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Lewend Mayiwar • Emotion Regulation via Self-Distancing

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Emotion Regulation via Self-Distancing

Consequences for Risk-Taking and Cognitive Processing

Lewend Mayiwar

No. 12 – 2023
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BI Norwegian Business School

Emotion Regulation via Self-Distancing

Consequences for Risk-Taking and Cognitive Processing

by
Lewend Mayiwar

A dissertation submitted to BI Norwegian Business School
for the degree of PhD

PhD specialisation: Leadership and Organisation

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Lewend Mayiwar
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Dedication

To my mother.

Acknowledgments

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List of Articles

Article 1— Fear From Afar, Not So Risky After All: Distancing Moderates the Relationship Between Fear and Risk Taking

Mayiwar, L. & Björklund, F.

Published in *Frontiers in psychology*, 12, 674059. doi: 10.3389/fpsyg.2021.674059

Article 2—How Regulating Fear and Anger Impacts Risk-Taking: Unpacking the Cognitive-Processing Mechanisms

Mayiwar, L. & Hærem, T., Løhre, E.

Manuscript prepared for submission.

Article 3—Social Distance and Information Processing in Decisions Involving Risk

Mayiwar, L.

Accepted for presentation at *SPUDM 2023*, Vienna, Austria.

Summary

Emotions often carry relevant information that guides decisions, particularly in ambiguous situations. However, without proper regulation, emotions can become a source of unwanted bias. The current dissertation examines how emotion regulation influences decision-making under risk and uncertainty while also specifying the cognitive-processing mechanisms. Three preregistered empirical papers demonstrate how emotion regulation via self-distancing reduces emotional influences in decision-making under risk and uncertainty through changes in cognitive processing. Overall, the findings suggest that decision-makers who reflect on emotional problems from a more psychologically distant perspective rely less on their gut feelings and instead process information more analytically. These changes in cognitive processing, in turn, lead to downstream consequences for decision-makers' risk-taking.

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Chapter 1: Introduction

Managing risk is at the core of any manager's job. For managers, risk preferences are expected to be stable and given by the principal (Eisenhardt, 1989; Schildberg-Hörisch, 2018). Yet, it is well-established that managers' (i.e., agents') decisions often deviate from agreed norms for risk-taking. Decision-makers do not always assess risks and probabilities by using objective and relevant information, but instead tend to rely on their emotions and "gut feelings".

Early studies in organizational research devoted much attention to understanding the cognitive factors that influence managers' propensity for risk-taking (e.g., Kahneman & Lovallo, 1993; MacCrimmon & Wehrung, 1990; March & Shapira, 1987; Sitkin & Pablo, 1992). While emotions were largely neglected in this stream of research, a so-called affect revolution spurred a new line of research on the role of emotions (Lerner & Keltner, 2001; Loewenstein et al., 2001; Slovic et al., 2007). The proliferation of emotion and decision-making research has led to an ongoing debate among both management and psychology scholars about whether or when emotions help or hinder decision-making (e.g., Cristofaro, 2019; Li et al., 2014; March, 2006; Reimann & Bechara, 2010; Seo & Barrett, 2007).

Emotions often carry task-relevant information that guides decisions involving risk in ambiguous environments (Bechara & Damasio, 2005; Damasio, 1996; Loewenstein et al., 2001; Slovic et al., 2007). Generally, adaptive heuristic mechanisms such as the "affect heuristic" (Slovic et al., 2007) and "somatic markers" (Bechara & Damasio, 2005; Damasio, 1996) help decision-makers navigate ambiguous situations by exploiting emotional signals. Although inherently adaptive, however, emotions can also bias decisions in unwanted ways if not properly regulated, as observed in various psychiatric disorders (Etkin et al., 2015).

A growing line of research has examined how individuals actively manage their emotions (Gross, 2015). This research positions decision-makers as active agents in managing their emotional lives, rather than as mere passive recipients of emotional influence.

Consider the following scenario. You feel frustrated and angry after receiving feedback from a senior executive that the team's sales numbers have been disappointing. You find yourself ruminating on the feedback, replaying the situation in your mind, and feeling stuck and unsure of what to do next. After a while, you realize that your rumination is not helping you to address the problem. You decide to try to downregulate the emotion by taking a step back from the situation and viewing it from a more objective perspective. You consider what you would say to a friend or colleague in a similar situation and what advice you would give to them.

What consequences might such emotion regulation have for decisions involving risk? And what are the potential mechanisms? Although researchers have increasingly made calls to understand emotion-regulatory effects on decisions involving risk (Lerner et al., 2015; Tompkins et al., 2018), few empirical studies have examined these questions.

This dissertation examines the role of emotion regulation in decision-making under risk (where outcome probabilities are known) and uncertainty (where outcome probabilities are unknown) and the underlying information-processing mechanisms. I focus on a tactic of emotion regulation known as self-distancing (Kross & Ayduk, 2017), rooted in classic ideas that emphasize the virtue of detached reasoning, such as Adam Smith's "impartial spectator" (Smith, 1759). As noted by Ashraf et al. (2005), Smith viewed decisions as a struggle between "passions" (e.g., emotions like fear and anger) and an "impartial spectator"—a "moral hector who, looking over the shoulder of the economic man, scrutinizes every move he makes" (Grampp, 1948, p. 317).

The next sections introduce the key concepts in the dissertation and their interrelations and then specify the research gaps guiding this work.

Emotion, Risk, and Uncertainty

Herbert Simon was early to note the importance of emotions in decision-making. He suggested that "In order to have anything like a complete theory of human rationality, we have to understand what role emotion plays in it." (1983, p. 29). However, early behavioral models of decision-making under risk and uncertainty largely focused on cognitive factors. Although Kahneman and Tversky (1979) identified the different effects of the transient emotions of losses and gains on risk-seeking, the theoretical explanation of how emotions influence decisions involving risk did not get much further than the famous dictum "losses loom larger than gains" (Kahneman & Tversky, 1979, p. 279). Later research set out to develop a more systematic understanding of the role of emotions in decisions involving risk and uncertainty.

It is worth noting that research on emotion is still in its nascency. As noted by Lerner and colleagues (2015), in terms of Kuhn's description of scientific revolutions (1962), the field has still not developed into a "normal science" with established paradigms. Definitions and measurements vary to a large extent, mostly because existing theories compete for the best explanation of emotion. The emotion debate is not new, however—the nature of emotion has been debated for centuries. The early emotion theorist William James' essay titled "What is emotion?" (1884) still has no clear answer. But this has not prevented researchers from developing theories to explain how emotions influence decisions.

Unlike moods, emotions have "an identifiable referent, a sharp rise in time, limited duration, and often high intensity" (Schwarz & Clore, 2007, p. 385). Affect is a broad term that encompasses a range of feelings that people can experience, including moods and emotions.

According to Russell (2003), affect encompasses two key dimensions: valence (ranging from negative to positive) and arousal (ranging from low activation to high activation). Studies frequently use the term affect to refer to valence alone.

Current theories of emotions and decision-making generally adopt one of two different theoretical perspectives: a valence-based perspective or a discrete emotion perspective. A less extensive line of research has also examined the role of arousal. The next subsections briefly describe these three streams of research on emotions and decision-making.

Valence

Most studies on emotion and risk derive from valence-based theories that map all emotions along a single dimension ranging from negative to positive. Indeed, valence is considered a core aspect of emotion (Russell, 2003).

The mood maintenance hypothesis (Isen & Patrick, 1983) proposes that individuals in a positive mood avoid risk to maintain their positive mood, while individuals in a negative mood seek out risk to break out of their negative mood.

The affect heuristic (Slovic et al., 2007) proposes that people evaluate objective features of objects and events based on the associated valence (i.e., "how *good* vs. *bad* do I feel about this?") The risk-as-feelings hypothesis (Loewenstein et al., 2001) states that risks tend to give rise to negative emotions like fear which in turn shape people's perceived probability of events. For instance, people are more willing to pay for air travel insurance when they are told it will protect them from "terrorist attacks" than if they are told it will protect them from "all possible causes" (Johnson et al., 1993). This is an example of non-normative behavior, in that people's willingness to pay for insurance should be determined by objective likelihood information rather than emotional responses.

Other researchers, on the other hand, have argued that emotions play normative functions, especially in decisions involving uncertainty. The somatic marker hypothesis (Damasio, 1996) proposes that unconscious physiological responses facilitate decision-making under uncertainty. Specifically, decisions that yield negative outcomes trigger processes that "mark" the course of action that produced the negative outcomes, thereby steering the decision-maker away from repeating the same course of action later.

Damasio and his co-researchers compared performance on a gambling task (the Iowa Gambling Task) among healthy participants and patients with damage to the ventromedial prefrontal cortex who 'showed impairments in judgment and decision making in real-life settings, in spite of maintaining normal intellect' (Bechara et al., 1997, p. 337). Damasio and colleagues showed that patients with damage to this area of the brain—which plays an important role in the processing and regulation of emotions—failed to accurately assess potential risks and rewards and consistently made poor choices (i.e., drawing from risky decks).

Discrete Emotion Models

Later research in psychology and organizational behavior moved beyond a valence-based approach and focused on discrete emotions (Lerner & Keltner, 2000; Raghunathan & Pham, 1999). For instance, Lerner and Keltner (2000) developed the appraisal tendency framework to show how emotions of similar valence can lead to opposite effects on decisions involving risk due to their underlying cognitive appraisals—that is, how people interpret an emotion-inducing situation.

The appraisal tendency framework is perhaps most well-known for its predictions concerning decisions involving risk. Lerner and Keltner (2001) showed that both situationally induced and individual differences in anger predicted greater risk-taking and optimism relative to fear. The appraisal tendency framework (Lerner et al., 2015) proposes that these differences emerge because angry people interpret ambiguous situations as predictable and controllable, whereas fearful individuals interpret such situations as unpredictable and uncontrollable.

The appraisal tendency framework is based on work by Smith and Ellsworth (1985), in which they identified six cognitive appraisal dimensions: pleasantness, anticipated effort, certainty, attentional activity, self-other responsibility/control, and situational control. Smith and Ellsworth's (1985) research demonstrated that emotions varied systematically along these dimensions, indicating a strong link between one's appraisal of a situation and emotional state. The appraisal-tendency framework presents a novel argument that these appraisals not only classify emotional experience but also predict how incidental emotions influence decision-making outcomes. Lerner and colleagues (2015; 2000, 2001) suggest that each emotion causes individuals to perceive new situations in ways that are similar to the cognitive appraisals that triggered the emotion, which in turn predicts various behavioral tendencies.

Arousal

While valence and appraisal models have dominated research in the risk domain, surprisingly little is known about arousal. Arousal, a core dimension of affect (Russell, 2003), is a neurophysiological state that ranges from low activation to high activation. High-arousal states can be either positive (e.g., feeling excited) or negative (e.g., feeling tense).

In a review of the biological relations between arousal and cognition, Arnsten (2009) demonstrates how even a mild increase in arousal triggers a switch from "top-down processing by the prefrontal cortex based on what is relevant to the task at hand, to bottom-up control by the sensory cortices" (p. 4). In other words, arousal triggers a switch from a reflexive (intuitive) processing to reflective (analytical) processing by the prefrontal cortex, which closely maps onto the risk-as-feelings and risk-as-analysis duality (Slovic et al., 2004).

Moreover, much like incidental emotions as described by the appraisal tendency framework (Lerner et al., 2015), arousal can also have carryover effects on judgments and decisions. For instance, some studies have shown that positive arousal induced by exposure to task-irrelevant stimuli carries over and influences subsequent risk decisions (Ariely & Loewenstein, 2006; Galentino et al., 2017; Jahedi et al., 2017).

For instance, an employee might experience physiological arousal, like increased heart rate and sweaty palms after receiving a critical email from their boss about a mistake. Later that day, when faced with an uncertain situation that requires calculated risks, the employee may struggle to accurately assess the potential outcomes and the risks involved due to the carry-over effect of the physiological arousal from the negative email.

Despite the central role of physiological aspects in emotion, studies investigating the effects of emotions on decision-making rarely include physiological measures (Blanchette & Richards, 2010).

Integral and Incidental Emotions

Judgment and decision-making scholars, be it implicitly or explicitly, largely focus on two types of emotions: those that are *integral* to the task at hand and those that are *incidental* (Västfjäll et al., 2016). Integral emotions arise from the decision task itself, such as the anxiety arising from having to make a decision concerning employee layoffs. Incidental emotions, on the other hand, persist beyond the emotion-eliciting event and influence decision-making (Andrade & Ariely, 2009; George & Dane, 2016; Lerner et al., 2015). This can cause individuals to misattribute “irrelevant” emotions to the decision task itself, unaware that the emotion has spilled over from another situation.

One of the first studies to provide evidence for the influence of incidental emotions was conducted by Johnson and Tversky (1983). In their study, they found that inducing emotions by having participants read a newspaper article subsequently influenced their perceived probability of risky events.

Unlike models that focus on integral emotions, such as the affect heuristic (Slovic et al., 2007), risk-as-feelings hypothesis (Loewenstein, 2001), and the somatic marker hypothesis (Damasio, 1996), the appraisal tendency framework (Lerner et al., 2015; Lerner & Keltner, 2001) focuses on incidental emotions. Studies based on the appraisal tendency framework usually manipulate emotions by instructing participants to recall and describe an emotion-eliciting event that happened in the past, before they are given a decision task.

The integral vs. incidental emotion distinction is important because it reflects opposing assumptions about the role of emotions and forms a key point of discussion in the current debate about whether emotional influences should be minimized or not.

Whereas integral emotions are typically viewed as useful sources of information that feed into people’s subjective utility, incidental emotions are normatively irrelevant to the decision at hand (Lerner et al., 2015). Of course, integral and incidental emotions may be more or less adaptive in certain contexts. Integral fear can prevent decision-makers from processing critical information if the emotional response is too intense. By the same token, incidental fear can be beneficial if it makes the decision-maker risk-averse in a situation where risk aversion pays off.

Regardless, researchers agree that incidental emotions should be regulated (Dorison et al., 2020; Lerner et al., 2015). Incidental emotions do not arise from considering the facts relevant to the task, but decision-makers may still attribute them to current decisions (Andrade & Ariely, 2009; Lerner et al., 2015). In addition, unlike integral emotions, incidental emotional influences tend to operate outside awareness (Han et al., 2007), and decision-makers regard them as unwanted (Wilson & Brekke, 1994, as cited in Lerner et al., 2015). Incidental emotions shape decisions even when real consequences are at stake (Lerner et al., 2004), meaning that important economic decisions are likely to be influenced by emotions that the decision-maker themself would consider irrelevant or unwanted.

Risk vs. Uncertainty

To further contextualize the role of emotions in decision-making, we also need to distinguish risk from uncertainty, as decision-making in these two conditions is driven by different mechanisms (Glöckner et al., 2012). Judgment and decision-making researchers have distinguished between descriptive and experience-based tasks that tap into decision-making under risk and uncertainty, respectively (Hertwig & Erev, 2009; Rakow & Newell, 2010). Descriptive tasks provide explicit information about outcome probabilities, where risks and payoffs can be calculated. On the other hand, experience-based tasks require participants to learn about outcome probabilities through trial and error, as they repeatedly make choices and observe the consequences of each choice.

It is worth noting that the distinction between risk and uncertainty is not always clear-cut. For example, a task could involve a description of probabilities that is ambiguous or incomplete, as in the classic Ellsberg task. Nevertheless, description-based and experience-based are generally thought to tap into risk and uncertainty, respectively.

Researchers have suggested that experience-based tasks are more reflective of real-world decision-making (Rakow & Newell, 2010), as people seldom have explicit information about probabilities. For instance, a decision-maker who does not have access to explicit information might have to draw on their prior experiences or what "feels right" to assess the probability of an event. Moreover, studies have found that decision patterns tend to reverse when moving from one paradigm to the other, a phenomenon that has been coined the "description-experience gap" (Rakow & Newell, 2010). That is, people tend to overweight rare events when they respond to a description of the incentive structure (Kahneman & Tversky, 1979), but underweight rare events when they rely on their past experience (Barron & Erev, 2003).

Descriptive tasks have been the dominant paradigm in behavioral economics. For instance, in the classic Asian disease problem (Tversky & Kahneman, 1981), participants read about a hypothetical disease and are asked to choose between a "safe" and a "risky" treatment. Participants receive information about the outcome probabilities associated with each choice option. Tversky and Kahneman (1981) used this problem to show how people become more risk-seeking when the same outcome is described in terms of losses (e.g., number of lives that will be lost if a given option is selected) as opposed to gains (e.g., number of lives that will be saved if a given option is selected). This phenomenon, which is known as loss aversion, is believed to reflect an irrational response that is triggered by the greater emotional intensity of the loss frame.

In experience-based tasks, on the other hand, emotions are thought to play an adaptive role. For instance, in the Iowa Gambling Task, participants must weigh the potential rewards and risks of different options as they draw cards from different decks and observe the outcome of their choices across repeated trials (Bechara et al., 1994). Damasio and colleagues found that unconscious physiological responses that arise from the body's reaction to considering different options improved decision-making by signaling which decks were safe and which were risky

(Bechara et al., 1997). Their findings thus challenged the idea that emotions are non-normative and irrational.

Moreover, these two types of tasks also come with different advantages and disadvantages. Descriptive tasks are simple and easy to administer and allow for the manipulation of specific variables to test different hypotheses (e.g., framing effects). However, they do a poor job of capturing the complexity and uncertainty of real-world decision-making. For instance, decision-makers seldom have complete information about probabilities. Experience-based tasks offer greater ecological validity as they capture learning processes involved in real-life decision-making. However, such tasks are more difficult to administer, and the results are more difficult to interpret given the multiple factors involved in trial-and-error learning.

Overall, decisions involving uncertainty seem to involve mechanisms that differ from those involving risk. While emotions play an influential role in decisions involving both risk and uncertainty, emotions seem to be particularly adaptive in situations that involve uncertainty.

Emotion Regulation and Decision-Making Under Risk and Uncertainty

Defining Emotion Regulation

Emotion researchers have identified various strategies that people use to regulate their emotions. The two-factor model developed by Gross (1998) distinguishes between two main categories of emotion regulation strategies: antecedent-focused and response-focused strategies. Generally, studies indicate that antecedent-focused emotion regulation is more effective because it regulates an emotion before it has fully developed. In contrast, response-focused emotion regulation involves the suppression of a full-blown emotional response. One of the most widely studied strategies of antecedent-focused emotion regulation is known as cognitive reappraisal. At a broad level, cognitive reappraisal involves changing one's perspective of an emotion-eliciting situation to reduce its emotional impact.

Reappraisal can be further broken down into specific tactics. Two commonly studied tactics of reappraisal are reinterpretation and self-distancing. Reinterpretation involves changing one's interpretation of the meaning of the actions, context, and/or outcomes in a given situation (Denny & Ochsner, 2014). For instance, one might reinterpret critical feedback as something helpful rather than something negative.

Self-distancing, on the other hand, involves viewing an emotion-inducing situation from a more distant perspective. Researchers typically induce self-distance by instructing participants to view an emotional stimulus or event from a detached, objective, and impartial third party (Powers & LaBar, 2019). For instance, one might try to downregulate an anger-eliciting event by imagining how an impartial observer would evaluate the event. Studies have found that self-distancing is more effective in down-regulating negative emotions than other tactics of reappraisal like reinterpretation.

Denny and Ochsner (2014) found that participants who received longitudinal training in distancing, compared to those who received training in reinterpretation, exhibited decreased levels of stress in daily life and decreased emotional reactivity to aversive stimuli. Moreover, a qualitative comparison of neuroimaging associations with distancing and reinterpretation indicated that distancing was more strongly related to activity in the prefrontal cortex (Ochsner & Gross, 2008). Furthermore, self-distancing not only downregulates emotional distress (Ahmed et al., 2018; Bruehlman-Senecal & Ayduk, 2015; White et al., 2019) but it also improves people's reasoning about personal problems (Grossmann & Kross, 2014; Kross & Grossmann, 2012).

Finally, self-distancing offers a flexible approach to regulating emotions. According to construal level theory (Trope & Liberman, 2010), psychological distance encompasses distance along four key dimensions: physical distance, temporal distance, social distance, and probabilistic distance. In other words, psychological distance encompasses events or objects that are not currently present, whether they occurred in the past or will occur in the future (temporal distance), happened to someone else (social distance), occurred in a different location (spatial distance), or are hypothetical alternatives to reality (Moran & Eyal, 2022). Thus, people can regulate their emotions along any of these dimensions, by imagining that an emotional situation is far from the self physically, temporally, or socially (Nook et al., 2020; Powers & LaBar, 2019).

