlations (Study 1)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. DF	3.34	0.97												
2. HD	4.28	1.00	-.25**											
3. Affect	3.60	0.73	.18**	-.02										
4. Urgency	2.42	0.88	.15**	-.08	.28**									
5. Rational	4.13	0.57	-.13**	.17**	-.12**	-.47**								
6. Control	3.81	0.60	-.08	.20**	-.02	-.39**	.63**							
7. Concrete	7.35	1.59	-.13**	.19**	.03	-.19**	.43**	.36**						
8. Arousal	0.44	2.52	.13**	.03	.06	-.06	.05	.08	.08					
9. Valence	-2.05	2.13	.01	.04	.03	.04	-.05	-.12**	-.07	-.23**				
10. Choice	0.21	0.41	-.03	.03	.21**	.15**	-.12*	-.04	-.01	.05	.06			
11. RT	43.10	27.71	-.07	-.03	-.08	-.11*	.11*	.14**	.03	-.04	-.06	.00		
12. Gender	1.50	0.50	.32**	-.10*	.16**	.10*	-.13**	-.05	-.12**	.14**	-.08	-.02	.03	
13. Age	40.74	14.28	-.36**	.07	.02	.01	.09	.13**	.16**	.00	-.04	.06	.14**	-.17**

Note. DF = dispositional fear, HD = habitual self-distancing, Affect = affective dimension of intuitive processing, Urgency = urgency dimension of intuitive processing, Rational = rational dimension of analytical processing, Control = control dimension of analytical processing, Choice (0 = safe option, 1 = risky option), RT = response time, Gender (0 = male, 1 = female). * $p < .05$. ** $p < .01$.

Consistent with our hypothesis, dispositional fear was positively correlated with affective processing and urgent intuition, and negatively correlated with rational processing. Habitual self-distancing was positively correlated with rational and controlled processing. Concrete construal was negatively correlated with dispositional fear and positively correlated with habitual self-distancing. Moreover, concrete construal was negatively correlated with urgent processing and positively correlated with rational and controlled processing. Arousal correlated positively with

dispositional fear, but not information processing. Thus, we decided to drop arousal from the mediation analysis. Finally, we explored correlations with risk-taking to assess potential implications for risky judgment and decision-making research. Risk-taking correlated positively with affective and urgent processing, and negatively with rational processing.