Given that adaptive emotion-regulation strategies like self-distancing reduce the intensity of negative emotions, clearly, they should play an important role in influencing the decision-making process too. But how exactly does emotion regulation regulate emotional influences in decision-making? And what are the underlying processes? These questions remain largely underexplored.

The Role of Reappraisal in Decisions Involving Risk and Uncertainty

A growing number of studies have investigated the reappraisal strategy in decisions under risk and uncertainty. Heilman et al. (2010) examined how reappraisal of incidental emotions influences risk-taking in experienced-based tasks (where probabilities of outcomes are unknown). They found that participants who regulated incidental fear and disgust through reappraisal (vs. expressive suppression) took fewer risks in the Iowa Gambling Task, thereby enabling these participants to maximize profit. Similar effects of reappraisal in experience-based tasks have been documented in studies measuring people's habitual use of reappraisal (e.g., Panno et al., 2013).

Using a description-based task, Miu & Crişan (2011) tested whether reappraisal and suppression during the task would differentially predict susceptibility to gain and loss framing effects (Kahneman & Tversky, 1979). Participants in the reappraisal condition were instructed to "Think about your decisions in this task in a way that helps you stay calm", while those in the suppression condition were instructed to "Try to control the emotions associated with your decisions in this task by not expressing them". Participants played several trials in the task. In each trial, they were endowed with a sum of money and had to choose between a sure option (lose/keep a certain amount for sure) or a risky option (gamble on a set probability of retaining the full endowment). Miu and Crişan (2011) found that reappraisal, but not expressive suppression, reduced susceptibility to gain and loss framing effects. In addition, participants who used reappraisal during the task reported greater positive affect and lower negative affect immediately after the task, suggesting that reappraisal reduces susceptibility to framing effects by regulating emotions associated with the decision frames.

The effect of reappraisal on susceptibility to framing effects has been replicated in other studies (e.g., Cheung & Mikels, 2011).

The Self-Distancing Tactic of Reappraisal in Decision-Making

While the aforementioned studies show how reappraisal works in general, some studies have focused more explicitly on the self-distancing tactic. Sokol-Hessner et al. (2009) found that instructing participants to think like a trader (i.e., adopting a self-distant perspective) during a description-based task reduced loss aversion by decreasing physiological responses. In another study, Sokol-Hessner and colleagues (2013) demonstrated that self-distancing reduced amygdala responses to losses in a gambling task and increased prefrontal activity. These findings are consistent with neuroscientific theories emphasizing the central role of arousal in modulating cognitive processing (Arnsten, 2009).

Furthermore, self-distancing seems to facilitate decision-making that conforms to normative models of economic behavior. Several studies have found that social distance (e.g., imagining deciding on behalf of someone else rather than oneself) reduces susceptibility to framing effects in risky-choice problems (e.g., Andersson et al., 2014; Mengarelli et al., 2014; Polman, 2012; Raue et al., 2015). Across three experiments that included both novices and professionals, Raue et al. (2015) found that activating a psychologically distant perspective by instructing participants to imagine deciding for someone else (vs. themselves), such as a distant colleague, reduced their susceptibility to gain and loss frames (i.e., normatively irrelevant information).

Gainsburg et al. (2022) studied the effect of adopting a third-person perspective in the dictator game, where participants are randomly assigned to the role of "decider" or "recipient". In this game, the decider is allotted a sum of money and can choose how much money to give to the recipient. Gainsburg and colleagues found that participants who were instructed to adopt a third-person perspective (i.e., a self-distanced perspective) while making their decisions made more rationally self-interested decisions in the dictator game (i.e., deciders kept more money for themselves and gave less money to the recipient)—in the dictator game, participants are randomly assigned to the role of "decider" or "recipient" where the decider is allotted a sum of money and can choose how much money to give to the recipient.

Collectively, these studies suggest that depersonalizing problems through self-distancing might facilitate more analytical processing of information. Indeed, several authors (e.g., Andersson et al., 2014; Raue et al., 2015) have speculated that reduced susceptibility to framing effects by self-distancing is driven by a switch from intuitive and emotional processing to analytical processing of information. This speculation is supported by studies that have found that higher temporal and social distance leads people to seek more information before making a decision (Halamish & Liberman, 2017) and improves decision-making under information overload (Fukukura et al., 2013).

Research Questions and Gaps

Researchers have called for a more in-depth investigation into the role of emotion regulation in decision-making (Dorison et al., 2020; Lerner et al., 2015), particularly when it comes to decisions involving risk (Tompkins et al., 2018). Despite recent efforts to understand the role of emotion regulation in decisions involving risk, several questions remain open to empirical investigation. This dissertation seeks to answer three key research questions that aim to fill three research gaps, describe in the next section.

RQ1: How does emotion regulation via self-distancing influence decisions involving risk and uncertainty?

RQ2: How does the regulation of discrete and negative high-arousal emotions like fear and anger influence risk-taking?

RQ3: What are the cognitive-processing mechanisms underlying the effect of self-distancing on risk-taking?

Research Gaps

Research Gap 1: Unpacking the Role of Reappraisal in Decision-Making

Studies of the general reappraisal strategy typically manipulate reappraisal by explicitly instructing participants to reduce their emotions. As noted by Webster et al. (2022), such instructions can lead to demand effects. Consider the following instructions used by previous decision-making studies to induce reappraisal: "Think about your decisions in a way that helps you stay calm" (Miu & Crişan, 2011), "Re-evaluate the options in a manner that reduce your emotional reactions and make your choices without using your emotions" (Cheung & Mikels, 2011), "Try to think about what you are seeing in such a way that you don't feel anything at all" (Heilman et al., 2010), and "Try to think about what you are seeing in such a way that you feel less negative emotion" (Lee & Gino, 2015).

Rather than instructing participants to reduce negative emotions, studies manipulating the self-distancing tactic of reappraisal usually instruct participants to reflect on the emotion-eliciting event from the perspective of a distant impartial observer, without explicitly mentioning that they should reduce negative emotions. For example, "Move away from the situation to a point where you can now watch the conflict from a distance…Watch the conflict unfold as if it were happening all over again to the distant you" (Kross et al., 2005).

Moreover, broad operationalizations of reappraisal do not provide insight into the specific ways in which participants use reappraisal. People differ in their modus operandi when it comes to emotion regulation. Self-distancing manipulations provide more specificity into how people regulate their emotions. Such specificity also puts us in a better position to inform practitioners on how they can use reappraisal to improve their decisions.

Self-distancing might also be more effective in interpersonal situations. For instance, advising people to calm down or "look at the bright side" can be perceived as invalidating their emotions, which has been shown to trigger negative emotional responses (Shenk & Fruzzetti, 2011). Instead, suggesting that someone imagine how they would view the problem if it were happening to someone else might help them step back and gain a more objective perspective without feeling like their emotions are being ignored.

Research Gap 2: Regulation of Discrete Incidental Emotions and Decision-Making

Most decision-making studies have examined the regulation of integral and general affective responses that are believed to arise from the task itself. Few studies have examined how the regulation of discrete incidental emotions influences decisions involving risk.

While it is well-established that discrete emotions (even those of the same valence and arousal) can lead to diverging effects on risk-taking (e.g., Fessler et al., 2004; Lerner & Keltner, 2001; Raghunathan & Pham, 1999), we lack an emotion-specific understanding of the role of emotion regulation in decision-making.

Consider fear and anger, two emotions that are negative and high in arousal but lead to opposite effects on risk-taking (see Lerner & Keltner, 2001). Given their opposing effects on risk-taking, it seems entirely plausible that the regulation of these emotions will also produce differential effects. On the other hand, if emotion regulation involves returning to a neutral state, then emotion regulation might have the same effect on risk-taking regardless of the target emotion.

Articles 1 and 2 in this dissertation address this gap by investigating how the regulation of incidental fear and anger (via self-distancing) influences risk-taking.

Research Gap 3: The Cognitive Processing Mechanisms

While a growing number of studies have shown that reappraisal and self-distancing influence people's decisions involving risk, the underlying cognitive processing mechanisms remain poorly understood. A few researchers have speculated that self-distancing impacts risk-taking by triggering a switch from intuitive (based on emotions and gut feelings) to analytical information processing (e.g., Andersson et al., 2014; Raue et al., 2015). That is, self-distancing. So far, however, no study has tested this assumption empirically.

Moreover, different theories make different predictions regarding the relationship between emotion and information processing. Valence-based models suggest that negative emotions trigger analytical processing because they signal that the situation is problematic or threatening, and thus, demand that the individual gathers information to cope with the situation (Schwarz, 1990, 2012). In contrast, positive emotions are thought to signal that a situation is safe, thereby allowing the individual to rely on existing knowledge without engaging in effortful processing (Blanchette & Richards, 2010).

According to the appraisal tendency framework (Lerner et al., 2015), emotions characterized by uncertainty (e.g., fear) prompt careful and analytical thinking, whereas emotions characterized by certainty (e.g., anger) prompt intuitive and heuristic thinking. The idea is that the experience of fear motivates people to scrutinize the situation at hand in greater detail to reduce uncertainty. While the appraisal tendency framework has provided important insight by demonstrating that emotions of the same valence can lead to opposite effects on decision making like risk-taking, the proposed relationship between discrete emotions and information processing has received very little empirical attention. Although a couple of studies have claimed support for these predictions laid out by the appraisal tendency framework, a closer look raises the question of whether the results might be driven by differences in arousal rather than appraisals.

For instance, Small and Lerner (2008) found that angry participants allocated less to welfare than sad and neutral-state participants and that this effect was eliminated under cognitive load. These results were interpreted as supporting the hypothesis that certainty emotions (anger) increase reliance on intuitive processing compared to uncertainty emotions (sadness). However, their results might be driven by arousal, as anger is higher in arousal than sadness. Moreover, Small and Lerner's (2008) study did not directly measure information processing.

Neurocognitive models emphasize physiological arousal as a key component that drives cognitive processing. Arnsten (2009) explains that an increase in arousal triggers a switch from "top-down processing by the prefrontal cortex based on what is relevant to the task at hand, to bottom-up control by the sensory cortices" (p. 4). Despite being considered a core dimension of affect (Russell, 2003), surprisingly little research has examined the role of arousal in judgments and decisions involving risk (Tompkins et al., 2018). Articles 2 and 3 examine the cognitive processing mechanisms underlying the effect of self-distancing on risk-taking. Article 2 also examines whether changes in information processing are driven by changes in physiological arousal.

Overview of Articles

Article 1 examines how the regulation of incidental fear and anger via self-distancing influences risk-seeking in description-based tasks (where outcome probabilities are known). The article consists of three studies that assess individual differences and situationally induced fear, anger, and self-distancing.

Article 2 extends Article 1 by examining how the regulation of incidental fear and anger via self-distancing influences risk-taking in an experience-based task (the Iowa Gambling Task) while also unpacking the information-processing mechanisms. The article consists of an online experiment and a laboratory experiment that also measured physiological arousal.

Article 3 extends the findings from Article 2 by examining whether self-distancing also impacts information processing and risk-seeking in situations that involve deciding on behalf of others, a situation that automatically induces a self-distant perspective. Article 3 does not focus on discrete incidental emotions as in Articles 1 and 2. Instead, it examines how deciding for others relative to oneself changes information processing due to a reduction in the emotional arousal that arises from the task itself. Like Article 1, Article 3 uses description-based tasks. Article 3 also explores whether the effects of self-distancing vary between leaders and non-leaders.

Statement of Transparency

This dissertation is guided by an open science approach that emphasizes transparency and reproducibility. All studies were preregistered. I report all measures, manipulations, data exclusions, and how I determined the sample size (Simmons et al., 2012). The preregistrations, data, code, and materials for the studies are available on an online repository (link included in each article).

Chapter 2: Fear from Afar, Not So Risky After All: Distancing Moderates the Relationship Between Fear and Risk Taking

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Abstract

A growing line of research has shown that individuals can regulate emotional biases in risky judgment and decision-making processes through cognitive reappraisal. In the present study, we focus on a specific tactic of reappraisal known as distancing. Drawing on appraisal theories of emotion and the emotion regulation literature, we examine how distancing moderates the relationship between fear and risk taking and anger and risk taking. In three pre-registered studies (N_{total} = 1,483), participants completed various risky judgment and decision-making tasks. Replicating previous results, Study 1 revealed a negative relationship between fear and risk taking and a positive relationship between anger and risk taking at low levels of distancing. Study 2 replicated the interaction between fear and distancing but found no interaction between anger and distancing. Interestingly, at high levels of distancing, we observed a reversal of the relationship between fear and risk taking in both Study 1 and 2. Study 3 manipulated emotion and distancing by asking participants to reflect on current fear-related and anger-related stressors from an immersed or distanced perspective. Study 3 found no main effect of emotion nor any evidence of a moderating role of distancing. However, exploratory analysis revealed a main effect of distancing on optimistic risk estimation, which was mediated by a reduction in self-reported fear. Overall, the findings suggest that distancing can help regulate the influence of incidental fear on risk taking and risk estimation. We discuss implications and suggestions for future research.

Keywords: judgment and decision making, emotion regulation, psychological distance, cognitive reappraisal, incidental emotions, risk taking, self-distancing

Introduction

Studies in the last couple of decades have provided significant insight into the complex ways in which emotions influence judgments and decisions. Although emotions serve as sources of information that help individuals navigate through uncertainty, emotions can also "carry over" and influence judgments and decisions in a biasing way (Lerner et al., 2015). As a result, scientists have increasingly recognized the importance of identifying specific ways to minimize such biases (Lerner et al., 2015). While still in its infancy, an emerging and promising line of research has explored how various emotion regulation strategies influence risky decision making (Sokol-Hessner et al., 2009, 2013; Heilman et al., 2010; Miu & Crişan, 2011; Panno et al., 2013). The present study seeks to contribute to this developing line of research in several ways.

First and foremost, we examine a specific emotion regulation tactic that has received relatively little attention in judgment and decision-making research, namely, distancing. This tactic involves mentally changing the psychological distance of a stimulus to reduce its emotional impact (see Powers & LaBar, 2019). It has been associated with a range of emotional (Kross et al., 2014; Bruehlman-Senecal and Ayduk, 2015; Nook et al., 2017, 2020; Ahmed et al., 2018; Powers & LaBar, 2019; White et al., 2019) and cognitive benefits (Kross & Grossmann, 2012; Grossmann & Kross, 2014; Sun et al., 2018). Studies suggest that distancing requires less effort than other tactics and strategies, rendering it a promising tool in practical settings (Powers & LaBar, 2019). Second, the present study examines how distancing moderates the relationship between incidental emotions—emotions that are elicited from unrelated situations—and risk taking. Finally, we focus on specific emotions that can be expected to lead to opposite effects on risk; n, fear and anger (Lerner & Keltner, 2000, 2001; Lerner et al., 2015). It is worth emphasizing at the outset that in some situations, emotions can be highly adaptive. However, individuals might wish to down-regulate emotions where they can be expected to lead to judgments and decisions that are inconsistent with one's goals or values. Moreover, whether risk taking is beneficial or detrimental is not a question that we can answer in this study.

Theory and Hypotheses

Incidental Fear and Anger

As noted by Lerner et al. (2015), the majority of research on emotion and risky decision making has focused on valence (i.e., subjective feelings of pleasantness/unpleasantness). Valence-based models posit that emotions of the same valence (i.e., positive vs. negative emotions) have similar effects on risk perception. Appraisal theories, on the other hand, posit that emotions of the same valence can have opposite effects on judgments and decisions. Moving beyond dimensions of valence, the Appraisal Tendency Framework (ATF; Lerner & Keltner, 2000, 2001) focuses on distinct emotions (e.g., fear, anger, sadness, happiness) and their associated appraisals (i.e., evaluations of events and situations). Lerner and Keltner (2001) demonstrated that fear and anger, both of which are negative valence and high arousal (i.e., intense) emotions, have opposite effects on risky judgments and decisions due to their distinct underlying appraisals of certainty and control (Lerner & Keltner, 2001; Lerner et al., 2003; Habib et al., 2015; Ferrer et al., 2017; Wake et al., 2020). Fear reduces risk taking due to its appraisals of uncertainty and low personal control. In contrast, anger increases risk taking due to its appraisals of certainty and personal control (Lerner & Keltner, 2001).

Finally, studies that examine the influence of specific emotions like fear and anger on judgments and decisions usually adopt an incidental emotion approach. In contrast to integral emotions, which are elicited by the decision task at hand, incidental emotions are elicited by unrelated events that carry over to the decision-making process (for an in-depth distinction, see

Västfjäll et al., 2016). For instance, anger triggered in one situation (e.g., anger stemming from bad traffic while driving to work) can carry over to influence judgments and decisions in unrelated settings (e.g., deciding to invest in a risky project without giving the decision sufficient thought). Unlike integral emotions which are "normatively defensible input to judgment and decision making" (Lerner et al., 2015, p. 803), incidental emotional influences are often unwanted.

Psychological Distance and Emotion Regulation

Trope and Liberman (2010) define psychological distance as "the subjective experience that something is close or far away from self, here and now" (p. 440). Psychological distance has been found to decrease emotional intensity (van Boven et al., 2010), and appears to be particularly effective in regulating basic emotions such as fear and anger (Katzir & Eyal, 2013). In a study by Davis et al. (2011), participants who imagined that aversive images presented on a screen were moving further away from them exhibited lower negative affect and physiological responses. Adopting a temporally distant perspective from future stressors has been associated with lower levels of anxiety and image vividness (White et al., 2019).

Supporting these findings, Nook et al. (2017) demonstrated that participants who wrote about negative images using psychologically distant (vs. close) language in physical, social, and temporal domains exhibited lower negative affect. Bruehlman-Senecal and Ayduk (2015) found that participants who reflected on how they would feel about recent stressors in the distant future showed significantly lower emotional distress. Moreover, the authors found that an impermanence focus (e.g., focusing on how one's feelings might change with time) mediated this effect. Similar results have been found in studies examining individual differences in temporal distancing (Bruehlman-Senecal et al., 2016). Not only do these findings support folk sayings like "time heals all wounds," but they show that people can mentally project themselves into the future to reduce stressors in the here and now.

Other studies have shown that distancing is also associated with cognitive benefits, such as wise reasoning (e.g., realizing the limits of one's knowledge and recognizing diverse perspectives; Kross & Grossmann, 2012; Grossmann & Kross, 2014). According to Construal Level Theory (CLT; Trope & Liberman, 2010), psychological distance exists across various dimensions, including temporal, social, and spatial distance. In terms of its emotion-regulatory function, it means that negative emotions can be downplayed by imagining that the emotional stimulus is temporally, physically, or socially far from the self. Indeed, distancing is a specific tactic of a general emotion regulation strategy known as reappraisal (see a taxonomy of distancing and emotion regulation by Powers & LaBar, 2019).

Reappraisal involves changing one's mental representation of an emotion-eliciting stimulus to minimize its emotional impact. This can be done through either reinterpretation (e.g., thinking of a lay-off as an opportunity to pursue a more desirable career) or distancing (e.g., adopting the perspective of a distant, uninvolved participant when dealing with a personal conflict at work). Our review, however, is restricted to studies investigating the distancing tactic. Although both tactics have been found to be effective in regulating negative emotions, some evidence suggests that distancing is more effective than reinterpretation. For instance, Denny and Ochsner (2014) compared the effects of longitudinal training in distancing and reinterpretation. Compared to those who were trained in reinterpretation, participants who were trained in distancing showed lower levels of stress in daily life and were more likely to evaluate aversive content neutrally. Moreover, distancing seems to require less effort than reinterpretation because it does not target specific features of an emotion-eliciting stimulus (Moser et al., 2017). Thus, distancing may offer regulatory benefits across a broader range of situations. Although emotion regulation studies are typically restricted to the down-regulation of negative emotions, there are situations where one's goal might be to down-regulate positive emotions or up-regulate negative emotions (e.g., Tamir & Bigman, 2014; Tamir & Ford, 2009). For example, like anger, happiness can lead to excessive risk taking (Lerner & Keltner, 2001).

Psychological Distance and Risk

Only recently have studies started to explore the role of psychological distance in risky decision making. This small set of studies has tested how psychological distance, across various dimensions, impacts risk taking (e.g., Polman, 2012; Raue et al., 2015; Sun et al., 2017; Zhang et al., 2017). For instance, social distance (i.e., choosing for socially distant others) has been associated with reduced loss aversion (Polman, 2012; Andersson et al., 2014; Sun et al., 2017; Zhang et al., 2017). In a medical scenario about a deadly virus, people who chose for others showed a greater tendency to accept the vaccine than those who chose for themselves (Zikmund-Fisher et al., 2006).

Similar results have been obtained in studies examining temporal distance. Chandran and Menon (2004) showed that "every day" framing made risks appear more proximal and concrete than "every year" framing, resulting in increased risk perceptions, intentions to engage in preventive behavior, and increased anxiety about hazards. Raue et al. (2015) manipulated psychological distance by varying the temporal, social, and spatial distance in decision scenarios. Across several experiments with students, physicians, and hotel managers, psychological distance reduced framing effects. Finally, Sun et al. (2018) similarly demonstrated that self-distancing (by adopting a distant observer's perspective) reduced probability-weighting biases.

The influence of psychological distance on risk is believed to result from a reduction in emotional intensity, as distance enables individuals to “zoom out” and transcend features of the here and now (Fujita et al., 2016). This notion is consistent with studies that have linked self-distancing to enhanced wise reasoning (Kross & Grossmann, 2012; Grossmann & Kross, 2014). These findings raise an interesting question; how does psychological distance shape the role of emotions like fear in decisions and judgments involving risk? A recent line of research provides a starting point. Although, it appears that these studies have either examined the general strategy of reappraisal or reinterpretation, not distancing. A study by Heilman et al. (2010) examined incidental regulation of fear and disgust on risk taking in the Balloon Analog Risk Task (BART) and Iowa Gambling Task (IGT). Participants were instructed to either reappraise or suppress their emotions while watching a fear-inducing or disgust-inducing video. As predicted, Heilman et al. (2010) found that reappraisal effectively reduced the influence of these two incidental emotions in both tasks. Similar results have been reported in studies examining integral emotion regulation and risk taking. Sokol-Hessner et al. (2009) found that instructing participants to adopt the perspective of a trader promoted risk taking by reducing physiological arousal. Building on these findings (Panno et al., 2013) found the same pattern of results for habitual reappraisal (i.e., naturally occurring individual differences in reappraisal). Specifically, habitual reappraisal was related to increased risk taking, accompanied by decreased sensitivity to changes in probability and loss amount. Yet, no study has directly tested how the distancing tactic of reappraisal regulates the influence of incidental emotions on judgments and decisions involving risk. This might be of particular interest in light of the benefits of distancing discussed in the previous section.

Present Research

Few studies have examined how psychological distance moderates the influence of incidental emotions on judgments and decisions involving risk. Some of the studies covered earlier have manipulated distance by varying the proximity to targets in risky decision-making tasks (Chandran & Menon, 2004; Raue et al., 2015; Sun et al., 2017; Zhang et al., 2017) or instructed participants to adopt a distant perspective while completing a task (Sun et al., 2018). The authors behind some of these studies speculate that the impact of psychological distance on risk occurs via a reduction in emotional intensity (e.g., Raue et al., 2015; Sun et al., 2018). The present study aims to test this hypothesis by examining how distancing moderates the relationship between incidental emotions and risky judgments and decisions. More specifically, we focus on the regulation of fear and anger.

A comparison between fear and anger is of theoretical interest since both are characterized by negative valence and high arousal (Smith & Ellsworth, 1985), but differ in their underlying appraisals (i.e., mental evaluations of a situation). While fear is characterized by appraisals of uncertainty and lack of control, anger is characterized by the opposite appraisal patterns. The ATF predicts that, because of their different appraisal patterns, fear should decrease risk taking whereas anger should increase risk taking. Thus, we predict that the opposing effects of anger and fear on risk taking will be particularly strong at low levels of distancing. We believe that this approach can help provide a more nuanced understanding of the role of emotion regulation in decision making, by showing that the impact of emotion regulation on judgments and decisions might depend on the target emotion.

Taken together, our study set out to examine how distancing moderates the influence of fear and anger on risk taking. Following our pre-registered hypotheses, we hypothesized that distancing would moderate the negative relationship between fear and risk taking, and the positive relationship between anger and risk taking. We conducted three pre-registered and high-powered studies to test these hypotheses. Study 1 tested the moderating role of habitual distancing on the relationship between trait fear and anger on risk taking. Study 2 experimentally manipulated distancing to examine whether trait fear and trait anger exert stronger effects on risk taking when decision scenarios are imagined as proximal. In other words, Study 2 examined how distancing from the decision-making task regulates the influence of incidental (trait) emotions. Finally, Study 3 manipulated both emotions (fear and anger) and distancing to examine how distancing from current fear-related and anger-related stressors carries over to impact subsequent risk taking.

Ethics and Transparency Statement

The three studies presented in this article received ethical approval from the Norwegian Center for Research Data (NSD) before data collection. Participants in each study provided their consent to participate. We report how we determined the sample size, all data exclusions, all manipulations, and all measures collected in this study (Simmons et al., 2012). We pre-registered each study on the Open Science Framework (OSF) prior to data collection. The pre-registrations, data, code, and materials associated with this paper are available on the OSF repository.[1]

Study 1

Participants

A total of 400 participants were recruited from Amazon's Mechanical Turk (Mturk), using the CloudResearch platform that blocks low quality participants by default (Litman et al.,

[1] https://osf.io/hg358/?view_only=510f9016d0fc47c39488665fda8d14ab

2017). Mturkers were eligible to participate only if they were currently residing in the US, were native English speakers, completed a minimum of 500 surveys, and had a 95% Mturk HIT approval rating. Participants were paid $1.20 for the roughly 10-min long study. Following the pre-registered exclusion criteria, the final sample included 370 participants (198 males, 171 females, one other/prefer not to answer; M_{age} = 41.58, SD_{age} = 11.96). Participants were excluded if they; spent < two minutes on the entire survey, indicated low English proficiency, reported not being serious about filling in the survey, failed a bot check, failed two out of three attention checks, and if they had correctly guessed the purpose of the study. We estimated the sample size by performing an a-priori power analysis (using Gpower 3.1.9.4) for a hierarchical linear regression model predicting risk preference. The power analysis indicated that we needed a sample of 355 participants to detect a small effect size (f^2 = 0.05; based on a meta-analysis by Wake et al., 2020). We entered the effect size estimate into the power analysis with the following input parameters: α = 0.05, power = 0.90, number of tested predictors = 6.

Design and Procedure

Participants were randomly assigned to receive the risky decision-making tasks in either the gain frame or loss frame (see description below). At the start of the survey, they read a consent form and indicated their agreement. Those who agreed received a brief cover story to dissociate the emotion measures from the risk preference measures. Specifically, we told them that different researchers had pooled together their questions for efficiency purposes and that the survey contained two different questionnaires: a “Self-Evaluation” questionnaire and a second questionnaire about “Preferences.” The trait emotions and habitual distancing measures (and items) were presented first, in random order.

Measures

Habitual Distancing

Individuals' general tendency to engage in distancing to regulate negative emotions was measured using the single-factor Temporal Distancing Questionnaire, developed by Bruehlman-Senecal et al. (2016). Across eight statements, participants indicated how they typically respond to negative events by taking a broad and distant perspective (1 = "strongly disagree," 7 = "strongly agree"). Example statements included "I generally don't take a step back from the event and place it in a broader perspective" (reverse-coded), "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 = 0.88).

Trait Fear

Dispositional fear was measured using the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990). Responses were measured on a 7-point Likert scale (1 = "not at all typical of me," 7 = "very typical of me"). All items were averaged to form a single variable. Example items included "If I do not have enough time to do everything, I do not worry about it" (reverse-coded), "My worries overwhelm me," and "I have been a worrier all my life." The PSWQ has been used in previous studies examining financial risk taking (Maner et al., 2007). The scale demonstrated strong reliability (α = 0.97). Although some theorists conceptualize worry and fear as two different (albeit very similar) emotions (Öhman, 2008), the present study follows the common, broader conceptualization of fear as an emotion that encompasses worry and anxiety (e.g., Borkovec et al., 1998). Indeed, studies on fear and risk taking typically operationalize fear using measures of anxiety and worry. Furthermore, a recent meta-analysis by Wake et al. (2020)

found no differences in the relationship between emotion and risk taking between studies that referred to "fear" and those that referred to "anxiety."

Trait Anger

We measured trait anger using the State-Trait Anger Expression Inventory (STAXI-II; Spielberger, 1999). Using a 10-item scale, participants rated the extent to which various behaviors were typical of them (1 = "almost never," 4 = "almost "always"). Items were averaged to form a single trait anger variable. The STAXI-II is commonly used in studies examining emotions and risk taking (Lerner & Keltner, 2001; Gambetti & Giusberti, 2012, 2014). The scale demonstrated strong reliability (α = 0.90).

Risky Decision-Making Tasks

Participants were presented with three different framing problems that were modeled on the classic Unusual Disease Problem (Kahneman and Tversky, 1979)2: The Cancer Problem (Fagley & Miller, 1987), Plant Problem (Bazerman, 1984), and the Shareholding Problem (Teigen & Nikolaisen, 2009). Half of the participants received the three risky decision-making tasks in the gain frame, while the other half received them in the loss frame. In each task, participants read a scenario and indicated the extent to which they preferred one option over the other on a 7-point Likert scale (1 = "strongly prefer option A over option B," 7 = "strongly prefer option B over A"). Option A was always the safe option, and option B the risky option. Thus, for each participant, risk preference was measured three times. A full description of these tasks can be found on the OSF repository (see text footnote 1). For example, in the Plant Problem (adapted from Bazerman, 1984), participants read:

A large hi-tech company is experiencing serious economic troubles and needs to lay off 6,000 employees. The vice president has been exploring alternative ways to avoid this crisis and has developed two plans:

(gain frame)

Plan A: This plan will save 2,000 jobs.

Plan B: This plan has a 1/3 probability of saving all 6,000 jobs, but a 2/3 probability of saving no jobs.

(loss frame)

Plan A: This plan will result in the loss of 4,000 jobs.

Plan B: This plan has a 2/3 probability of resulting in the loss of all 6,000 jobs, but a 1/3 probability of losing no jobs.

Control Variables

Following the pre-registration, age and gender were included as control variables. Previous research has found that males are more likely to engage in risky behavior and to respond to anger with risk taking (Ferrer et al., 2017). Furthermore, risk taking has also been found to decrease with age (Rolison et al., 2014). We also controlled for framing condition (0 = Gain frame, 1 = Loss frame) to account for potential differences in the influence of emotions in gain and loss frames. The subsequent studies use the same control variables.[2]

Statistical Analysis

A linear hierarchical multilevel model was fitted using the lme4 (Bates et al., 2014) and the *lmerTest* packages implemented in Rstudio (R Core Team, 2014). Risk preference was

[2] The pre-registrations lacked the specification that framing would be used as a control variable. Excluding framing as a control variable from the Study 1 analysis did not significantly change the interaction between distancing and anger but rendered the interaction between distancing and fear insignificant. Excluding framing from the Study 2 analysis did not significantly change any of the two interactions.

predicted by the experimental manipulation (gain vs. loss frame), dispositional fear and anger, habitual distancing, and the interaction of habitual distancing with dispositional fear and anger. Participants and decision tasks were treated as random-intercept effects. The discussion will only focus on the final, overall model (i.e., Step 3). However, mean-centered beta coefficients and model fit statistics for each step of the regression are listed in Table 1. The choice of a linear mixed model deviated from the pre-registration, which specified the use of hierarchical multiple regression. A linear mixed model seemed more appropriate, however, as it accounts for repeated-measures dependencies—in this case, the repeated measure of risk preference across the three risky decision-making tasks. The results remain the same regardless of the analytical approach used. Assumptions of normality of residuals, linearity, and heteroscedasticity did not seem to be violated. For this and the two subsequent experiments, one-tailed *p*-values and confidence intervals are reported for the pre-registered directional hypotheses (Cho and Abe, 2013).[3] For all other tests, two-tailed *p*-values are reported. Descriptive statistics of key variables across the three studies can be found in the online repository.

Results

Hypotheses Testing

All continuous predictors were mean centered before running the analyses (Aiken et al., 1991). Adding "subject" and "scenario" as random effects significantly improved the model fit compared to the model without the random effects, supporting the rationale for using a mixed model. The results from the hierarchical multilevel analysis are summarized in Table 1.[4] Risk

[3] Although the Study 1 preregistration included directional hypotheses – which justifies the use of one-tailed tests (Cho & Abe, 2013) – it did not specify whether one-tailed or two-tailed tests would be used. However, Study 2 and Study 3 preregistrations have specified the use of one-sided testing.
[4] Table generated using the tab_model function in the "sjPlot" in R (Lüdecke, 2021).

preference was significantly higher in the loss frame, $\beta = .44$, $p = .001$ (two-tailed), 95% CI [.17, .72], thus, replicating the classic framing effect. Supporting the pre-registered directional moderation hypotheses, the final model indicated that habitual distancing significantly interacted with dispositional fear, $\beta = .10$, $p = .038$ (one-tailed), 90% CI [.01, .20] and anger, $\beta = -.25$, $p = .029$ (one-tailed), 90% CI [-.46, -.03] in the predicted directions.

None of the simple slopes for the interaction between fear and distancing (low distancing: $\beta = -.07$, $p = .51$, high distancing: $\beta = .16$, $p = .11$) and the interaction between anger and distancing (low distancing: $\beta = .34$, $p = .05$, high distancing: $\beta = -.23$, $p = .38$) were significant. Moreover, contrary to our predicted main effects of fear and anger, neither dispositional fear nor anger alone predicted risk preference (fear: $\beta = .05$, $p = .28$ (one-tailed), 90% CI = -.08, .18; anger: $\beta = .06$, $p = .36$ (one-tailed), 90% CI = -.21, .32).

Table 1. Summary of Hierarchical Multilevel Analysis for Predicting Risk Taking (Study 1)

	Model 1		Model 2		Model 3	
Predictors	*Estimates*	*CI*	*Estimates*	*CI*	*Estimates*	*CI*
Intercept	3.17 **	2.73 – 3.61	3.18 **	2.75 – 3.62	3.18 **	2.74 – 3.62
Age	-0.01	-0.02 – 0.00	-0.02	-0.02 – 0.01	-0.01	-0.02 – 0.00
Gender	-0.14	-0.42 – 0.14	-0.17	-0.45 – 0.12	-0.16	-0.45 – 0.12
Framing	0.43 **	0.16 – 0.71	0.43 **	0.16 – 0.71	0.44 **	0.17 – 0.72
Anger			0.17	-0.08 – 0.42	0.06	-0.21 – 0.32
Fear			0.04	-0.10 – 0.17	0.05	-0.08 – 0.18
Distancing			0.13	-0.00 – 0.26	0.10	-0.03 – 0.24
Distancing x Anger					-0.25 *	-0.46 – -0.03
Distancing x Fear					0.10 *	0.01 – 0.20
Random Effects						
σ^2	2.12		2.12		2.12	
τ_{00}	1.13 subject		1.11 subject		1.08 subject	
	0.11 scenario		0.11 scenario		0.11 scenario	
ICC	0.37		0.36		0.36	
N	369 subject		369 subject		369 subject	
	3 scenario		3 scenario		3 scenario	
Observations	1107		1107		1107	
Marginal R^2 / Conditional R^2	0.018 / 0.379		0.024 / 0.379		0.031 / 0.379	

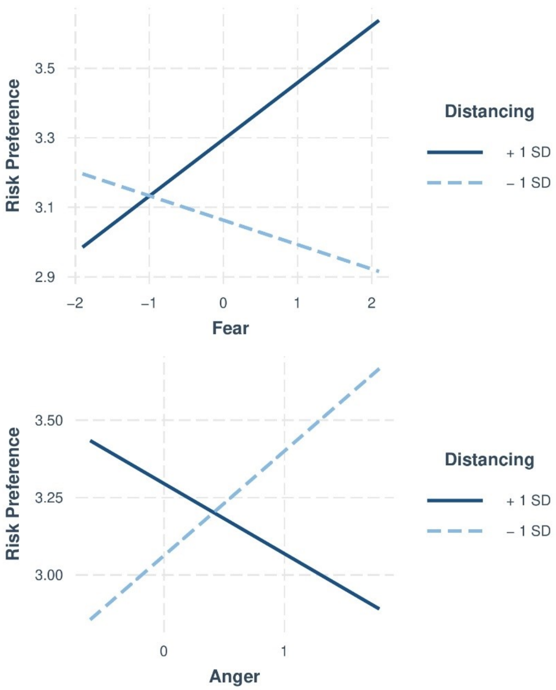
Note. Continuous predictors are mean-centered. **p* < .05, ***p* < .01. One-tailed *p*-values and Cis are reported for the two hypothesized relationships (fear, anger, and their interactions with distancing). Abbreviations: σ^2, within-person variance; τ_{00}, between-person variance; CI, confidence interval; ICC, intraclass correlation.

As shown in Figure 1, for individuals low on habitual distancing, dispositional fear is negatively related to risk preference whereas dispositional anger is positively related to risk preference.[5] Interestingly, this pattern is reversed for individuals high on habitual distancing.

[5] Plot created using the interact_plot() function in the *interactions* package in R (Long, 2020).

Specifically, at high levels of distancing, fear is positively related to risk preference whereas anger is negatively related to risk preference. Thus, not only did distancing attenuate the relationship between fear and risk preference, but even reversed the relationship. These results are discussed later in the Discussion section.

Figure 1. Significant Moderation by Distancing in Study 1



Note. Upper panel: negative relationship between fear and risk taking at lower levels of distancing. Lower panel: positive relationship between anger and risk taking at lowers levels of distancing. Each interaction plot presents the relationship at two levels of the moderator variable (−1SD standard deviation and +1SD standard deviation). Risk preference scored on a 1–7 scale.

Finally, following the pre-registered exploratory analyses, we also tested whether the interactions depended on the framing condition. Accordingly, a new model was tested that included two three-way interactions (fear*distancing*frame, anger*distancing*frame). None of the three-way interactions were significant (fear*distancing*frame: $\beta = -.11$, $p = .383$ (two-tailed), 95% CI = -.34, .13; anger*distancing*frame: $\beta = .23$, $p = .398$ (two-tailed), 95% CI = -.30, .76). This Is consistent with Lerner and Keltner (2001), who argued that the opposite effects of fear on anger (i.e., fear increasing risk aversion and anger increasing risk taking) should hold regardless of framing.

Discussion

Study 1 examined whether habitual distancing (i.e., individuals' general tendency to adopt an objective and distant perspective when faced with negative events) moderates the influence of dispositional fear and anger on risk taking. Drawing on the ATF (Lerner & Keltner, 2001) and a developing line of research on emotion regulation and decision making (e.g., Heilman et al., 2010; Miu & Crişan, 2011; Panno et al., 2013), it was predicted that fear would be negatively related—and anger positively related—to risk taking, but only for individuals low on habitual distancing. Results supported both hypotheses. For individuals low on habitual distancing, fear decreased risk taking and anger increased risk taking. Interestingly, as opposed to the expected pattern of results, we found that fear increased risk taking whereas anger decreased risk taking at high levels of distancing.

Although these results are difficult to interpret, one might speculate that people who naturally engage in distancing are more likely to reframe decision problems in a way that alters the influence of incidental emotions. We suggest that future studies aim to uncover underlying mechanisms. Consistent with Lerner and Keltner (2001), these results did not depend on the frame that participants received. Moreover, dispositional fear and anger alone did not predict risk taking. Their associations with risk taking were qualified by distancing. Finally, it is also worth mentioning that this study included three different domains of risk, thus accounting for possible domain-specific variations (Kühberger et al., 1999).

Taken together, the results suggest that dispositional emotions and emotion regulation through distancing can predict the decisions people make. In Study 2, we used new measures of fear and anger to examine whether the null findings might be attributed to the measures.

Study 2

Study 2 attempted to address some of the limitations in Study 1 in two ways. First, we included new measures of dispositional fear and anger. Second, instead of measuring habitual distancing, we manipulated distancing. Because dispositional emotions may be particularly difficult to regulate (Lerner and Keltner, 2001), an interesting question is whether manipulating distancing from the risky decision-making task itself can reduce the influence of such emotions. To this end, Study 2 aimed to test whether distancing moderates the relationship between (1) dispositional fear and risk taking and (2) dispositional anger and risk taking.