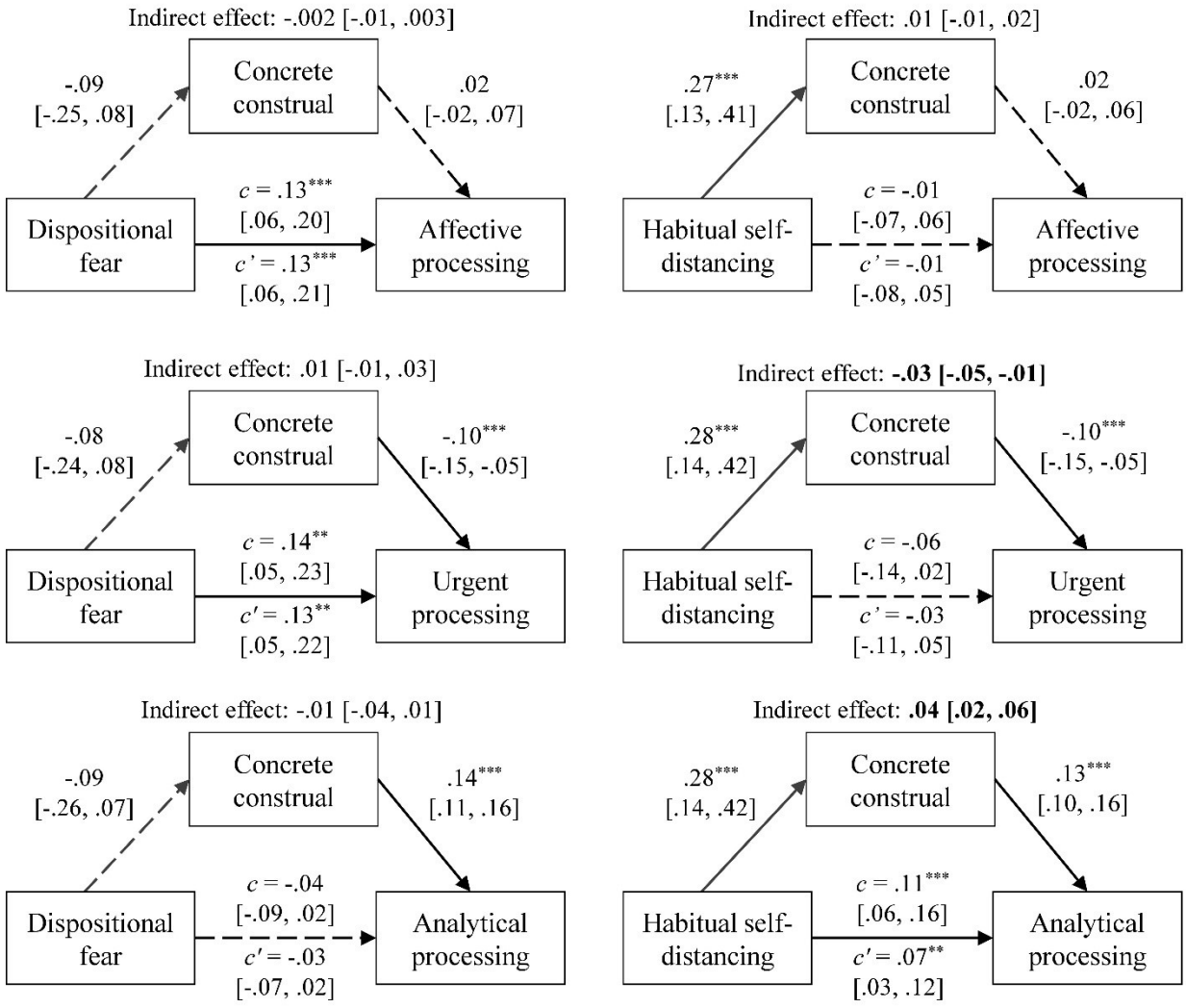
4.2.2. Mediation Analysis

In our preregistration, we specified running linear regression models before the mediation analyses to test the main associations. For simplicity, we only present the mediation models (which show both main and indirect associations). One major change from our preregistration concerns the measure of intuitive processing. Because problem construal was related to the two sub-dimensions of intuitive processing (affective and urgency) in opposite directions, we decided to examine the two sub-dimensions separately. Using the averaging of the two sub-dimensions would have led to inaccurate conclusions (Peter, 1981). Furthermore, although we specified habitual self-distancing as a control variable, we explored the same mediation models with habitual self-distancing as the independent variable.

We ran two sets of mediation models using the PROCESS macro for R (Hayes, 2017). The first set of models included dispositional fear as the independent variable, while the second set included habitual self-distancing as the independent variable. Each set consisted of three models that differed with respect to the three dependent processing variables. All mediation models included age, gender, and valence as control variables. Five thousand bootstrap samples were used to estimate the indirect associations. An indirect association is significant if the 95% confidence interval does not include zero. The mediation models are shown in Figure 1.

Figure 1

Indirect models (Study 1)



Note. Coefficients are unstandardized [95% confidence interval]. Solid lines indicate significant paths. Dashed lines indicate insignificant paths. Significant indirect effects are indicated in bold.

Problem construal did not mediate the relation between dispositional fear and information processing, but it mediated the relation between habitual self-distancing and information processing. Habitual self-distancing was negatively related to urgent processing and positively related to analytical processing via concrete problem construal.