Participants

A total of 600 participants were recruited from Mturk, using the CloudResearch platform (Litman et al., 2017). The sample size was estimated by performing an a-priori power analysis (using Gpower 3.1.9.4) for a hierarchical linear regression model predicting risk preference. The power analysis indicated that we needed a sample of 550 participants to detect a small effect size ($f^2 = 0.02$; based on a meta-analysis by Wake et al., 2020). The effect size estimate was entered into the power analysis with the following input parameters: $\alpha = 0.05$, power = 0.80, number of tested predictors = 3. Mturkers were eligible to participate only if they were currently residing in the US, were native English speakers, completed a minimum of 500 surveys, and had a 95% Mturk HIT approval rating. Participants were paid $1.30 for the roughly 10-minutes long study.

As specified in the pre-registration, participants were excluded if they; spent <2 min on the entire survey, indicated low English proficiency, reported not being serious about filling in the survey, failed a bot check, and if they correctly guessed the purpose of the study. Although not specified in the pre-registration, participants were also excluded if they spent < 3s on the page that included the self-distancing instructions. The final sample included 470 participants (235 males, 233 females, two other/prefer not to answer; M_{age} = 40.55, SD_{age} = 12.21). This study received ethical approval from the Norwegian Center for Research Data (NSD) before data collection.

Design and Procedure

This study used a 2 (distance: near vs. far) x 2 (frame: gain vs. loss) between-subjects design. As in Study 1, participants read a consent form and indicated their agreement. Those who agreed went on to receive a similar cover story and answered the trait emotions measurements. Again, these measures (and items) appeared in random order.

Self-Distancing Manipulation

Participants were randomly assigned to receive either a low distance or high distance prompt right before the risky decision-making tasks were presented. In the high distance condition, participants were instructed to "Imagine that the situation in the scenario happened very far from where you are now, like very long ago, very far in the future, or in another distant country." In the low distance condition, participants were instructed to "Imagine that the situation in the scenario happened very close to where you are now, like yesterday, tomorrow, or right in front of your eyes." This manipulation was adapted from van Dijke et al. (2018) (for a similar distancing manipulation, see Sun et al., 2018).

Measures

Trait Fear

Trait fear was measured using the Fear Survey Schedule-II (Geer, 1965; Bernstein and Allen, 1969). Responses were measured on a 7-point Likert scale (1 = "no fear," 7= "terror"). All items were averaged to form a single variable. Example items included "I fear being criticized," "I'm afraid of snakes," and "I'm afraid of not being a success." This scale has been widely used in previous studies examining fear and risk taking (e.g., Lerner and Keltner, 2001). The scale demonstrated strong reliability (α = 0.86).

Trait Anger

We used two complementary measures of trait anger: the State-Trait Anger Expression Inventory (STAXI-II; Spielberger, 1999) and Lerner and Keltner's (2001) 10-item anger scale. We combined the two measures to form one single index of trait anger (α = 0.94) Subjects rated the extent to which various behaviors were typical of them. Example items from the STAXI-II included "I am quick tempered" and "I feel infuriated when I do a good job and get a poor evaluation." Example items from the Lerner and Keltner (2001) anger scale included "I often find myself feeling angry" and "Other drivers on the road infuriate me." Responses were measured on a 7-point Likert scale (1 = "not at all true of me," 7 = "very true of me").

Risky Decision-Making Tasks

We used the same risky decision-making tasks as those in Study 1. Participants were randomly assigned to receive the tasks in either the gain frame or loss frame.

Manipulation Check

We used a single item from van Dijke et al. (2018): "How far away from the described scenarios did you feel?" (1 = "very close" to 9 = "very far"). Participants received the manipulation check after the decision-making task.

Statistical Analysis

Following our pre-registered plan, before proceeding to our main analysis of the interaction between distancing and emotions, we ran a two-way ANOVA to examine whether there was an interaction between framing and distancing in predicting risk preference. Specifically, we predicted that risk preference would be higher in loss frames and lower in the gain frame when distance is low. The ANOVA yielded a main effect of framing, $F(1, 466) = 52.51$, $p < 0.001$, $\eta_p^2 = 0.101$. However, the ANOVA yielded no main effect of distancing, $F(1, 466) = 0.71$, $p = 0.401$, $\eta_p^2 = 0.001$, and no interaction between distancing and framing, $F(1, 466) = 0.88$, $p = 0.35$, $\eta_p^2 = 0.002$.

Next, we proceed with our main analysis to examine the interaction between fear and distancing, and anger and distancing. A linear hierarchical multilevel model was fitted using the lme4 (Bates et al., 2014) and the *lmerTest* packages implemented in the R statistical environment (R Core Team, 2014). As in Study 1, the decision to use multilevel analysis deviated from the pre-registration, but results remain the same regardless of the analytical approach. Risk preference was predicted by framing (0 = Gain 1 = Loss), dispositional fear and anger, distancing (−0.5 = Near, +0.5 = Far), and the interactions of distancing with dispositional fear and anger. We used effect-coding (−0.5/+0.5) instead of dummy coding (1/0) to be able to interpret the lower-order main effects (Singmann & Kellen, 2019). Participants and decision scenario were treated as random-intercept effects. The discussion will focus only on the final, overall model (i.e., Step 3). Mean-centered beta coefficients and model fit statistics for each step of the regression are listed in Table 2. Assumptions of normality, linearity, and heteroscedasticity did not appear to be violated.

Table 2. Summary of Hierarchical Multilevel Analysis for Predicting Risk Taking (Study 2)

	Model 1		**Model 2**		**Model 3**	
Predictors	*Estimates*	*CI*	*Estimates*	*CI*	*Estimates*	*CI*
Intercept	3.49 **	3.23 – 3.76	3.48 **	3.20 – 3.76	3.47 **	3.20 – 3.75
Age	0.01	-0.00 – 0.01	0.01	-0.00 – 0.02	0.01	-0.00 – 0.02
Gender	-0.23 *	-0.43 – -0.03	-0.24 *	-0.45 – -0.04	-0.25 *	-0.46 – -0.05
Framing	0.71 **	0.52 – 0.91	0.69 **	0.50 – 0.88	0.71 **	0.52 – 0.90
Distance			0.07	-0.12 – 0.28	0.07	-0.12 – 0.26
Anger			0.18 ***	0.09 – 0.27	0.20 **	0.08– 0.32
Fear			0.01	-0.07 – 0.10	-0.12	-0.24 – 0.01
Distance x Anger					-0.04	-0.21 – 0.13
Distance x Fear					0.25 *	0.08 – 0.42
Random Effects						
σ^2	2.04		2.04		2.04	
τ_{00}	0.47 $_{subject}$		0.43$_{subject}$		0.41 $_{subject}$	
	0.05 $_{scenario}$		0.05 $_{scenario}$		0.05 $_{scenario}$	
ICC	0.20		0.19		0.19	
N	468 $_{subject}$		468 $_{subject}$		468 $_{subject}$	
	3 $_{scenario}$		3 $_{scenario}$		3 $_{scenario}$	
Observations	1404		1404		1404	
Marginal R^2 / Conditional R^2	0.053 / 0.247		0.069 / 0.247		0.075 / 0.247	

Note. Continuous predictors are mean-centered. *$p < .05$, **$p < .01$. One-tailed p-values and Cis are reported for the hypothesized relationships (fear, anger, and their interactions with distancing). Abbreviations: σ^2, within-person variance; τ_{00}, between-person variance; CI, confidence interval; ICC, intraclass correlation.

Results

Manipulation Check

An independent samples t-test revealed that participants in the far condition imagined the decision scenarios to be further away ($M = 8.13$, $SD = 1.13$) than participants in the close condition ($M = 2.24$, $SD = 1.60$), $t(468) = -46.14$, $p < 0.001$, $d = -4.27$, 95% CI [−4.58, −3.93].

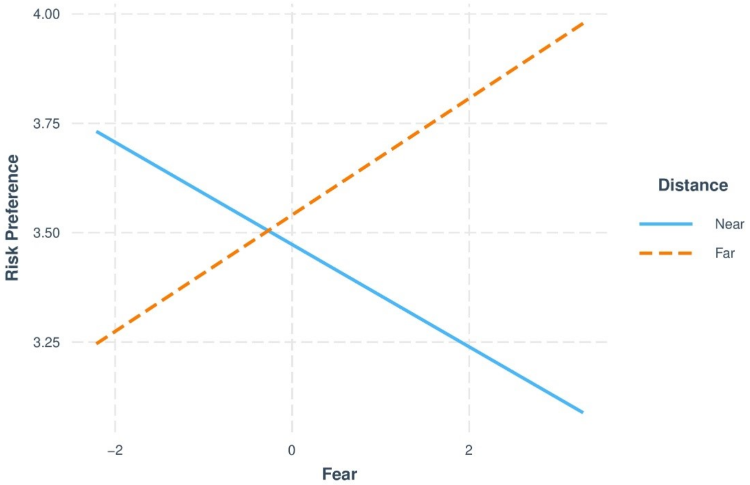
Hypotheses Testing

All continuous predictors were mean-centered before running the analyses (Aiken et al., 1991). Including "subject" and "scenario" random effects significantly improved the model fit compared to the model without the random effects, supporting the rationale for using a mixed model. The results from the hierarchical multilevel analysis are summarized in Table 2.

Risk preference was significantly higher in the loss frame, $\beta = 0.71$, $p < 0.001$, 95% CI [0.52, 0.90]. Thus, replicating the classic framing effects. Dispositional anger predicted higher risk taking, $\beta = 0.20$, $p = 0.003$ (one-tailed), 90% CI [0.07, 0.31]. Dispositional fear, on the other hand, did not significantly predict risk taking, although it was in the predicted direction, $\beta = -0.12$, $p = 0.06$ (one-tailed), 90% CI [−0.24, 0.01]. As predicted, distancing significantly interacted with fear, $\beta = 0.25$, $p = 0.007$ (one-tailed), 90% CI [0.08,0.42]. However, there was no interaction with dispositional anger, $\beta = -0.04$, $p = 0.34$ (one-tailed), 90% CI [−0.21, 0.13]. The simple slopes for the interaction between fear and distancing were not significant (low distance: $\beta = -0.12$, $p = 0.12$; high distancing: $\beta = 0.13$, $p = 0.07$).

Figure 2 illustrates a cross-over interaction between dispositional fear and distancing. In the immersed condition, dispositional fear is negatively related to risk preference. In the distanced condition, dispositional fear is positively related to risk preference.

Figure 2. Significant Moderation by Distancing in Study 2



Note. The interaction plot presents the relationship at two levels of the moderator variable (−1SD standard deviation and +1SD standard deviation). Risk preference scored on a 1–7 scale.

As in Study 1, pre-registered exploratory analyses were performed to test whether the two interactions depended on the framing condition. A new model was tested that included two three-way interactions (fear*distancing*frame and anger*distancing*frame). None of the three-way interactions were significant (fear*distancing*frame: $\beta = 0.01$, $p = 0.95$, 95% CI = −0.38, 0.41; anger*distancing*frame: $\beta = -0.09$, $p = 0.66$, 95% CI = −0.49, 0.31). However, we did not calculate power for these exploratory interactions, which needs to be taken into account when interpreting the results.

Discussion

Study 2 extended Study 1 in two ways; (1) by including new measures of dispositional fear and anger, and (2) by manipulating distancing. As in Study 1, fear alone did not predict risk taking. However, anger was significantly and positively related to risk taking. This suggests that the main association between trait emotions and risk taking may depend on the specific measures used. The main hypothesis of interest was, however, the moderating role of distancing. In Study 2, we tested whether instructing individuals to distance themselves from the risky decision scenarios moderates the relationship between (1) dispositional fear and risk taking and (2) dispositional anger and risk taking. Consistent with Study 1, fear was negatively related to risk taking in the immersed condition. Interestingly, again, distancing not only attenuated this relationship but even reversed it, such that fear was positively related to risk-seeking in the distanced condition. Anger, on the other hand, did not interact with distancing. Finally, as in Study 1, neither interaction depended on the framing (i.e., loss vs. gain).

Study 3

Study 3 attempted to replicate the previous findings in an experiment by manipulating both emotions and distancing. The aim was to test whether distancing oneself moderates the influence of fear and anger on risky judgments and decisions. Specifically, participants adopted either an immersed or distanced perspective while reflecting on fear-related and anger-related stressors before the risky judgment and decision-making tasks. Participants were not instructed to engage in distancing during the tasks as in Study 2. Rather, what we study here can be referred to as incidental distancing.

Participants

A total of 700 participants were recruited from Mturk, using the CloudResearch platform (Litman et al., 2017). We estimated the sample size by performing an a-priori power analysis (using Gpower 3.1.9.4) for a two-way between subject ANCOVA. The power analysis indicated that we needed a sample of 603 participants to detect a small effect size of f^2 = 0.135 (based on a meta-analysis by Wake et al., 2020). The effect size estimate was entered into the power analysis with the following input parameters: $\alpha = 0.05$, power = 0.80, number of groups = 4, number of covariates = 2.

Mturkers were eligible to participate only if they were currently residing in the US, were native English speakers, completed a minimum of 500 surveys, and had a 98% Mturk HIT approval rating. Participants were paid $1.20 for the roughly 10-min long study. As specified in the pre-registration, participants were excluded if they; spent < 2 minutes on the entire survey, indicated low English proficiency, reported not being serious about filling in the survey, failed a bot check and an attention check, and if they had correctly guessed the purpose of the study. The final sample included 643 participants (309 males, 328 females, 6 other/prefer not to answer; $M_{age} = 41.27$, $SD_{age} = 13.15$).

Procedure and Design

Study 3 used a 2 (emotion: fear vs. anger) × 2 (perspective: immersed vs. distanced) between-subjects design. Participants read a consent form first, and those who agreed proceeded to receive a similar cover story like the ones used in the previous two studies.

Emotion Induction

The emotion induction procedure was adapted from Lerner and Keltner (2001) and Lerner et al. (2003). The procedure consisted of two parts. First, they read a short story (131 words in the fear condition, 148 words in the anger condition) that described how the COVID-19 pandemic has increased unemployment and job loss (fear condition) or how the pandemic has resulted in unfair treatment of employees (anger condition). Below the paragraph were real news headlines that matched the content of the story. For instance, in the fear condition, participants saw news headlines about increased unemployment rates and job loss due to the pandemic. In the anger condition, participants saw headlines about companies that had taken advantage of the pandemic and treated employees in unethical ways. Materials are available on the OSF project page (see text footnote 1). In the second part, we asked the participants to think about a specific aspect of the pandemic that has made them most angry/afraid.

Self-Distancing Manipulation

Right after the emotion induction page, participants were asked to reflect on their thoughts and feelings about the emotional event that they identified on the previous page from an immersed or a distanced perspective (adapted from Bruehlman-Senecal & Ayduk, 2015, White et al., 2019). This manipulation focuses on the temporal dimension of psychological distance. Participants received the following instructions:

Immersed condition:

"Now that you've thought of a specific event related to the pandemic that makes you afraid [angry], imagine this very event unfold through your own eyes as if it was happening to you right now. As you continue to see the situation unfold in your own eyes, please take the next couple of minutes to describe your stream of thoughts about how you feel about this event that makes you afraid [angry]."

Distanced condition:

"Now that you've thought of a specific event related to the pandemic that makes you afraid [angry], take a few steps back and move away from the event to a point where it feels very distant from you. To help you do this, imagine what your life will be like 10 years in the future, envisioning what you might be doing and how you might be spending your time at this future time point."

We told them to take at least three minutes to describe their current thoughts and feelings (participants could not proceed to the next page until three minutes had passed).

Measures

Risky Judgment and Decision-Making Tasks

This study included two risk operationalizations; risk taking and risk estimation. We measured risk preference using the same scale as in the previous two studies. This time, as per the pre-registration, participants were given only one risky decision-making task; the Plant Problem (Bazerman, 1984), in the gain frame. Our decision to use only the gain frame was based on a recent meta-analysis by Wake et al. (2020) that suggested a stronger relationship between fear and risk in gain frames.

Risk estimation was measured with an adapted version of Lerner's shortened optimistic risk estimation scale (Lerner & Keltner, 2001; Winterich et al., 2010). Participants indicated from 1 (extremely unlikely) to 7 (extremely likely) the likelihood that each of five positive and negative events would happen to them at any point in their future life. We slightly modified the scale in this study to ensure that the items were better suited for an Mturk sample. Specifically, we excluded the items "I had a heart attack before age 50" and "I got into a prestigious internship program." These two items were replaced with an item from the original scale. The items included in this study were: 1. "I could not find a job for 6 months" (reverse-scored). 2. "I received statewide recognition in my profession." 3. "My income doubled within 10 years after my first job." 4. "I chose the wrong profession" (reverse-scored). 5. "I married someone wealthy." Items were averaged to form an optimistic risk estimates score ($\alpha = 0.56$).

This indicates low reliability but is in line with previous studies (Winterich et al., 2010; Drace & Ric, 2012). As specified in our pre-registration, we included risk estimation as an additional measure to match our experiment more closely with Lerner and Keltner (2001, Study 4). Specifically, in their initial study examining trait fear and anger, they used the Unusual Disease Problem. However, in their follow-up experiment that manipulated both emotions, they used the risk estimation scale. We suspected that the influence of manipulated incidental emotions on risk taking might be weaker in decision tasks like the Plant Problem that seem somewhat more cognitively demanding. Unlike such decision tasks, the risk estimation scale concerns individuals' perceived likelihood of future events. This makes it possible for people to "guess" and rely on their intuition when estimating the likelihood of events—they simply do not have much else to base their judgments on than their gut feeling.

Manipulation Checks

To measure the effectiveness of emotion induction, participants were instructed to indicate how they felt while reflecting on the event in the writing task that they completed before the risky judgment and decision-making tasks. Participants rated the extent to which they felt fearful, worried, anxious, angry, outraged, and irritated (1= "not at all," 7 = "very much"). The first three items were averaged to form an index for fear, and the last three items were averaged to form an index for anger. The temporal distancing manipulation check was measured with a single item: "To what extent did your thoughts during the reflection period focus on the present/near future vs. distant future?" (1 = "the present/near future," 9 = "distant future"). This manipulation check was adapted from Bruehlman-Senecal and Ayduk (2015). Participants received the emotion and distance manipulation check items at the end of the survey.

Results

Manipulation Checks

To examine whether our manipulations were successful, we ran a series of ANOVAs. For perceived distance, an ANOVA revealed that participants in the distant condition focused on the distant future ($M = 6.07$, $SD = 1.36$) more than participants in the immersed condition ($M = 2.02$, $SD = 1.23$), $F(1, 641) = 1{,}563.23$, $p < 0.001$, $\eta_p^2 = 0.710$. For self-reported fear, a two-way ANOVA revealed a significant interaction between emotion and distancing conditions, $F(1, 639) = 23.94$, $p < 0.001$, $\eta_p^2 = 0.040$.

Tukey-adjusted pairwise *t*-tests indicated that participants in the immersed fear condition experienced more fear ($M = 5.30$, $SD = 1.48$) than participants in the distant fear condition ($M = 3.21$, $SD = 1.99$), $t(639) = 10.64$, $p < 0.0001$ (two-tailed), $d = 1.18$, 95% CI [0.94, 1.41], and the immersed anger condition ($M = 3.91$, $SD = 1.90$), t(639) = 7.02, $d = 0.78$, $p < 0.0001$ (two-tailed), 95% CI [0.55, 1.00]. For self-reported anger, a two-way ANOVA did not reveal a significant interaction between emotion and distancing conditions, $F(1, 639) = 0.53$, $p = 0.470$, η2p < 0.001. Suggesting that the manipulation worked in the intended way, Tukey-adjusted pairwise *t*-tests indicated that participants in the immersed anger condition experienced more anger ($M = 5.58$, $SD = 1.41$) than participants in the distant anger ($M = 4.22$, $SD = 1.99$), t(639) = 7.20, $p < 0.0001$ (two-tailed), $d = 0.82$, 95% CI [0.58, 1.05] and the immersed fear conditions ($M = 3.16$, $SD = 1.73$), $t(639) = -13.08$, $p < 0.001$ (two-tailed), $d = -1.45$, 95% CI [−1.69, −1.20]. Overall, these results suggest that the emotion and distancing manipulations were successful.

Hypotheses Testing

Two two-way ANCOVAs were performed that examined the effects of distancing and emotion on risk preference and optimism while controlling for age and gender. First, a two-way

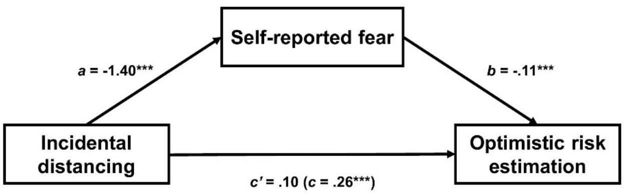
ANCOVA was tested with risk preference (from the framing problem) as the dependent variable. The main effects of emotion, $F(1, 636) = 0.00$, $p = 0.96$, $\eta_G^2 < 0.001$, and distancing, $F(1, 636) = 2.06$, $p = 0.15$, $\eta_G^2 = 0.003$, and their interactions were not significant, $F(1, 636) = 0.94$, $p = 0.33$, $\eta_G^2 = 0.001$. A second two-way ANCOVA was performed with risk estimation as the dependent variable. The main effect of emotion, $F(1, 636) = 0.10$, $p = 0.76$, $\eta_G^2 < 0.001$, and the interaction between emotion and distance, $F(1, 636) = 0.27$, $p = 0.60$, $\eta_G^2 < 0.001$, were not significant.

Incidental distancing, however, had a main effect on risk estimation, $F(1, 636) = 7.81$, $p = 0.005$, $\eta_G^2 = 0.01$. Participants in the immersed condition ($M = 3.16$, $SD = 1.10$) were less optimistic in their risk estimates than participants in the distant condition ($M = 3.42$, $SD = 1.15$), t(638) = −2.82, $p = 0.005$ (two-tailed), $d = -0.22$, 95% CI [−0.38, −0.07]. As per the pre-registration, we also tested the difference in risk estimation between immersed and distanced conditions in each of the two emotion conditions separately. Optimistic risk estimation was higher in the distanced fear condition ($M = 3.46$, $SD = 1.22$) compared to the immersed fear condition ($M = 3.13$, $SD = 1.09$), $t(323) = -2.22$, $p = 0.013$ (one-tailed), $d = -0.25$, 90% CI [−0.43, −0.06]. There was no statistically significant difference in risk estimation between the immersed anger and distanced anger conditions, $t(308) = -1.64$, $p = 0.10$ (two-tailed), $d = -0.19$, 95% CI [−0.41, 0.04]. The section below explores the main effect of distancing further by testing whether self-reported fear mediates the relationship between incidental distancing and risk estimation.

Exploratory Mediation Analysis

Given the main effect of distancing on risk estimation found earlier (section Hypotheses Testing), we performed a mediation analysis to explore whether incidental distancing increased optimistic risk estimation through reduced fear (as measured with the manipulation check). The analysis followed recommendations by Yzerbyt et al. (2018), using the *Jsmediation* package. First, we report the results from the joint significance test of the a-component (a path) and b-component (b path) of the mediation model and conclude mediation if both are significant. Next, we report the boot-strapped estimated size of the indirect effect (ab) and its 95% confidence interval. Results indicated that reduced fear, but not anger, mediated the relationship between incidental distancing and optimistic risk estimation. Specifically, both the a and b paths were significant [a point estimate = −1.40, $SE = 0.15$, $t(641) = 9.59$, $p < 0.001$, b point estimate = −0.11, $SE = 0.02$, $t(640) = 4.77$, $p < 0.001$], as was the indirect effect (point estimate = 0.16, 95% CI [0.09, 0.23], 5,000 Monte Carlo iterations). The model is illustrated in Figure 3.

Figure 3. Mediation Model in Study 3



Note. Coefficients are unstandardized regression coefficients. The unstandardized regression coefficient representing the total relationship between incidental distancing condition and risk estimation is in parentheses. ***$p < 0.001$.

Discussion

In Study 3, we aimed to replicate the findings from the previous two studies by manipulating emotion and distancing. Furthermore, we adjusted our emotion manipulation to the current COVID-pandemic for a more ecologically valid manipulation. We found no support for our hypothesis regarding a moderating role of distancing, nor did we find a main effect of emotion (i.e., fear and anger). However, we found a positive main effect of distancing on risk estimation (but not risk taking). Participants in the distanced condition showed more optimistic risk estimations in a subsequent risk judgment task than participants in the immersed condition. Further exploratory analysis indicated that the effect of distancing on optimistic risk estimation was mediated by reduced fear. In other words, adopting a distant perspective while reflecting on current stressors increased optimistic risk estimation by reducing fear. However, the lack of a control group prevents us from drawing more specific conclusions. We expand on these points in the next section.

General Discussion

The current study set out to examine how psychological distancing moderates the relationship between fear and risk taking, and anger and risk taking. In Study 1, at low levels of habitual distancing, dispositional fear predicted lower risk taking, whereas dispositional anger predicted greater risk taking. These relationships (fear and risk taking, anger and risk taking) reversed among individuals higher on distancing. Study 2 manipulated distancing and used different measures of dispositional fear and anger. Distancing interacted with dispositional fear but not anger. Replicating the pattern for fear observed in Study 1, the relationship between fear and risk taking was negative for participants who adopted a distanced perspective while reading the risk scenarios, but positive for those who adopted an immersed perspective. Finally, Study 3 manipulated emotions and distancing to examine the impact of incidental distancing from fear and anger on risk preference and risk estimation.

While the study found no main effect of emotion or interaction between emotion and distancing on risk preference and risk estimation, exploratory analyses revealed that incidental distancing (across both emotion conditions) increased optimistic risk estimation through a reduction in self-reported fear. This is a relevant finding, as subjective probabilities inform people on what actions they should take, and thus, may shape important life outcomes. Overall, although we find mixed results across the three studies, the results regarding fear reveal a clearer pattern. Distancing moderated the relationship between fear and risk taking the same way in both Study 1 and 2. While we did not observe a moderating effect of distancing in Study 3, distancing increased optimistic risk estimation via reduced fear.

The results contribute to the field by providing important insight into the interplay between psychological distance and emotions in risky judgment and decision making. Previous research has found that distancing is associated with a range of cognitive (Kross & Grossmann, 2012; Grossmann & Kross, 2014; Sun et al., 2018) and affective benefits (Kross et al., 2014; Bruehlman-Senecal & Ayduk, 2015; Nook et al., 2017, 2020; Ahmed et al., 2018; Powers & LaBar, 2019; White et al., 2019). With respect to its emotion-regulatory function, studies suggest that it may be even more effective than its counterpart tactic reinterpretation (Denny & Ochsner, 2014). The overall results of the present research provide some evidence that distancing regulates the influence of incidental fear on judgments and decisions involving risk. The influence of incidental fear (Study 1 and 2) and anger (Study 1) on risk taking was reduced and even reversed among the high distancers.

More specifically, at high levels of distancing, fear increased risk taking. To our knowledge, this is a previously unknown effect. Since we found it in two studies, there is little reason to believe that this is an artifact. Nevertheless, future research is needed to examine how replicable this effect is (i.e., boundary conditions) and what drives it. The measures that we used did not provide much information about the process behind the effect. A previous study has shown that the relationship between fear and risk taking depends on how individuals cognitively frame the situation (Lee & Andrade, 2015). Although Lee and Andrade (2015) did not examine distancing per se, the results suggest that the influence of emotions on risk taking depends on how individuals interpret their emotional experiences. Future studies can try to uncover mediators behind the reversal of the relationship between fear and risk taking by using a similar approach to the one we used in Study 3.

In Study 3, we observed that a decrease in fear mediated the positive effect of distancing on optimistic risk estimation. As our emotion manipulation check only tapped into fear and anger, future studies should include mediators that tap into other emotions that are typically associated with optimism, such as hope and relief. Studies can also investigate the mental and cognitive processes underlying the unexpected positive relationship between fear and risk. One example is information processing. Appraisal theories suggest that uncertainty-related emotions like fear increase systematic reasoning, whereas certainty-related emotions like anger lead to intuitive reasoning (Lerner & Keltner, 2000; Tiedens & Linton, 2001; Lerner et al., 2015). It would be interesting to examine whether the unexpected positive relationship between fear and risk taking—and the negative relationship between anger and risk taking in Study 1—is explained by a shift from systematic processing to intuitive processing and vice versa.

Relatedly, it is possible that distancing regulates the appraisals underlying the predicted effects of fear and anger on risk taking (Lerner & Keltner, 2001). One could therefore test, for example, whether distancing from fear increases risk taking by reducing the level of uncertainty associated with fear.

It should be noted that the effect occurred in decision situations that were characterized by ambiguity. This is relevant since it appears reasonable to expect that reversal effects occur more often in such situations than those that are less ambiguous. Level of ambiguity might therefore constitute a boundary condition for the reversal effect. Indeed, Lerner and Keltner

(2001) documented ambiguity with respect to certainty and control as a boundary condition for the predicted effects of fear and anger. Moreover, although the effects in our study were observed in controlled laboratory settings, they could be expected to exist in real-life decision-making situations (e.g., Hodgkinson et al., 1999). Overall, it remains unclear exactly what lies behind these unexpected associations. We hope that our findings will encourage steps toward a more nuanced understanding of how emotion and distancing interact in risky decision making.

Limitations and Future Research

We would like to highlight several limitations and directions for future research. Overall, we found mixed results with small effect sizes across the three studies. While habitual distancing interacted with both fear and anger (Study 1), manipulated distancing only interacted with fear (Study 2). Study 3 did not find a moderating role of distancing. One possible reason for the mixed results is that we measured and manipulated both emotion and distancing in different ways across the studies. Study 1 looked at habitual distancing from negative events, whereas Study 2 and 3 manipulated distancing. Moreover, overall, we did not find support for our predicted (based on e.g., Lerner & Keltner, 2001; Lerner et al., 2003, 2015; Habib et al., 2015) main effects of fear and anger. This may be attributed to methodological aspects in our studies, as we used slightly different measurements and manipulations. In the one instance where we used the exact measurement used by Lerner and Keltner (2001), we did find a main effect (anger in Study 2). It appears less likely that the null findings can be attributed to power or sample issues. More research is needed to test the replicability of these main effects of fear and anger, and their boundary conditions.

A key strength of this paper is in the multilevel approach used in Study 1 and 2, where participants received the risky decision-making tasks in different domains and frames. However, these tasks do not reflect decision making in real life. Decisions are often made in situations where information about outcomes is unknown. Furthermore, rather than instructing participants to explicitly engage in psychological distancing, decision scenarios can activate psychological distance indirectly by varying the distance of the targets (see Raue et al., 2015). Raue et al. (2015) showed that increasing the psychological distance in risky scenarios eliminated and even reversed the classic framing effects. They interpreted this in terms of a reduction in emotional intensity and a shift from intuitive to deliberate information processing. Our study is the first to test how distance regulates emotional biases in risky decision making. It would be interesting to test whether indirect psychological distance regulates incidental emotions in similar ways.

Moreover, unlike previous studies that have examined the general reappraisal strategy, participants in this study were not explicitly told that the goal was to down-regulate negative emotions through reappraisal. The literature suggests that distancing is an efficient but relatively effortless tactic (Moser et al., 2017) with long-term benefits such as reduced levels of stress (Denny & Ochsner, 2014). There is, however, a need for further research on how distancing impacts risky decision making in emotionally intense real-life situations.

However, studies will also need to examine conditions under which distancing may be ineffective, or even backfire. As noted by Sheppes and Levin (2013), the decision to apply an emotion regulation strategy is a difficult decision in itself. In situations where emotions are known to influence our judgments and decisions in a negative way, it should be advisable to regulate emotions. In other situations, however, it may be less advisable to regulate emotions. Despite potential downsides, we believe that the main function of distancing is not to eliminate emotions, but rather, to help individuals process them.

Finally, there is evidence suggesting that distancing may be less effective in regulating certain emotions. Construal Level Theory (CLT) distinguishes between emotions based on their underlying level of construal (i.e., level of abstractness). For instance, fear constitutes a so-called "low-level" emotion because it is concerned with immediate and visible threats (e.g., seeing a snake while hiking). Anxiety, on the other hand, is a "high-level" emotion because it is concerned with distant and ambiguous threat (e.g., feeling anxious about the possibility of losing one's job in the future). A similar distinction has been made between personal (low-level) and moral anger (high level) (Agerström et al., 2012).

Because high-level emotions like anxiety and moral anger necessitate distancing, CLT predicts that distancing may in fact intensify these emotions. Doré et al. (2015) found that use of anxiety-related words following a tragic event increased over temporal and spatial distance. The opposite was found for sadness-related words. Relatedly, Bornstein et al. (2020) found that abstract processing decreased fear and intensified other high-level emotions like guilt. Agerström et al. (2012) found that greater temporal distance increased anticipated intensity of moral anger but decreased the anticipated intensity of personal anger. Although these studies did not use the same manipulations as those used in our study, the pattern of results suggests that distancing might have different effects on different emotions. Thus, future research examining emotion regulation through distancing and decision making should take into account the abstraction level of the emotion, in addition to other appraisals like certainty and control.

Practical Implications and Concluding Thoughts

The present study points to distancing as a promising tool in organizational settings. For instance, contexts that favor systematic and rule-based decision making might benefit from distancing as a simple tactic to help decision makers avoid excessive risk aversion or risk taking.

The idea that a big picture focus can help improve decision making under risk is not new. In fact, in an early paper on the cognitive aspects of risk taking, Kahneman and Lovallo (1993) argued that “a broad view of decision problems is an essential requirement of rational decision making” (p. 20). They further argued that decision makers, particularly managers, tend to adopt a narrow frame of decision problems, failing to place them in broader contexts (Kahneman and Lovallo, 1993).

Extending Kahneman and Lovallo’s (1993) notion, we believe that one way in which a broad perspective impacts decision making is through the regulation of emotional influences. Distancing can prove effective in situations where fear might lead to excessive levels of risk aversion and where anger might lead to excessive levels of risk taking. Moreover, moving beyond self-regulation, it would be interesting to examine how leaders can regulate employees’ emotions and cognitions. Anecdotal reports suggest that employees around the globe may be experiencing high levels of anxiety and pessimism brought by COVID-19 (Jacobs and Warwick-Ching, 2021). It is conceivable that leaders can regulate employees’ negative emotions and perceptions by removing them from the “here and now.”

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Chapter 3: How Regulating Fear and Anger Impacts Risk-Taking: Unpacking the Cognitive-Processing Mechanisms

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Abstract

We develop and test an integrative model that illustrates how the regulation of fear and anger via self-distancing impacts risk-taking in a repeated-choice task (the Iowa Gambling Task) while also uncovering the information-processing mechanisms. In two preregistered experiments, we found that emotion regulation via self-distancing (vs. self-immersion) reduced risk-taking through changes in information processing. Self-distancing indirectly reduced risk-taking through a decrease in intuitive processing (Experiment 1) and an increase in analytical processing (Experiment 2). These changes in information processing adaptively decreased risk-taking. Consistent with neurocognitive models, we found that a reduction in physiological arousal drove the mediating effect of analytical processing (Experiment 2). While the direct effect of self-distancing on risk-taking varied between those who regulated fear and anger, the indirect effect via information processing was consistent across fear and anger, supporting our preregistered hypotheses. Overall, these findings suggest that self-distancing, even when incidental, facilitates adaptation to uncertainty in decisions involving risk.

Keywords: incidental emotions, risk and uncertainty, self-distancing, intuition and analysis

Introduction

Researchers hold that decisions involving risk are driven by two different mechanisms: risk-as-feelings and risk-as-analysis (Slovic et al., 2004). This dual-process framework suggests that decision-makers tend to rely on their emotions when making decisions involving risk but may override their automatic and emotional responses through deliberation. In other words, regulating one's emotions should trigger a switch from risk-as-feelings to risk-as-analysis. While this prediction is simple and elegant, we know very little about the antecedents and consequences of these mechanisms. Theories make contradicting predictions and empirical studies are sparse.

Unlike decision theoretical models that focus on valence, discrete emotion models propose that specific emotions that are similar in valence and arousal (most commonly tested by contrasting fear and anger) can lead to opposite effects on information processing and risk-taking (e.g., Fessler et al., 2004; Lerner & Keltner, 2001; Raghunathan & Pham, 1999). This prediction is based on the assumption that fear and anger differ in terms of their motivational and cognitive properties. For instance, while anger is associated with certainty and an intuitive approach to decisions, fear is associated with uncertainty and a need for deliberation. As such, discrete emotion models would predict that emotion regulation can activate either the risk-as-feeling or risk-as-analysis mechanism depending on which emotion is being regulated.

Neurocognitive models, however, place greater weight on the role of physiological arousal with regard to information processing. High-arousal emotions can automatically capture attention and disrupt higher-order cognitive processes, that is, lead us to rely more on gut feelings (Arnsten, 2009). From this perspective, the regulation of fear and anger should involve similar information-processing mechanisms in decisions involving risk, since these emotions are characterized by similar levels of physiological arousal.

Integrating discrete emotion models with neurocognitive models, we propose that while the regulation of fear and anger should have differential effects on risk-taking, the information-processing mechanisms should only be sensitive to changes in physiological arousal and should not vary between the regulation of fear and anger (as both are physiologically similar). In two preregistered experiments, we examine how the regulation of fear and anger through self-distancing (Ayduk & Kross, 2017) impacts risk-taking in a repeated-choice task (the Iowa Gambling Task) through changes in information processing, and whether such changes are driven by changes in physiological arousal.

In line with discrete emotion models, we propose differential direct effects of fear and anger on risk-taking. However, our model also integrates the neurocognitive perspective and proposes that the regulation of these two emotions involves similar information-processing mechanisms. Overall, our study sheds light on the complex interplay between emotion regulation, risk, and cognitive processing by integrating discrete emotion models with neurocognitive models.

The Effect of Regulating Fear vs. Anger on Risk-Taking

A valence-based approach to emotions has long been dominant in research on decision-making, with a main focus on the difference between positive and negative emotions (Schwarz & Clore, 2007). However, decision-making researchers have increasingly studied emotions as discrete states that are accompanied by unique motivational and cognitive properties (e.g., Lerner & Keltner, 2000; Raghunathan & Pham, 1999). For instance, Lerner and Keltner (2000) developed the appraisal tendency framework to model the influence of discrete emotions like fear and anger on decisions like risk-taking. The framework assumes that each emotion is associated with a set of cognitive appraisals that causes people to interpret future events in line with the appraisals that characterize the emotion, which in turn account for differences in judgments and decisions.

Lerner and Keltner (2001) showed that fear and anger, both of which are negative and high in arousal, influenced risk-taking in opposite directions, with anger leading to greater risk-taking due to its underlying appraisal of certainty and predictability. Fear, on the other hand, is associated with appraisals of uncertainty and situational control, and leads to less risk-taking. This pattern of findings has been replicated in various studies (e.g., Gambetti & Giusberti, 2012; Habib et al., 2015; Lerner et al., 2003; Tsai & Young, 2010; Wake et al., 2020). Thus, a reasonable prediction is that the regulation of these emotions will also lead to opposite effects on risk-taking. In other words, the impact of emotion regulation on risk-taking might depend on whether one is regulating fear or anger. A study by Mayiwar & Björklund (2021) found some support for this idea.

Integrating the emotion regulation literature with discrete emotion models of decision-making, we hypothesized that the direct effect of emotion regulation on risk-taking depends on the emotion being regulated. Specifically, we hypothesized that the regulation of anger but not fear reduces risk-taking.

In this study, we focus on a strategy of emotion regulation known as cognitive reappraisal. This strategy involves mentally reframing a situation to minimize its emotional impact (McRae & Gross, 2020). This strategy is generally more effective in down-regulating negative emotions than other strategies (see meta-analysis by Webb et al., 2012). We focus on a specific tactic of reappraisal known as self-distancing, which involves viewing an emotion-eliciting event from a detached third-person perspective (Kross & Ayduk, 2017). Studies typically contrast self-distancing with self-immersion (visualizing an emotional experience from a first-person perspective), which usually leads to rumination and maladaptive coping (Kross & Ayduk, 2008).

Unlike previous decision-making studies, the current study focuses on the self-distancing tactic rather than the general reappraisal strategy. There are two key benefits to this. First, the manipulation of self-distancing is less likely to trigger demand effects compared to reappraisal (Webster et al., 2022). Studies that have manipulated reappraisal explicitly instruct participants to reduce negative emotions, which is likely to influence how participants respond to subsequent measures and tasks. Second, self-distancing manipulations usually include self-immersion as a comparison condition. This is helpful for our purposes as it allows us to examine how subtle changes in the instructions provided to participants (i.e., instructing them to adopt a first-person vs. third-person perspective) impacts their decisions.