4.2.3. Exploratory Analysis: Consequences for Risk-Taking

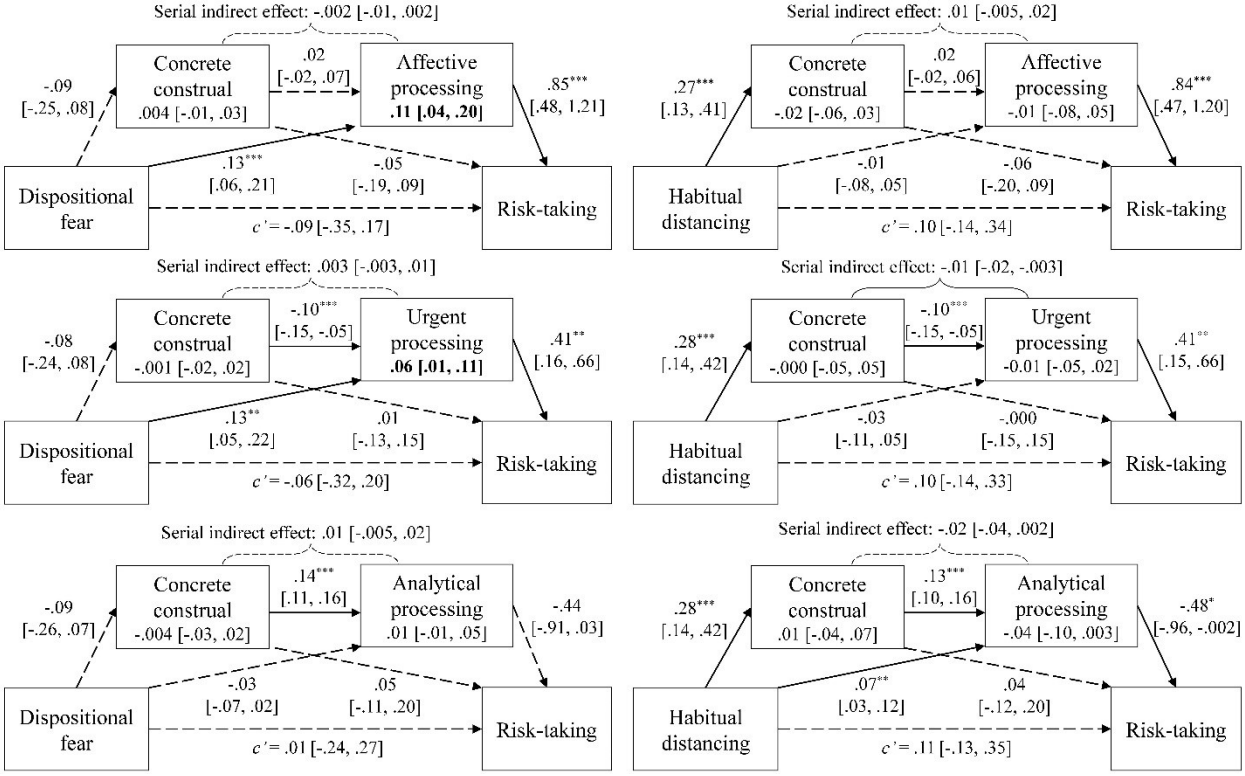
Finally, we explored whether the indirect associations predicted risk-taking by running serial mediation models. The mediation models and results are shown in Figure 2.

There was no significant serial mediation by construal and information in the relation between dispositional fear and risk-taking. Nevertheless, the relation between dispositional fear and risk-taking was mediated by affective processing and urgent processing.

Habitual self-distancing was serially associated with risk-taking through construal and urgent processing. Specifically, distancers construed the task more concretely and vividly, which in turn predicted lower urgent processing, which finally predicted lower risk-taking.

Figure 2

Serial indirect models (Study 1)



Note. Coefficients are unstandardized [95% confidence interval]. Solid lines indicate significant paths. Dashed lines indicate insignificant paths. Significant simple indirect effects are indicated in bold.

4.3. Discussion: Study 1

Study 1 found support for our main preregistered hypothesis that dispositional fear is positively associated with intuitive processing. Exploratory analysis indicated habitual self-distancing, on the other hand, was positively associated with analytical processing. Contrary to our preregistered hypotheses, dispositional fear predicted less concrete problem construal and problem construal was negatively associated with urgent processing and positively associated with analytical processing. Exploratory analysis indicated that habitual self-distancing predicted more concrete problem construal.

While problem construal did not mediate the relation between dispositional fear and information processing, it did mediate the relation between habitual self-distancing and information processing. Exploratory analyses demonstrated the downstream consequences of these indirect associations for risk-taking.