Unpacking the Information-Processing Mechanisms

According to dual-process theories, decisions are the product of two types of processing. The intuitive Type 1 mode is automatic, quick, and effortless, whereas the analytical Type 2 mode is deliberate, slow, and effortful. Type 1 represents the default mode of processing which can be overridden through Type 2 processing (e.g., Kahneman & Frederick, 2002; Stanovich & West, 2000). Type processing, or intuition, is typically conceptualized as stemming from emotional reactions (Dane & Pratt, 2007; Dickert, 2010; George & Dane, 2016; Hodgkinson & Sadler-Smith, 2018; Sinclair, 2010; Slovic et al., 2007).

Appraisal theorists propose that emotions associated with uncertainty (e.g., fear) prompt analytical processing, whereas emotions associated with certainty (e.g., anger) prompt intuitive processing (Lerner et al., 2015; Tiedens & Linton, 2001). Fear, an emotion associated with perceptions of low certainty, is thought to signal that a situation demands additional attention, thereby triggering analytical processing. In contrast, anger, an emotion associated with perceptions of high certainty, is thought to signal that a situation is under personal control, thereby triggering intuitive processing. Thus, the appraisal tendency framework predicts that the information-processing mechanisms underlying the effect of emotion regulation on risk vary between fear and anger.

However, neurocognitive models predict no difference in information processing between the regulation of fear and anger, because these two emotions are physiologically indistinguishable. Neurologically, a situation that triggers either fear or anger should reduce prefrontal cortex activation and trigger reflexive heuristic-based reasoning due to increases in physiological arousal (Arnsten, 2009; Hodgkinson & Sadler-Smith, 2018; Kaufman, 1999; Lieberman, 2007).

Arnsten (2009) explains that negative arousal triggers a switch "from thoughtful 'top-down' control by the PFC [prefrontal cortex] that is based on what is most relevant to the task at hand, to 'bottom-up' control by the sensory cortices" (p. 4). Crucially, even a small increase in arousal is sufficient to impair cognitive processing (Arnsten, 2009). These neural changes thus correspond to a switch from slow and thoughtful processing by the prefrontal cortex to more rapid and reflexive responses by the amygdala, which can impair problem-solving (Pham, 2007).

Meanwhile, emerging evidence indicates that adaptive emotion regulation strategies trigger the opposite neural changes. For instance, the reappraisal strategy has been linked to a decrease in amygdala activation (i.e., the "emotional part" of the brain) and an increase in top-down regulation by the prefrontal cortex (Drabant et al., 2009; Goldin et al., 2008; Moser et al., 2017; Powers & LaBar, 2019; Sokol-Hessner et al., 2013).

These changes in information processing should, in turn, adaptively reduce risk-taking in the Iowa Gambling Task, in which advantageous decision-making is driven by the avoidance of risky options. Indeed, arousal, which we conceptualize as a key driver of intuitive processing, has been associated with increased attention to high-risk options because such options typically involve greater rewards (e.g., Jahedi et al., 2017; Mano, 1992). This is consistent with studies that have demonstrated that people's general preference for intuitive processing predicts lower task performance whereas preference for analytical processing predicts improved performance, especially in complex tasks (see meta-analysis by Alaybek et al., 2022).

For instance, using the same task employed in the current study (the Iowa Gambling Task), Harman (2011) found a positive association between an analytical cognitive style and performance. Individuals with a low preference for analytical reasoning placed greater weight on risky options with large immediate rewards. It is worth noting that these studies measured individuals' general preference for intuitive and analytical reasoning, thereby assuming that those who performed well also processed information more analytically. In the present study, we measured individuals' actual mode of processing employed during the task.

Taken together, we hypothesized that a) self-distancing reduces risk-taking but only when regulating anger (vs. fear), and b) irrespective of whether individuals regulate fear or anger, self-distancing reduces intuitive processing and increases analytical processing through changes in physiological arousal, and that this change in information processing mediates the effect on risk-taking.

Transparency Statement

We report how we determined the sample size, all data exclusions, all manipulations, and all measures collected in this study. We preregistered both experiments before collecting data and completed data collection before running any analyses. We performed all analyses in RStudio 1.4.1106 (RStudio Team, 2022). The preregistrations, data, code, and supplementary materials can be accessed at https://osf.io/jhdsf/?view_only=37e370391f2947cd9d07b6761b332076.

Experiment 1

Sample

We preregistered the experiment on the Open Science Framework (link: https://osf.io/yr75s/?view_only=a1b2de6b49304a0c9435be117273b041). We recruited participants by posting advertisements on LinkedIn and using paid advertisements on Facebook. The post contained a brief description that masked the experiment's true purpose and a link to a Qualtrics survey. To qualify, participants had to be above 18 years old and fluent in English, as the entire experiment was in English. All participants had the chance to win a gift card worth approximately $100.

Our sample size was constrained by limited resources. Thus, we a priori determined to collect data from as many participants as possible. Following the preregistration, we excluded participants who spent less than three minutes on the experiment, reported not being serious about completing the experiment (< 4 on a 5-point Likert scale), those who indicated low English proficiency (< 5 on a 7-point Likert scale), and those who failed a comprehension check.

Our final sample consisted of 157 participants (79 males, 76 females, two other/prefer not to answer; $M_{age} = 26.77$, $SD_{age} = 7.75$). On average, participants had seven years of work experience ($SD = 8.74$). We conducted a sensitivity analysis by running 100 simulations using the *simr* package (Green & MacLeod, 2016) in RStudio to determine the smallest effect size the study could detect for the interaction between emotion and self-distancing in a logistic mixed effects model predicting risk-taking. This study had 80% power (with $\alpha = 5\%$, one-tailed) to detect a medium effect size (odds ratio of 0.40, which corresponds to a Cohen's *d* of -0.51) for the interaction.

Procedure and Design

After providing their informed consent, participants received a brief "two-part" cover story to dissociate the emotion and emotion regulation induction from the dependent variables. Next, participants proceeded to the online experiment. We manipulated emotions and self-distancing in a 2 (fear vs. anger) x 2 (self-immersed vs. self-distanced) between-subjects design. 43 participants were in the self-immersed fear condition, 39 participants in the self-distanced fear condition, 37 participants in the self-immersed anger condition, and 33 participants in the self-distanced anger condition.

The manipulation consisted of two stages that we adapted from previous studies on incidental emotions and risk (e.g., Lerner & Keltner, 2001) and studies on self-distancing (e.g., Bruehlman-Senecal & Ayduk, 2015; White et al., 2019). In the first stage, we instructed participants to recall and identify an event in their past that caused intense fear or anger. In the second stage, we instructed participants to write about the identified event from either an immersed or distanced perspective. Please see the supplementary file for the instructions.

Next, participants completed the Iowa Gambling Task, followed by the cognitive processing measure, manipulation checks, and demographics. Participants were debriefed at the end.

Measures

Risk-Taking

To simulate risky decision-making in settings characterized by complexity and ambiguity, we used the Iowa Gambling Task (Bechara et al., 1994). Unlike most studies that examine one-shot decision tasks that provide information about outcomes and probabilities, this task requires that participants learn this information through trial and error.

Players see four decks of cards that they must choose from over the course of 100 trials. Each time a card is drawn from one of the decks, the player either wins or loses money. Decks A and B are risky as they yield the largest rewards but also the largest losses. On the other hand, decks C and D yield the smallest rewards but also the smallest losses. The bad decks involve higher risk (as defined by the variance of the deck) than the good decks. Table 1 shows the payoff scheme in the task and each deck's risk profile. Decks A and B are risky and disadvantageous in the long run, whereas decks C and D are safer and advantageous. Players receive no information about the decks and the probabilities of their payoffs; they must rely on their own estimations of risk and determine which decks are risky and which are profitable over time.

Table 1. Payoff Scheme in the Iowa Gambling Task

	Deck A	Deck B	Deck C	Deck D
Gain	$100	$100	$50	$50
Loss	$150-$350	$1250	$50	$250
Gain/loss frequency	5:5	9:1	5:5	9:1
Expected value	-$250	-$250	$250	$250
Risk (std. dev.)	125.63	125.63	25.13	25.13

We administered the task on PsyToolKit (Stoet, 2010, 2017) using the same setup as the original study by Bechara et al. (1994). Participants were endowed with a hypothetical base loan of $2,000 and were instructed to earn as much money as possible.

Information Processing

We used the Cognitive Processing Questionnaire developed by Bakken et al. (under preparation) to measure participants' reliance on intuitive and analytical processing during the task. Participants received the scale after they had completed the Iowa Gambling Task. We used five items that measured analytical processing and three items measuring intuitive processing. These items are based on conceptualizations and operationalizations in previous studies (see Sinclair et al., 2010; Sinclair & Ashkanasy, 2005).

The analytical scale included statements such as “I considered all alternatives carefully,” “I analyzed all available information in detail,” and “I considered all consequences for my decision.” The intuitive scale included statements such as “I made the decision because it felt right to me" and "I based the decisions on my inner feelings and reactions." Participants rated the items on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). The analytical (α = .87) and intuitive (α = .73) scales demonstrated good reliability.

Self-Reported Fear and Anger

Participants indicated on a 7-point Likert scale (1 = *not at all*, 7 = *very much*) the extent to which they felt fearful, worried, anxious, angry, outraged, and irritated during the autobiographical recall task.[6] We averaged the first three items into a fear scale and the last three into an anger scale. Both demonstrated good reliability (α_{fear} = .85, α_{anger} = .89).

Perceived Distance

Finally, we tested whether participants in the distanced condition perceived greater distance from the recalled emotional event we asked them to write about during the first part of the experiment. Participants responded to the item "How far did you feel from the event you wrote about?" on a 7-point Likert scale (1 = *very near*, 7 = *very distant*).

Results

The supplementary file contains the descriptive results from Study 1 and Study 2 (https://osf.io/fx3qc). Following the preregistered analytical plan, we report one-tailed *p*-values and confidence intervals for the preregistered directional hypotheses (Cho & Abe, 2013) and two-tailed *p*-values for exploratory tests.

Self-Reported Fear and Anger

An independent sample *t*-test indicated a significant difference in self-reported fear and anger between the two emotion groups. Those in the fear condition reported significantly higher

[6] We also measured subjective arousal, valence, and appraisals of certainty and control. These are reported in the supplementary file (see the OSF project page).

fear (*M* = 3.34, *SD* = 1.63) than those in the anger condition (*M* = 2.56, *SD* = 1.40); *t*(151) = 3.17, *p* < .001 (one-tailed), *d* = -0.52, 90% CI [-0.79, -0.25]. Similarly, those in the anger condition reported significantly higher anger (*M* = 4.23, *SD* = 1.60) than those in the fear condition (*M*=2.53, *SD* = 1.51); *t*(151) = -6.74, *p* < .001 (one-tailed), *d* = 1.10, 90% CI [0.81, 1.39].

Perceived Distance

An independent sample *t*-test indicated that perceived distance did not significantly differ between the self-immersed and self-distanced groups, *t*(151) = -0.81, *p* = .213 (one-tailed), *d* = 0.13, 90% CI [-014, 0.40]. Descriptively, perceived distance from the recalled event was higher in the self-distanced group (*M* = 4.05, *SD* = 1.44) compared to the self-immersed group (*M* = 3.85, *SD* = 1.70).

Hypothesis Testing

Direct Effect of Self-Distancing from Fear vs. Anger on Risk-Taking

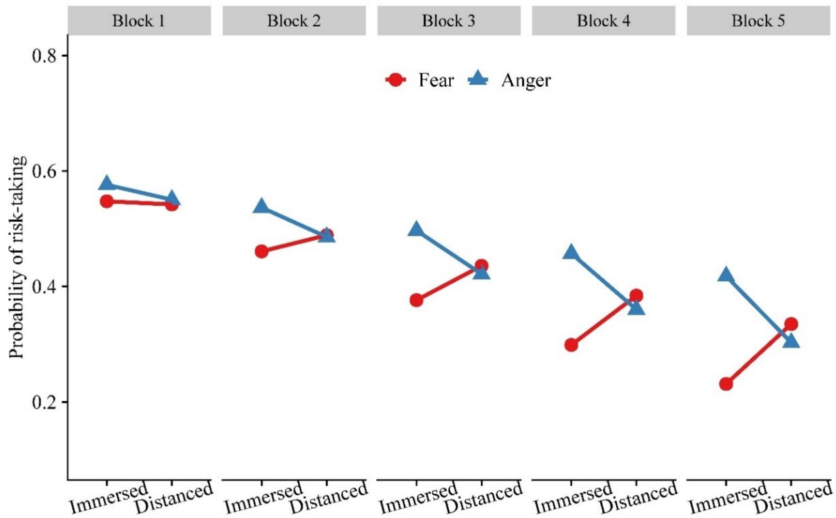
We ran a logistic mixed effects model using the *lme4* package (Bates et al., 2014) to analyze the data with 100 trials nested within each participant. Each participant had 100 responses on the dependent variable (risk-taking). Following the preregistration, we included the interaction between self-distancing and emotion as predictors while controlling for age, gender, subjective arousal, and the two modes of information processing. We included trial and subjects as random factors. Continuous predictors were mean-centered before running the analyses (Aiken et al., 1991). For the emotion and distancing dummy variables, we used effect coding (−0.5/+0.5) (Singmann & Kellen, 2019).

For ease of interpretation, we report the odds ratio instead of the standard coefficient in logistic regression, which represents a log-odds ratio. The odds ratio captures changes in the probability of the event corresponding to a 1-unit change of the predictor. For example, an odds ratio of 1.5 means that the probability of the event is 1.5 times higher (or 50 percent). Values below 1 indicate a negative impact (reduction in odds ratio), values above 1 indicate a positive impact (increase in odds ratio), and a value of 1 indicates no change in odds ratio.

The interaction between incidental anger (vs. fear) and self-distancing (vs. self-immersion) was not significant, exp(b) = 0.59, $p = .100$ (one-tailed), 90% CI = 0.30, 1.16. Figure 1 illustrates the interaction. Next, we explored whether this interaction was moderated by the trials in the task. Researchers have characterized the early trials in the Iowa Gambling Task as decision-making under uncertainty (because not much is known about the relative risks and benefits of each deck) and later trials as decision-making under risk (Buelow & Blaine, 2015). Following previous research, we grouped the 100 trials into five blocks of trials (trials 1-20, 21-40, etc.).

There was a significant three-way interaction between self-distancing, emotion, and block, exp(b) = 0.79, $p < .001$ (two-tailed), 95% CI = 0.71, 0.88. Figure 1 shows that self-distancing reduced risk-taking among angry participants, and this effect gradually strengthened across trials. While the simple slopes were not significant, the results indicated that the effect of self-distancing on risk-taking was negative among angry participants and positive among fearful participants. The simple slopes gradually strengthened with each block of trials and were strongest in the last block (slope of self-distancing in the anger condition in the last block: exp(b) = 0.64, $p = .154$ (two-tailed); slope of self-distancing in the fear condition in the last block: exp(b) = 1.55, $p = .123$ (two-tailed)).

Figure 1. Interaction Between Emotion Regulation and Emotion Condition Across Trials (Experiment 1)



Moreover, block also significantly interacted with the two modes of information processing [intuitive processing*block: exp(b) = 1.07, $p < .001$ (two-tailed), 95% CI = 1.04, 1,10; analytical processing*block: exp(b) = 0.88, $p < .001$ (two-tailed), 95% CI = 0.86, 0.91]. Intuitive processing predicted greater risk-taking whereas analytical processing predicted lower risk-taking. These associations gradually strengthened across trials. The plots are included in the Appendix.

Indirect Effect of Self-Distancing on Risk-Taking via Information Processing

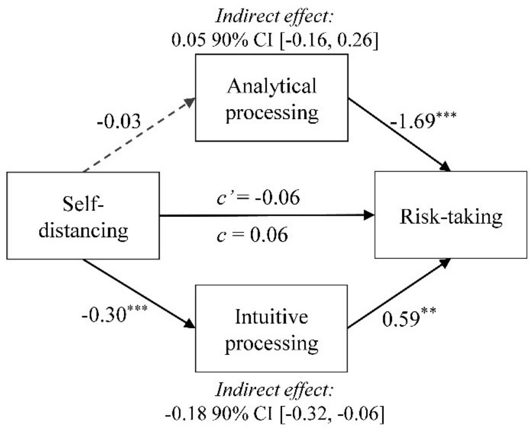
Next, we tested the mediating mechanism of information processing using Model 4 in Hayes' PROCESS macro for R (2017) with 5,000 bootstraps. Hayes' PROCESS does not support mixed-effects mediation analysis. Thus, consistent with previous research, we calculated the sum of selections from the two risky decks and used this as the dependent variable. This deviates from the preregistered analysis in which we specified running the mediation analysis in a mixed effects framework. However, mixed effects mediation analysis is inappropriate here given that the mediators are not repeated measures (only risk-taking is a repeated measure).

We used the same control variables as earlier. We also controlled for the emotion condition (including this does not change the results). A mediation effect is significant if the confidence interval does not include zero. As per our preregistration, we used one-sided testing by estimating 90% confidence intervals for the preregistered directional tests and 95% confidence intervals for exploratory tests.

Intuitive processing significantly mediated the effect of self-distancing on risk-taking (indirect effect: -0.18, 90% CI = -0.32, -0.06). Self-distancing reduced intuitive processing [b = -0.30, $p < .001$ (one-tailed), 90% CI = -0.41, -0.19] which in turn predicted greater risk-taking [b = 0.59, $p = .003$ (one-tailed), 90% CI = 0.86, 0.91]. Self-distancing did not increase analytical processing [b = -0.03, $p = .340$ (one-tailed), 90% CI = -0.15, 0.09]. Although analytical processing predicted lower risk-taking [b = -1.68, $p < .001$ (one-tailed), 90% CI = -2.02, -1.35], it did not significantly mediate the effect of self-distancing on risk-taking (indirect effect: 0.05, 90% CI = -0.16, 0.26).

Figure 2 shows the mediation model and path coefficients. Block did not moderate any of the indirect effects, although the indirect effects gradually strengthened across trials.

Figure 2. Mediation Model (Experiment 1)



Finally, using Model 59 in Hayes's PROCESS macro, we examined whether the emotion condition moderated the indirect effects. The emotion condition did not moderate the indirect effect via intuitive processing (indirect effect = 0.22, 95% CI = -0.11, 0.57) or analytical processing (indirect effect = 0.000, 95% CI = -0.51, 0.50).

Discussion: Experiment 1

Experiment 1 provided some support for our hypothesis that the influence of self-distancing on risk-taking varies between fear and anger. Supporting Hypothesis 1, self-distancing reduced risk-taking but only among participants in the anger condition, although this interaction was only significant in later trials of the task. Moreover, irrespective of the emotion being regulated, self-distancing reduced risk-taking through a decrease in intuitive processing. Analytical processing, however, did not significantly mediate this effect. Thus, we found partial support for Hypothesis 2. Overall, these results provide some preliminary evidence for the idea that while the distinction between fear and anger is important with respect to the direct effect of emotion regulation on risk-taking, this distinction seems less relevant when it comes to the indirect effect of emotion regulation via information processing.

Nevertheless, the experiment has several limitations. First, as this was an online experiment, it is possible that lack of control over environmental disturbances (e.g., multitasking, interruptions, and other distractions) made the manipulations of emotions and emotion regulation less effective and the proposed relations weaker than expected. Indeed, the perceived distance manipulation check did not significantly differ between the self-immersed and self-distanced groups. In addition, it is not clear why intuitive but not analytical processing mediated the effect of self-distancing.

In Experiment 2, we aimed to address these limitations by running the same experiment in a controlled laboratory setting. We also included a physiological measure of arousal to directly examine our assumption that the information-processing mechanisms underlying the effect of self-distancing on risk-taking are driven by changes in physiological arousal.

Experiment 2

We ran the second experiment in a controlled laboratory setting. Participants were seated in isolated rooms connected to sensors that measured their physiological arousal. They completed the emotion and distancing manipulation using paper and pen. See the "supplementary material" folder on the OSF page for an image of the experimental setting.

Sample

We preregistered our experiment on the Open Science Framework (link: https://osf.io/c6ft4/?view_only=bb9ee995bc7a4434b765e3d9605b86ae). Participants were mainly students at a business school. To qualify, participants had to be above 18 years old and fluent in English. Participants had the chance to win a gift card worth approximately $100. As our sample size was constrained by limited resources, we set out to recruit at least 200 participants. A total of 150 people participated in the laboratory experiment. Six participants did not complete the decision-making task, leaving us with a final sample size of 144 (73 males, 71 females, M_{age} = 26.17, SD_{age} = 7.98). Participants had, on average, eight years of work experience (SD = 11.70).

We conducted a sensitivity analysis by running 100 simulations using the *simr* package (Green & MacLeod, 2016) in RStudio to determine the smallest effect size this study could detect for the interaction between emotion and self-distancing in a logistic mixed effects model predicting risk-taking. This study had 80% power (with α = 5%, one-tailed) to detect a medium effect size (odds ratio of 0.38, which corresponds to a Cohen's d of -0.54) for the interaction.

Procedure, Design, and Measures

We used the same procedure and measures as in Experiment 1, except that we included a skin conductance measure and had participants complete the emotion and self-distancing component using paper and pen.

27 participants were in the self-immersed fear condition, 28 participants in the self-distanced fear condition, 33 participants in the self-immersed anger condition, and 32 participants in the self-distanced anger condition.

Scale reliabilities were similar to those observed in Experiment 1: intuitive (α = .69), analytical (α = .86), self-reported fear (α = .88), and self-reported anger (α = .90).

Physiological Arousal

Sensors were attached to each participant's palm and forearm of their non-dominant hand that measured skin conductance. We instructed participants to sit still and only use their dominant hand to complete the experiment. The skin conductance data were extracted and analyzed in Ledalab 3.4.8 (a Matlab-based toolbox; Benedek & Kaernbach, 2010). We decomposed the recordings into continuous signals of tonic and phasic activity using continuous decomposition analysis, as recommended by Benedek and Kaernbach (2010). A key advantage of this method is a reduced risk of underestimating skin conductance amplitudes due to superimposed skin conductance responses (Benedek & Kaernbach, 2010).

After decomposition, we extracted several parameters using an amplitude criterion (i.e., the threshold for a skin conductance response to be registered) of 0.05 muS and a response window of 1-15 seconds following the onset of the self-distancing (vs. self-immersion) instructions. We used integrated skin conductance responses, which researchers have recommended over other indices (Benedek & Kaernbach, 2010; Caruelle et al., 2019; Christopoulos et al., 2019).

Results

Self-Reported Fear and Anger

Those in the fear condition reported significantly higher fear $M = 3.69$, $SD = 1.76$) than those in the anger condition ($M = 2.69$, $SD = 1.48$); $t(142) = 3.73$, $p < .001$ (one-tailed), $d = -0.63$, 90% CI [-0.91, -0.34]). Similarly, those in the anger condition reported significantly higher anger ($M = 4.13$, $SD = 1.48$) than those in the fear condition ($M = 2.31$, $SD = 1.41$); $t(142) = -7.52$, $p < .001$ (one-tailed), $d = 1.26$, 90% CI [0.96, 1.56].

Perceived Distance

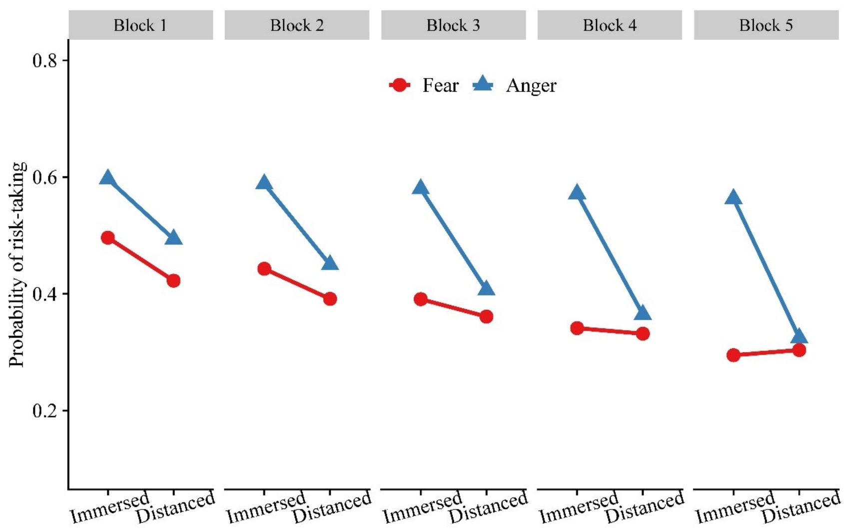
Participants who reflected on their fear or anger-eliciting event from a distanced perspective reported significantly greater perceived distance ($M = 4.36$, $SD = 1.44$) than the immersed participants ($M = 3.68$, $SD = 1.55$), $t(142) = -2.73$, $p = .004$ (one-tailed), $d = 0.46$, 90% CI = 0.18, 0.73.

Hypothesis Testing

Direct Effect of Self-Distancing from Fear vs. Anger on Risk-Taking

We ran the same logistic mixed effects model as in Experiment 1. The predicted interaction between the emotion regulation (self-immersed vs. self-distanced) and emotion (fear vs. anger) conditions was not significant, exp(*b*) = 0.57, $p = .163$ (one-tailed), 90% CI = 0.29, 1.11. However, as in Experiment 1, we found a significant three-way interaction between emotion regulation, emotion, and block, exp(*b*) = 0.80, $p < .001$ (two-tailed), 95% CI = 0.72, 0.89. As shown in Figure 3, the negative effect of self-distancing on risk-taking is notably stronger in the anger condition. Simple slopes analysis indicated that the negative effect of self-distancing on risk-taking was significant in later trials, but only in the anger condition, exp(*b*) = 0.41, $p = .002$ (two-tailed), and not in the fear condition, exp(*b*) = 0.99, $p = .981$ (two-tailed).

Figure 3. Interaction Between Emotion Regulation and Emotion Condition Across Trials (Experiment 2)

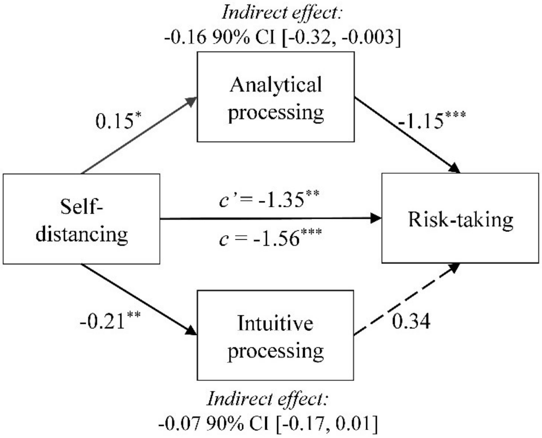


Moreover, consistent with Experiment 1, block significantly interacted with the two modes of information [intuitive processing*block: exp(b) = 1.05, $p < .001$ (two-tailed), 95% CI = 1.02, 1.08; analytical processing*block: exp(b) = 0.85, $p < .001$ (two-tailed), 95% CI = 0.83, 0.88]. Intuitive processing predicted greater risk-taking whereas analytical processing predicted lower risk-taking. These associations gradually strengthened across trials (see Appendix for the interaction plots).

Indirect Effect of Self-Distancing on Risk-Taking via Information Processing

We used the same analytical approach as in Experiment 1. Analytical processing significantly mediated the effect of self-distancing on risk-taking (indirect effect: -0.16, 90% CI = -0.32, -0.02). As shown in Figure 4, self-distancing increased analytical processing (b = 0.14, p = .03 (one-tailed), 90% CI = 0.02, 0.27) which in turn decreased risk-taking (b = -1.15, $p < .001$ (one-tailed), 90% CI = -1.48, -0.81). Although self-distancing reduced intuitive processing (b = -0.21, p = .001 (one-tailed), 90% CI = -0.33, -0.10), intuitive processing did not significantly predict risk-taking (b = 0.34, p = .120 (one-tailed), 90% CI = -0.02, 0.70) and did not mediate the effect of self-distancing (indirect effect: -0.07, 90% CI = -0.17, 0.01). Block did not moderate any of the indirect effects (although the indirect effects gradually strengthened across trials).

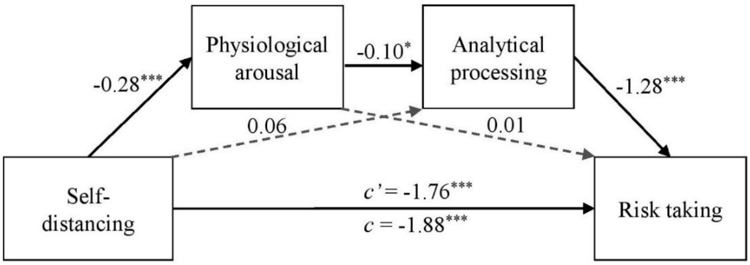
Figure 4. Mediation Model (Experiment 2)



Next, we tested our key assumption that physiological arousal drives changes in information processing. Given that analytical processing mediated the effect of self-distancing on risk-taking, we examined whether self-distancing reduced risk-taking by decreasing physiological arousal and subsequently increasing analytical processing. We ran a serial mediation model using Model 6 in Hayes' PROCESS macro. Following the previous mediation analyses, we controlled for the emotion condition. We also included gender as a control variable because it correlated significantly with physiological arousal (the results remain the same without controlling for gender). Continuous predictors were standardized.

The serial indirect effect via physiological arousal and analytical processing was significant (index of serial indirect effect: -0.02, 95% Bootstrap CI = -0.05, -0.00). Self-distancing reduced physiological arousal (b = -0.28, p < .001 (two-tailed), 95% CI = -0.44, -0.12), which in turn predicted lower analytical processing (b = -0.10, p = .018 (two-tailed), 95%CI = -0.17, -0.02), which finally predicted less risk-taking (b = -1.28, p < .001 (two-tailed), 95%CI = -1.75, -0.81). The serial mediation model is shown in Figure 5.

Figure 5. Serial Mediation Model (Experiment 2)



Finally, using Model 87 in Hayes' PROCESS, we found that block moderated this serial indirect effect (*b* = -0.02, 95% Bootstrap CI = -0.04, -0.00), such that the strength of the indirect effect gradually strengthened across trials and became significant in the last block of trials (*b* = -0.14, 95% CI = -0.51, 22).

Discussion: Experiment 2

While our preregistered analysis did not find a significant moderating effect of self-distancing, we replicated the exploratory three-way interaction observed in Experiment 1: Self-distancing reduced risk-taking but only among angry participants, and this effect gradually strengthened across the trials. Similarly, we found that the hypothesized influence of information processing on risk-taking increased with each block. Participants who relied on their intuition took more risks in later trials, whereas those who relied on careful analysis took fewer risks.

Finally, while self-distancing reduced intuitive processing and increased analytical processing, only analytical processing mediated the effect of self-distancing on risk-taking. Analytical processing reduced risk-taking, but intuitive processing's positive effect on risk-taking was not significant. As in Experiment 1, none of the indirect effects were moderated by the emotion condition (fear vs. anger). Finally, a serial mediation model showed that the indirect effect of self-distancing on risk-taking through analytical processing was driven by a decrease in physiological arousal.

General Discussion

The current study demonstrates how the regulation of fear and anger impacts risk-taking in a repeated-choice experience-based task while also unpacking the much-debated cognitive-processing mechanisms. Self-distancing adaptively reduced risk-taking (in the Iowa Gambling Task), but only among angry decision-makers. Moreover, across both fear and anger, self-distancing led to a decrease in intuitive processing (Experiment 1) and an increase in analytical processing via a reduction in physiological arousal (Experiment 2), which led to an increase in choices from the least risky and most profitable decks. Notably, these effects emerged without instructing participants to minimize their emotions or providing information about how to approach the task; they were simply instructed to adopt a self-distant (vs. self-immersed) perspective while reflecting on an emotional event before the task.

These findings build on a growing line of research on emotion regulation, information processing, and risk-taking (e.g., Heilman et al., 2010; Martin & Delgado, 2011; Mayiwar & Björklund, 2021; Miu & Crişan, 2011; Panno et al., 2013; Sokol-Hessner et al., 2009, 2013) by presenting an integrative model that takes into account the role of discrete emotions and physiological arousal.

Theoretical Implications

Discrete emotion models of decision-making propose that fear and anger—two emotions that are similar in valence and arousal—produce opposite effects on decisions involving risk (e.g., Fessler et al., 2004; Lerner et al., 2015; Raghunathan & Pham, 1999). This hypothesis has received much empirical support (e.g., Gambetti & Giusberti, 2012; Habib et al., 2015; Lerner et al., 2003; Tsai & Young, 2010). In line with this idea, we found that the impact of emotion regulation (via self-distancing) on risk-taking differed between those who regulated fear and those who regulated anger. Self-distancing (vs. self-immersion) reduced risk-taking but only among angry participants, although, this interaction only emerged in later trials.

We found the same trial-dependent effect of information processing on risk-taking. The positive influence of intuitive processing on risk-taking and the negative influence of analytical processing on risk-taking gradually strengthened across trials. These results, although exploratory, offer important insight into how emotion regulation shapes learning.

The gradual increase in risk-taking among the intuitive and non-regulated decision-makers suggests an impairment in learning task-relevant cues and reduced sensitivity to previous losses, leading to poor expectations about the consequences of choices. Unlike one-shot risk-taking tasks that provide explicit information about outcomes and probabilities, we show how participants who regulate their emotions learn critical information about the task as they observe the outcome of their choices across repeated trials in the Iowa Gambling Task (Bechara et al., 1994).

Most importantly, our study provides insight into the information-processing mechanisms underlying the effect of self-distancing. We found that self-distancing indirectly reduced risk-taking through a decrease in intuitive processing (Experiment 1) and an increase in analytical processing (Experiment 2). The serial mediation model in Experiment 2 further specifies this mechanism. Self-distancing reduced physiological arousal, which facilitated analytical processing and enabled decision-makers to improve their choices. Unlike the direct effect of self-distancing on risk-taking, these indirect effects through information processing did not vary between fear and anger. These results support neuroscientific models that highlight the central role of arousal in driving changes in cognitive processing (Arnsten, 2009; Hodgkinson & Sadler-Smith, 2018; Lieberman, 2007).

In a review of the biological relations between arousal and cognition, Arnsten (2009) specifies the chemical pathways of how cognitive processing shifts with increased arousal from a reflective (analytical) to reflexive (intuitive) processing to processing by the prefrontal cortex, even for low levels of arousal. Neuroscientists emphasize the importance of the prefrontal cortex as a "sketch pad" for working memory and executive function (e.g., Goldman-Rakic et al., 1996). In the task we used, remembering the outcomes and deliberating the consequences of future choices is essential to learning which decks contribute to risks, losses, and gains.

Finally, our findings offer important insight into the learning mechanisms in the Iowa Gambling Task. In this task, participants are hypothesized to rely on emotional markers that develop from implicit learning which they then use to estimate the long-term expected value of choice alternatives (Bechara et al., 1994, 1997).

Damasio and colleagues (Bechara et al., 1994, 1997; Bechara & Damasio, 2005; Damasio, 1996) propose a process that relies on unconscious coordination between emotion and cognition. The present study provides insight into a complementary or alternative mechanism to coordinate emotions and cognition. We find that emotion regulation reduces decision-makers' susceptibility to incidental emotions by increasing analytical processing and reducing intuitive processing. This might help decision-makers better access relevant emotional signals (i.e., somatic markers) to discriminate good decks from bad.

Limitations and Future Research

The current study has several limitations that merit attention, some of which point to potential directions for future research. One limitation of the current study is that we only simulated decision-making conditions without involving real financial consequences. Moreover, we eliminated the type of noise and possible confounding variables we would find in a real-life setting. Hence, replicating our findings in a real-life context may be difficult. Other variables may increase or decrease the effects we identified in our relatively controlled setting. Nevertheless, we ran Experiment 1 online, where we had little control over potential disturbing factors. Although this decreased experimental control, it also arguably made Experiment 1 closer to a real-world setting where such disturbances are natural.

Moreover, the hypothesized difference between fear and anger only emerged in the final trials of the task. One explanation is offered by the appraisal tendency framework. Lerner and Keltner (2001) suggested, and showed, that differences in risk-seeking between fearful and angry individuals emerge most strongly when participants judge events that are ambiguous in terms of controllability and predictability. For events that are clearly controllable and certain (or clearly uncontrollable and uncertain), these appraisal tendencies are no longer relevant because the judgment target is unambiguous with respect to these dimensions. It is possible that the last stage of the Iowa gambling task involves a degree of ambiguity that is not too ambiguous or non-ambiguous, as participants have gained sufficient experience to develop some sense of predictability. Future research is needed to test the robustness of this exploratory finding.

Finally, although we found support for our hypothesis that the information-processing mechanisms should not vary between fear and anger, the lack of statistical significance does not provide any evidence of the absence of an effect. A more well-powered experiment may indeed reveal significant results. However, it is worth noting that, aside from the lack of statistical significance, the direction of the moderated mediation effect went in opposite directions across the two experiments. Thus, even if we expect a difference between fear and anger, it is difficult to predict how such an effect might look.

Conclusion

The current study elucidates how the regulation of fear and anger impacts risk-taking while also unpacking the information-processing mechanisms. Self-distancers were less susceptible to the influence of fear and anger when making decisions involving risk and processed information less intuitively and more analytically. Overall, these results suggest that self-distancing, even when incidental, helps decision-makers reduce ambiguity and adapt more efficiently to dynamic choice environments.

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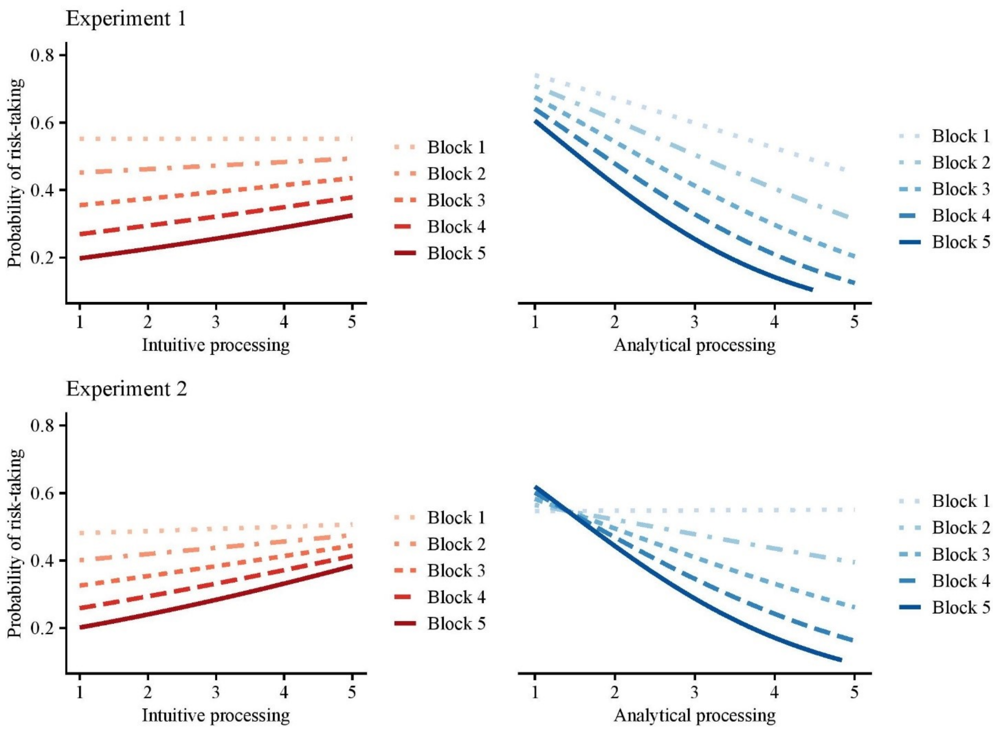
Appendix

Interactions Between Information Processing and Block in Experiments 1 and 2



Chapter 4: Social Distance and Information Processing in Decisions Involving Risk

Lewend Mayiwar

Abstract

Building on an extensive line of research on self-other differences in risky decision-making, this study investigated the underlying information processing mechanisms. In a preregistered experiment, employees and leaders (*N* = 602) recruited from various organizations (finance, health, and government) completed a hypothetical decision-making task relevant to their work or industry. Participants completed the task in both gain and loss frames. Next, participants reported the extent to which they processed information intuitively and analytically. Results indicated that participants who made decisions on behalf of others (a colleague or a new customer) processed information less intuitively compared to those who made decisions for themselves. Social distance did not impact analytical processing. The reduction in intuitive processing predicted lower risk-seeking. Exploratory analysis indicated that these effects only emerged among non-leaders. These findings are discussed in light of dual-process models of risk-seeking and highlight the importance of considering the role of experience in decision-making.