One limitation of this study is the double-barreled item that measured problem construal. Although we followed previous studies that have used similar double-barreled items (e.g., Traczyk et al., 2015), such items generally produce unreliable and inaccurate estimates (Hinkin, 1998; Saris & Gallhofer, 2007) and may partly explain why some of the relations were not significant. We aimed to address this limitation in Study 2.

5. Study 2

We conducted Study 2 for several reasons. First, we aimed to replicate the unexpected and exploratory findings in Study 1. As specified in the Study 2 preregistration, we initially planned to make two key revisions to our hypotheses. For this study, we proposed a negative relation between dispositional fear and concrete problem construal (as opposed to a positive relation as specified in the Study 1 preregistration) and a positive relation between habitual self-distancing and concrete problem construal (in Study 2, we preregistered self-distancing as an independent variable instead of a control variable).

Second, we proposed that a concrete problem construal would be negatively related to intuition and positively related to analytical processing. However, as in Study 1, we deviated from the preregistered plan and examined the two sub-dimensions of intuitive processing separately as we later discovered that affective intuition and urgent intuition were related to construal in opposite directions. Moreover, we split the double-barreled construal item into two: one item measuring concreteness and the other measuring vividness. Finally, to gain qualitative

insight into how fearful and self-regulated participants reasoned through the decision problem we asked them to reflect on their decision-making.

We preregistered the study before data collection (https://osf.io/zmt4g).

5.1. Method

5.1.1. Participants

We aimed for the same sample size as in Study 1. Our final sample size consisted of 501 participants (249 males, 249 females, three other/prefer not to answer; M_{age}= 40.95, SD_{age}= 12.85) from Prolific. Participants were paid £1.50 for the roughly 12-minute-long study. We used the same Prolific prescreens and power analysis as in Study 1. In the Study 2 preregistration, to increase power, we specified using the entire sample size.

5.1.2. Procedure and Measures

We used the same procedure, measures, and control variables as in Study 1, but made two minor changes. First, we split the double-barreled construal item in Study 1 into two: "How vivid was the scenario in your mind when you were deciding between the two plans?" (1 = *not vivid at all*, 9 = *very vivid*) and "How concrete was the scenario in your mind when you were deciding between the two plans?" (1 = *not concrete at all*, 9 = *very concrete*). The reliability of the construal scale was strong (α = .82). Reliabilities for the remaining scales were very similar to Study 1 (dispositional fear: α = .84, habitual self-distancing: α = .85, affective processing: α = .60, urgent processing: α = .84, analytical processing: α = .85).

Second, once participants had completed the decision-making problem, they briefly reflected on their choice ("We would like to know more about your own reflections on the task involving employee lay-offs. What were your thoughts and feelings during the task? How did

you approach your decision?"). We included this question to collect qualitative insight into their own experiences of solving the problem.

Those who scored high on dispositional fear tended to focus more on how the problem made them feel ("I felt like I was playing with people's lives", "I felt very guilty making either decision", "I felt uneasy making a decision that could potentially lose people their jobs.", "I felt uncomfortable at the prospect that people might lose their jobs as a result of a decision that I was making").

In contrast, those who scored high on habitual self-distancing tended to be more calculative and focused on objective statistical information ("I worked out the average outcome of the 2nd choice, found it was the same as the outcome of the first choice and realised the choices had the same odds so really it came down to whether I should guarantee saving some jobs, or take the fairly low chance of saving them all.", "I considered the odds that they plan to save all jobs would work and tried to balance this against the known outcome of the first plan. Ultimately it seemed a reasonable risk to take to try and save all jobs").

5.2. Results: Study 2

5.2.1. Correlations

Correlations are shown in Table 3.

Table 3

Means, standard deviations, and correlations (Study 2)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. DF	3.29	0.95												
2. HD	4.22	1.00	-.31**											
3. Affect	3.58	0.73	.14**	-.06										
4. Urgency	2.35	0.87	.09*	.01	.27**									
5. Rational	4.11	0.58	-.16**	.07	-.00	-.44**								
6. Control	3.74	0.59	-.13**	.08	-.06	-.40**	.65**							
7. Concrete	6.62	1.49	-.17**	.13**	.12**	-.24**	.44**	.31**						
8. Arousal	0.08	2.52	.09*	.03	.04	.02	.02	.09*	.11*					
9. Valence	-2.19	1.98	-.06	.04	.01	.09*	-.11*	-.13**	-.05	-.18**				
10. Choice	0.18	0.38	-.05	-.00	.11*	.11*	-.12**	-.06	-.02	-.00	.10*			
11. RT	44.73	37.12	-.11*	.07	.02	-.01	.00	.05	-.04	-.01	-.03	.08		
12. Gender	1.50	0.50	.36**	-.06	.13**	.10*	-.11*	-.11*	-.01	.08	-.16**	-.06	-.13**	
13. Age	40.95	12.85	-.25**	.02	.03	.03	.15**	.09*	.20**	.05	-.10*	.01	.07	-.11*

Note. DF= dispositional fear, HD = habitual self-distancing, Affect = affective dimension of intuitive processing, Urgency = urgency dimension of intuitive processing, Rational = rational dimension of analytical processing, Control = control dimension of analytical processing, Choice (0 = safe option, 1 = risky option), RT = response time, Gender (0 = male, 1 = female). * $p < .05$. ** $p < .01$.

Consistent with our preregistered hypotheses, dispositional fear was positively correlated with both modes of intuitive processing and negatively with both modes of analytical processing. Additionally, dispositional fear was negatively correlated with response time, suggesting that indicating that those scoring higher on fear arrived at their decision more quickly in the risky choice problem. Habitual self-distancing did not correlate significantly with any of the information-processing variables.

Concrete problem construal was negatively correlated with dispositional fear and positively with habitual self-distancing. In addition, while concrete problem construal correlated positively with both modes of analytical processing, for the two modes of intuitive processing, the correlations went in opposite directions (negatively with urgent processing but positively with affective processing).

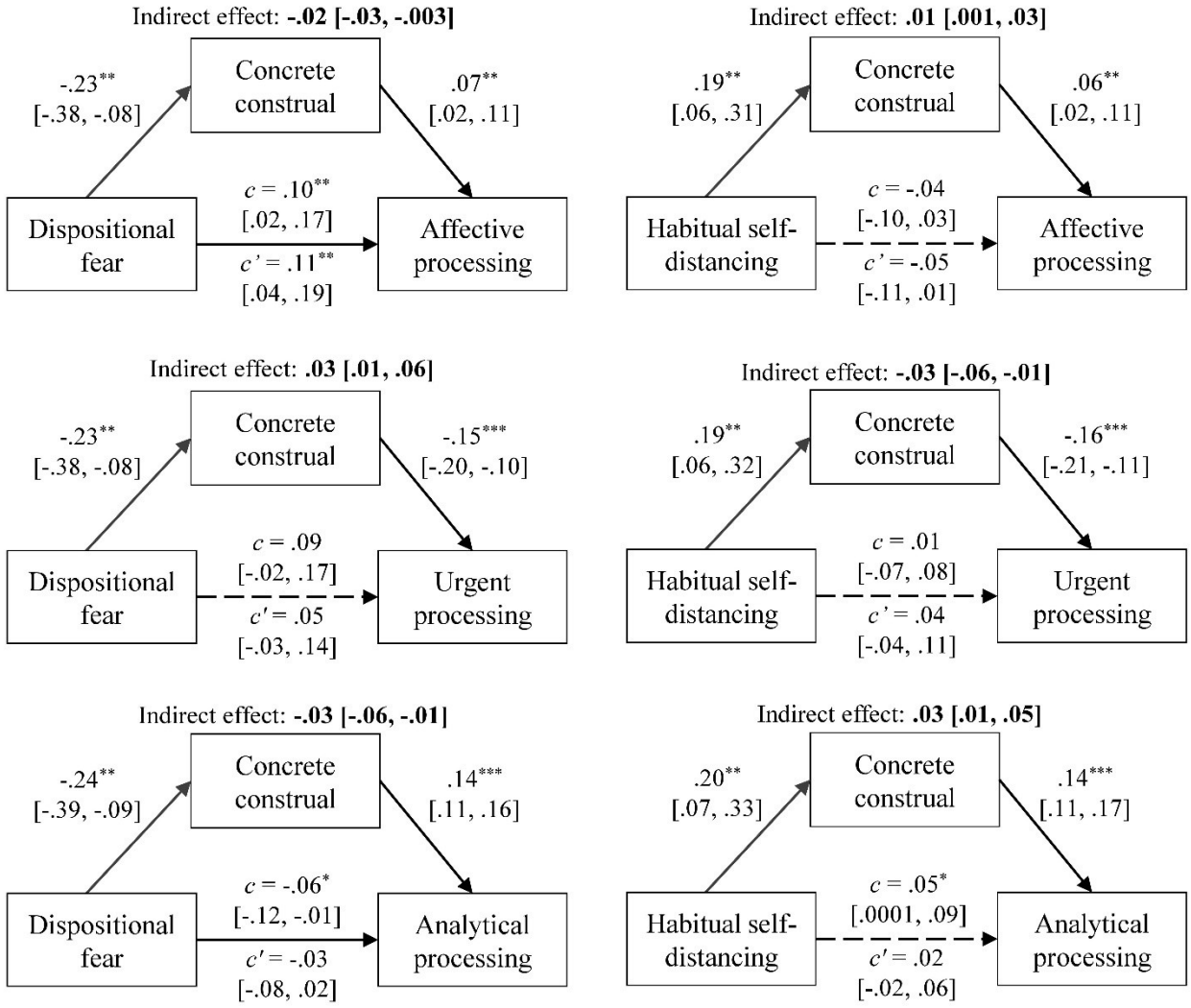
Finally, following Study 1, we explored correlations with risk-taking. Risk-taking was positively correlated with both modes of intuitive processing and negatively correlated with the rational mode of analytical processing.

5.2.2. Mediation Analysis

We followed the same analytical procedure as in Study 1. The mediation models are summarized in Figure 3, from which we see that dispositional fear was indirectly related to less affective, more urgent, and less analytical processing via a less concrete problem construal. Using habitual self-distancing as the independent variable in the second set of mediation models, we found the opposite pattern: Habitual self-distancing was indirectly related to more affective, less urgent, and more analytical processing via a more concrete problem construal.

Figure 3

Indirect models (Study 2)



Note. Coefficients are unstandardized [95% confidence interval]. Solid lines indicate significant paths. Dashed lines indicate insignificant paths. Significant indirect effects are indicated in bold.

5.2.3. Exploratory Analysis: Consequences for Risk-Taking

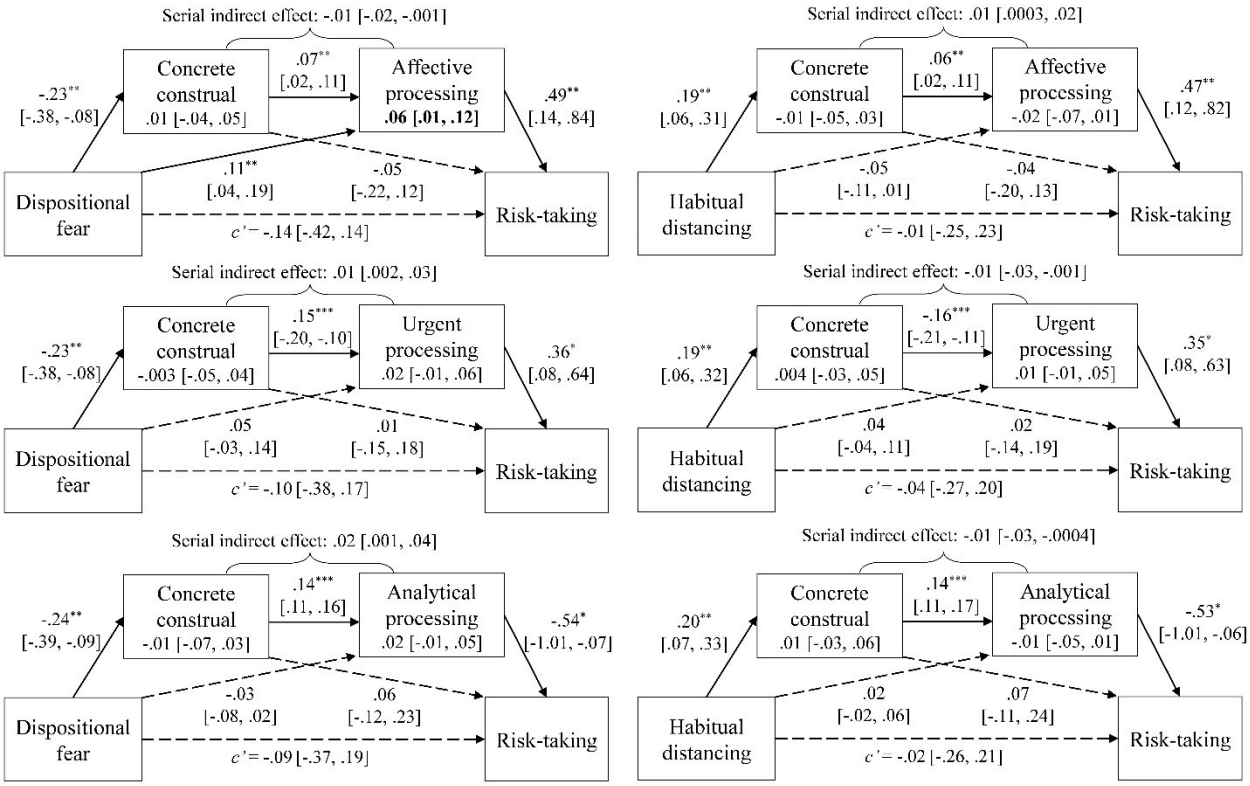
Next, running the same exploratory analyses in Study 1, we extended the mediation models by adding risk-taking as the dependent variable. The results replicated Study 1, with additional significant indirect paths. Figure 4 shows the serial indirect models. Dispositional fear was serially associated with risk-taking through 1) less concrete construal and more affective

processing, 2) less concrete construal and more urgent processing, and 3) less concrete construal and less analytical processing. There was also a significant indirect relation between dispositional fear and risk-taking via affective processing alone, consistent with Study 1.

The opposite pattern of results was observed in the second set of models that included habitual self-distancing as the independent variable. Habitual self-distancing was serially associated with risk-taking through 1) more concrete construal and less affective processing, 2) more concrete construal and less urgent processing, and 3) more concrete construal and greater analytical processing.

Figure 4

Serial indirect models (Study 2)



Note. Coefficients are unstandardized [95% confidence interval]. Solid lines indicate significant paths. Dashed lines indicate insignificant paths. Significant simple indirect effects are indicated in bold.

6. Meta-Analytic Correlations

While the results for fear were rather consistent across the two studies, the results for self-distancing were less consistent. Thus, we examined meta-analytic correlations using the *metacor* R package (Laliberté, 2019). The results are summarized in Table 4. As expected, dispositional fear was positively correlated with affective and urgent processing, negatively correlated with rational and controlled processing, and negatively correlated with concrete problem construal. Habitual self-distancing correlated positively with the two types of analytical processing, negatively but not significantly with intuitive processing, and positively with concrete construal.

Table 4

Meta-analytic correlations

Variables	Meta-analytic correlation
Dispositional fear, affective processing	0.16 (95% CI = 0.10 – 0.22, $p < .001$)
Dispositional fear, urgent processing	0.12 (95% CI = 0.06 – 0.18, $p < .001$)
Dispositional fear, rational processing	-0.15 (95% CI = -0.20 – -0.08, $p < .001$)
Dispositional fear, controlled processing	-0.10 (95% CI = -0.04 – -0.17, $p < .001$)
Dispositional fear, concrete construal	-0.15 (95% CI = -0.21 – -0.09, $p < .001$)
Habitual self-distancing, concrete construal	0.16 (95% CI = 0.09 – 0.22, $p < .001$)
Habitual self-distancing, affective processing	-0.04 (95% CI = -0.11 – 0.10, $p = .089$)
Habitual self-distancing, urgent processing	-0.03 (95% CI = -0.12 – 0.05, $p = .21$)
Habitual self-distancing, rational processing	0.12 (95% CI = 0.02 – 0.22, $p = .011$)
Habitual self-distancing, controlled processing	0.14 (95% CI = 0.02 – 0.26, $p = .009$)

7. General Discussion

Individual differences in intuition and analysis have been used to predict many psychological phenomena. In this study, we aimed to uncover the affective antecedents of in-situ information processing during risky decision-making. Consistent with neurocognitive models,

(e.g., Arnsten, 2009; Johnson et al., 2020), dispositional fear was positively associated with intuitive processing and negatively associated with analytical processing. In contrast, habitual self-distancing was positively associated with analytical processing. Moreover, these associations occurred indirectly via problem construal.

Dispositional fear predicted less concrete problem construal (i.e., more abstract construal), which in turn predicted more urgent intuitive processing. This might be driven by a fearful individuals' general tendency to abstract away from concrete aversive information; a general dispositional approach that they bring to the decision problem. Moreover, this thinking pattern may be what prevents effective problem construal, cognitive appraisal, and problem-solving/coping (see Watkins & Roberts, 2020). As noted by Ecker and Gilead (2018), "mental simulation is a deliberate and mental process, [and] individuals are not obliged to engage in it, and indeed, they often choose not to" (p. 626).

In contrast, individuals who reported higher levels of habitual self-distancing (a tactic of reappraisal used to downregulate negative emotions like fear) processed information more analytically through more concrete problem construal. These individuals may be more willing to deconstruct and analyze unpleasant risky problems. These findings build on a growing line of research on self-distancing (Kross & Ayduk, 2017) by showing the implications for decision-making.

It is worth noting that in Study 2, dispositional fear was indirectly related to less affective information processing via less concrete problem construal, whereas habitual self-distancing was indirectly related to more affective information processing via more concrete problem construal. These results suggest that dispositional fear can reduce not only analytical processing but also

the capacity to trust one's gut feelings, whereas habitual self-distancing may facilitate greater flexibility in cognitive processing.

Finally, exploratory analyses demonstrated downstream consequences for risk-taking. The indirect relations between dispositional fear and information processing, and habitual self-distancing and information processing, predicted risk-taking in the decision-making problem. All serial indirect associations were significant in Study 2 but only one was significant in Study 1.

The results reported here should be interpreted with caution, however, as the direct and indirect associations were weak, and the confidence intervals of the indirect effects barely excluded zero. The scenario that we used might not have been sufficiently effective in eliciting a sense of riskiness. Since participants in the current studies (Prolific users) are likely accustomed to solving similar problems, it is possible that they did not perceive the presented problem as novel. Consequently, the emotional arousal elicited by the scenario may have been limited. Although dispositional fear correlated positively with arousal in both studies, the correlations were small.

One suggestion for future research is to use problems that might be more effective in eliciting a sense of riskiness. Another direction is to use dispositional scales of fear and emotion regulation that match the domain of the decision-making problem.

Apart from the associations being weak, some of them were not significant. Nevertheless, unlike traditional approaches to mediation, modern approaches do not require the presence of a significant direct association (Hayes, 2009; Hayes & Rockwood, 2017). Thus, our findings suggest that even in the absence of a significant direct path from dispositional fear and emotion regulation to information processing, these relations can occur indirectly via problem construal.

8. Conclusion

We show how dispositional fear and habitual emotion regulation (self-distancing) predict in-situ information processing in decisions involving risk via problem construal. Dispositional fear predicted more intuitive processing via less concrete problem construal (i.e., more abstract construal), whereas habitual self-distancing predicted greater analytical processing via more concrete problem construal. Our study points to interesting avenues for future research and offers useful insight for organizations where risky decisions are common.

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CRediT authorship contribution statement

Lewend Mayiwar: Conceptualization, Methodology, Software, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing – Original Draft, Writing – Review & Editing, Project Administration, Funding Acquisition. **Thorvald Hærem:** Supervision, Conceptualization, Methodology, Formal Analysis, Writing – Review & Editing, Supervision, Funding Acquisition. **Adrian Furnham:** Supervision, Writing – Review & Editing, Funding Acquisition.

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