Keywords: self-other differences, judgment and decision making, risk and uncertainty, psychological distance, intuition

Introduction

Decisions that involve risk and uncertainty are often stressful, particularly when outcomes have personal implications. However, when observing others struggling with the same decisions, we usually find it considerably easier to remain calm and objective. Psychologists have termed this puzzling phenomenon “Solomon’s paradox” (Grossmann & Kross, 2014), named after a wise king renowned for making wise choices for others, but whose poor personal decision-making led to the downfall of his kingdom.

Researchers have extensively investigated how people’s decisions differ when making choices for themselves versus for others, particularly in the domain of risk. Simply instructing participants to imagine deciding on behalf of a distant other (rather than themselves) neutralizes their risk preferences and judgments (e.g., Andersson et al., 2014; Polman, 2012; Raue et al., 2015; Sun et al., 2017, 2018, 2021; Zhang et al., 2017).

Some organizations have even formed policies and regulations discouraging people from making decisions for socially close others. For instance, the American Medical Association (2023) has implemented specific regulations to prevent doctors from treating themselves, their close friends, or their family members.

What might cause these self-other differences in decision-making? Some researchers have argued that decisions for oneself rely on cues and processes that are unavailable when evaluating the choices of others (Fernandez-Duque & Wifall, 2007). The detached observer may not be as responsive to the potential joy of obtaining a significant reward or the potential remorse of incurring a loss. This asymmetry in decision-making for the self vs. others maps onto the idea that decision-makers approach decisions involving risk through either an emotional or a logical route (Slovic et al., 2004; Slovic & Peters, 2006).

While studies have shown how decision outcomes vary when deciding for others, the underlying processes remain relatively unexplored (Fiedler & Hillenbrand, 2020). The current study tests the hypothesis that as decision-makers experience greater psychological distance when deciding on behalf of others, they experience lower emotional arousal. Given that intuitive responses are largely driven by emotional responses (Dane & Pratt, 2007), especially by arousal (Sinclair et al., 2010), deciding for others should decrease intuitive processing.

Finally, few studies have investigated the influence of social distance on decisions involving risk among experienced decision-makers. For instance, leaders, who have more experience making risky decisions on behalf of others in high-stake situations, might be less sensitive to changes in social distance compared to non-leaders. Our sample, which included both leaders and employees, provides a unique opportunity to examine such differences.

Social Distance and Risk

Social distance refers to the psychological distance one feels from a specific individual or group of people (Trope & Liberman, 2010). People's default reference point is the self and the here and now; it is egocentric. However, people are also capable of traversing the self and here and now through mental abstraction. According to construal level theory (Trope & Liberman, 2010), an increase in psychological distance shifts people's representations from concrete to abstract representations that highlight decontextualized and schematic information. Social distance represents one of the four key dimensions of psychological distance. The remaining dimensions include physical, temporal, and probabilistic distance.

Judgment and decision-making studies commonly induce social distance by instructing participants to imagine deciding on behalf of a friend or colleague (vs. the self). Studies show that social distance attenuates and even eliminates well-known biases like loss aversion—which are believed to reflect intuitive responses.

Several studies have found that participants become less risk-seeking when deciding on behalf of others than themselves (e.g., Fernandez-Duque & Wifall, 2007; Garcia-Retamero & Galesic, 2012; Stone et al., 2013; Zhang et al., 2017; Zikmund-Fisher et al., 2006). While some studies have found a positive effect of social distance on risk-seeking, this effect only seems to emerge in situations where decisions are not very consequential (Beisswanger et al., 2003; Stone et al., 2013). According to Stone and Allgaier's (2008) social values analysis model, decisions for others relative to oneself depend on the value that people place on risks. Specifically, taking risks is perceived positively in situations where the potential impact on relationships is minor, but not in cases where relationships or monetary gains are at stake.

Social Distance and Information Processing

Researchers have speculated that the impact of social distance on risk-taking might be explained by changes in information processing (e.g., Andersson et al., 2014; Fernandez-Duque & Wifall, 2007, Raue et al., 2015).

According to dual-process theories of decision-making, people make decisions using two different modes of processing (Epstein, 1994; Kahneman & Frederick, 2002; Stanovich & West, 2000). The first is an intuitive type that is quick, effortless, and largely based on emotional responses (Dane & Pratt, 2007). The second is an analytical type that is based on slow and effortful processing of relevant information.

Drawing on dual-process process theories of decision-making, researchers have proposed that two key mechanisms underlie decisions involving risk: risk-as-feelings vs. risk-as-analysis (Slovic et al., 2004; Slovic & Peters, 2006). Risk-as-feelings refers to intuitive reactions to threats whereas risk-as-analysis refers to a logical, deliberative approach to assessing risk. While the intuition-analysis duality forms the very basis of behavioral models of risk, very little is known about the antecedents of information processing. I argue that social distance is an important determinant of information processing due to its role in modulating arousal.

Indeed, psychological distance is a well-known tactic of adaptive emotion regulation (Moran & Eyal, 2022; Powers & LaBar, 2019). Psychological distance, more commonly referred to as self-distancing (Kross & Ayduk, 2017), has been associated with reduced arousal and greater activation in brain regions responsible for analytical processing (Powers & LaBar, 2019). Thus, the psychological distance that people experience when deciding for others should, in principle, give rise to similar effects.

Sun et al. (2021) found in a series of experiments that participants who made decisions on behalf of another typical student on their campus were less likely to exhibit biased probability judgments (i.e., overweighting small probabilities and underweighting large probabilities). Importantly, they showed that a reduction in emotional arousal drove this effect. They also found that participants spent more time looking at probability information.

This idea is backed by neuroscientific studies that highlight arousal as a key component in influencing cognitive processes. Neurologically, an increase in arousal impairs regions in the brain responsible for careful and analytical processing. Arnsten (2009) explains that even a mild increase in arousal is sufficient to trigger a switch from top-down regulation based on what is relevant to the task to bottom-up processing based on sensory input. Neuroscientific studies of decision-making have found that biases like loss aversion, which are thought to result from intuitive processing, are associated with increased physiological arousal (Sokol-Hessner et al., 2009). Moreover, neuroimaging studies have shown that brain regions related to emotion are more active when individuals make decisions for socially close individuals than for socially distant individuals (Albrecht et al., 2011; Jung et al., 2013).

Information Processing and Risk

Few studies have empirically examined how the intuitive and analytical modes of information processing predict risk-seeking. Additionally, the literature points to contradicting predictions.

On the one hand, the heuristics-and-biases program (Tversky & Kahneman, 1974) proposes that people are risk-averse when outcomes are framed as gains but risk-seeking when outcomes are described as losses—tendencies that are thought to be driven by intuitive processing (Guo et al., 2017). This perspective would thus predict that intuitive processing will lead to lower risk-seeking when faced with potential gains but greater risk-seeking when facing potential losses.

However, intuitive processing might increase risk-seeking irrespective of framing. Fernandez-Duque and Wifall (2007) found that both a reduction in social distance and faith in intuition predicted greater risk-seeking, although their study did not manipulate gain and loss framing. Moreover, several studies have found a positive association between arousal (a form of intuition) and risk-seeking (Galentino et al., 2017; Jahedi et al., 2017; Mano, 1992; Sullivan et al., 2021; Yechiam & Telpaz, 2011). For instance, across a series of studies, Yechiam and Telpaz (2011) found a positive association between arousal and risk-seeking in the gain frame. Galentino et al. (2017) reasoned that arousal might alter sensitivity to reward, thereby orienting people towards risky options because they are associated with greater reward.

Transparency Statement

Participants in each study provided their consent to participate. I report how I determined the sample size, all data exclusions, all manipulations, and all measures collected in this study (Simmons et al., 2012). The study was preregistered before data collection (https://osf.io/tr6pd/?view_only=e5e18a322b2646e2a5bbd18ca81cacc4). All analyses were carried out in Rstudio 1.4.1106 (RStudio Team, 2022). Data, code, and materials are available at https://osf.io/x96cd/?view_only=4578a1d229c6469d8ca63495e31459ff.

Method

Participants and Design

Participants were 645 employees and leaders in Norway working at three different organizations (data was collected during Spring 2022).[7] Each of the three organizations' human resource departments sent invitation letters to all employees and leaders requesting them to participate in a survey. The first sample consisted of financial advisors at a trade union, most of whom did not occupy leadership positions ($N_{\text{non-leaders}}$ = 185, N_{leaders} = 29).
The second sample consisted of mostly leaders working for a hospital ($N_{\text{non-leaders}}$ = 5, N_{leaders} = 212). The third sample consisted of mostly leaders working for a municipality organization ($N_{\text{non-leaders}}$ = 23, N_{leaders} = 191).

Following the preregistration, I excluded participants if they did not complete the experiment, failed an attention check, and indicated not being serious while completing the

[7] One sample was excluded due to an error in the social distance manipulation, where participants in the distant condition were instructed to make a decision for a distant colleague "who they did not know well". In only this sample, the social distance manipulation led to a significant *decrease* in perceived distance, indicating that those in the socially distant condition perceived the scenario as more proximal than those in the socially proximal condition. Studies have shown that social distance manipulations fail when the distant other is an unfamiliar person (Clark & Semin, 2008; Sun et al., 2017). An unfamiliar colleague may have invoked other cues that somehow led the participants to perceive the distant decision scenario as more proximal. Moreover, the excluded participants were recruited broadly from social media platforms. The other samples consisted of participants from specific organizations who read scenarios that concerned their own organization (in the "self" condition).

experiment (< 5 on a 9-point scale). This resulted in a total sample of 602 participants. Most were in the age ranges of 40-49 and 50-59, and most identified as female (406; $N_{\text{Male}} = 187$; $N_{\text{Other}} = 2$).

Participants were randomly assigned to one of two different conditions: 302 participants completed a decision problem in a socially proximal condition (deciding on behalf of oneself) and 300 participants completed the decision problem in a socially distant condition (deciding on behalf of a distant colleague or a new customer) condition. Next, participants indicated the extent to which they processed information intuitively and analytically and their level of arousal during the problem. Finally, participants provided demographic information.

Risky Decision-Making Problems

Participants completed a risky choice problem modeled on the classic Disease Problem (Kahneman & Tversky, 1979) in which they had to choose between a safe and a risky option. Participants received the problem in both the gain and loss frame in randomized order. Participants first selected one of the two options (0 = Safe option, 1 = Risky option) and then indicated their preference for the risky option over the safe option (1 = *Strongly prefer Plan A,* 5 = *Neutral*, 9 = *Strongly prefer Plan B*). Following the preregistration, I used the continuous variable as the primary dependent measure.

All problems involved high-stake financial situations. Each decision problem was specifically developed for the target sample to enhance the realism of the scenarios and hence the immersion experienced by participants (Aguinis & Bradley, 2014). The decision problems are presented below (only the gain frame is shown here), translated from Norwegian.

Financial Advisors

The sample of financial advisors received the following problem:

You want to **[your new customer wants to]** save NOK 500,000 over 10 years to have extra funds for retirement. You will now be shown two different sets of choices, where you will choose one fund from each set, based on the information provided.

[Next page]

Which plan will you choose? **[Which fund would you advise your former colleague to choose?]**

Plan A: The expected gain at the time of withdrawal is NOK 240,000.

Plan B: There is a 1/3 probability of a gain of NOK 720,000 but a 2/3 probability of no gain.

Leaders at a Municipality Organization

You **[a former colleague]** are the leader of a large department in a district. Significant budget cuts have been announced, which could lead to up to 60 employees being made redundant. Different plans have been developed to handle the budget cuts, and as a leader, you are faced with various choices. You **[your former colleague]** are a key decision-maker and have been presented with two different plans to handle this transition.

[Next page]

Which plan will you choose? **[Which plan would you advise your former colleague to choose?]**

Plan A: 20 of the 60 employees will be keep their jobs.

Plan B: 1/3 probability that all 60 employees will keep their jobs, but a 2/3 probability that none of the 60 employees will keep their jobs.

Employees and Leaders at a Hospital

You work at Innlandet Hospital **[a former colleague now works at another hospital]** which is undergoing extensive restructuring in the coming years. Over the next four years, costs will be cut by up to 100 million Norwegian kroner per year, which means that 400 employees may be affected and lose their jobs. This will affect both patient care and employees to varying degrees. You are a key decision-maker and have been presented with two different plans for managing this restructuring.

[Next page]

Which plan will you choose? **[Which plan would you advise your former colleague to choose?]**

Plan A: 150 of the 400 affected employees will keep their jobs.

Plan B: There is a 35% chance that all 400 employees will keep their jobs.

Measures

Information Processing

After completing the decision-making task, participants indicated the extent to which they processed information intuitively (three items) and analytically (five items) during the task. I adapted these items from an information processing scale developed by Bakken et al. (in preparation). These items are close to conceptualizations and operationalizations in previous studies (Sinclair et al., 2010; Sinclair & Ashkanasy, 2005). Both scales demonstrated good reliability ($\alpha_{analytical} = 0.85$; $\alpha_{intuitive} = 0.70$).

The analytical scale included the following items: “I considered all alternatives carefully,”, “When making decisions, I considered both options”, “I evaluated systematically all key uncertainties", "I analyzed all available information in detail," and "I considered all consequences for my decision".

The intuitive scale included the following items: "I made the decision because it felt right to me", "I based the decision on my inner feelings and reactions", and "It was more important for me to feel that the decision was right than to have rational reasons for it".

Arousal and Valence

After having completed the decision-making task, I used the self-assessment manikin (Bradley & Lang, 1994) to measure the arousal (1 = *Calm*, 9 = *Aroused/Activated*) and valence (1 = *Unhappy*, 9 = *Happy*) of participants' emotions as they were making their decision.

Manipulation Check

Finally, participants indicated their perceived distance using one item: "How near or far did you feel from the decision-making scenario?" (1 = *Very close*, 9 = *Very far*) after having completed the task. I adapted this item from a study by van Dijke et al. (2018).

Demographics

Participants indicated their age, gender (0 = Male, 1 = Female, 2 = Other/prefer not to say), and leadership status (0 = not in a leadership position, in a leadership position).

Results

I preregistered the use of one-tailed *p*-values for the preregistered directional tests and two-sided *p*-values for exploratory tests (Cho & Abe, 2013; Lakens, 2022). However, the preregistration specified testing competing hypotheses, which makes the key tests somewhat exploratory. Thus, two-tailed *p*-values and corresponding 95% confidence intervals are reported for the tests under the section Hypothesis Testing.

Manipulation Check

I ran an independent samples *t*-test to examine whether the social distance manipulation increased perceived distance from the decision-making scenario. Participants reported greater perceived distance in the socially distant condition ($M = 5.89$, $SD = 2.34$) compared to the socially proximal condition ($M = 5.52$, $SD = 2.30$), $t(600) = -1.96$, $p = .025$ (one-tailed), $d = 0.16$, 90% CI = 0.03, 0.29).

Correlations

Table 1 presents the correlations among the key variables. Social distance correlated negatively with intuitive processing ($r = -0.10$, $p = .017$), indicating lower intuitive processing among participants who decided on behalf of someone else. Intuitive processing did not correlate significantly with risk-seeking in the gain frame ($r = 0.07$, $p = .072$) or the loss frame ($r = -0.02$, $p = .660$). Similarly, analytical processing did not correlate significantly with risk-seeking in the gain frame ($r = -0.02$, $p = .665$) or the loss frame ($r = -0.07$, $p = .095$).

Arousal correlated positively with intuitive processing ($r = 0.13$, $p = .001$), supporting the hypothesized positive link between these two variables. Arousal also correlated positively with risk-seeking in both frames (gain frame: $r = 0.16$, $p < .001$; loss frame: $r = 0.13$, $p = .002$).

Furthermore, intuitive processing correlated negatively with response time whereas analytical processing correlated positively with response time, but these correlations were only significant in the loss frame (intuition: $r = -0.09$, $p = .343$; analysis: $r = 0.09$, $p = .028$). Nevertheless, these results still provide some degree of validation of the two measures.

Finally, leadership status correlated with several of the key variables. Thus, subsequent analyses explored whether leadership status moderated the hypothesized effects of social distance on risk-seeking and information processing.

Table 1. Means, Standard deviations, and Correlations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Distance	1.50	0.50								
2. Intuitive	5.10	1.75	-.10*							
3. Analytical	6.58	1.36	-.02	-.03						
4. Risk-Gain	3.80	2.04	-.07	.07	-.02					
5. Risk-Loss	4.14	2.09	.04	-.02	-.07	.51**				
6. RT-Gain	69.59	90.86	.06	-.06	.05	-.03	-.02			
7. RT-Loss	72.79	89.61	-.05	-.09*	.09*	.01	-.01	.08		
8. Arousal	4.04	2.02	-.04	.13**	-.04	.16**	.13**	.02	-.02	
9. Leader	1.67	0.47	.08*	-.16**	-.06	.15**	.19**	.07	.01	.20**

Note. Distance (0 = deciding on behalf of oneself, 1 = deciding on behalf of someone else), RT = response time, Leader (0 = currently not in a leadership position, 1 = currently in a leadership position). * $p < .05$. ** $p < .01$.

Hypothesis Testing

Main Effect of Social Distance on Risk-Seeking

Following the preregistration, I first tested the effect of social distance on risk-seeking in the gain frame and loss frame. All tests were performed using mixed effects modeling with the *lmer* R package (Bates et al., 2014) to account for random variation introduced by the differences in the decision scenarios. While the preregistration specified using the continuous risk preference scale as the primary dependent variable (preference for the risky option over the safe option), I also ran the tests using the binary choice variable (0 = Safe, 1 = Risky) to assess the robustness of the findings.

With the continuous variable as the dependent variable, the linear mixed-effects model indicated that social distance reduced risk-seeking in the gain frame ($B = -0.36$, $p = .024$, 95% CI = -0.68, -0.05) but not in the loss frame ($B = 0.09$, $p = .590$, 95% CI = -0.23, 0.41). Similarly, using the binary choice variable, the binomial mixed-effects model indicated a significant effect of social distance on risk-seeking in the gain frame (*B* = -0.39, *p* = .043, 95% CI = -0.77, -0.01) but not in the loss frame (*B* = -0.16, *p* = .370, 95% CI = -0.51, 0.19).

Indirect Effect of Social Distance on Risk-Seeking via Information Processing

Next, I tested whether information processing mediated the effect of social distance on risk-seeking, using the *mediation* R package (Tingley et al., 2014). Following the previous analysis, the mediation models included sample as a random factor.[8] A mediating effect is significant if the confidence interval does not include zero.

Social distance reduced intuitive processing (*B* = -0.31, *p* = .030, 95% CI = -0.58, -0.03) but did not significantly impact analytical processing (*B* = -0.04, *p* = .716, 95% CI = -0.26, 0.18). Intuitive processing positively predicted the continuous measure of risk-seeking in the gain frame (*B* = 0.13, *p* = .004, 95% CI = 0.04, 0.23) and mediated the effect of social distance on risk-seeking in the gain frame (index of mediation = -0.04, 95% CI = -0.10, -0.002). Intuitive processing did not predict risk-seeking in the loss frame (*B* = 0.04, *p* = .442, 95% CI = -0.06, 0.13), although it was in the same direction as in the gain frame. The same results were found with the binary choice variable.

Indirect Effect of Social Distance on Risk-Seeking via Arousal

As per the preregistration, I also examined whether arousal mediated the effect of social distance on risk-seeking. Social distance had a negative but insignificant effect on arousal (*B* = -0.21, *p* = .189, 95% CI = -0.52, 0.10). With the continuous risk-seeking measure, arousal positively predicted risk-seeking in the gain frame (gain frame: *B* = 0.10, *p* = .014, 95% CI = 0.02, 0.18; loss frame: *B* = 0.07, *p* = .078, 95% CI = -0.01, 0.16), but did not mediate the effect of social distance (index of mediation = -.02, 95% CI = - 0.05, 0.01). Arousal did not predict

[8] The *mediation* package does not accommodate more than one random factor.

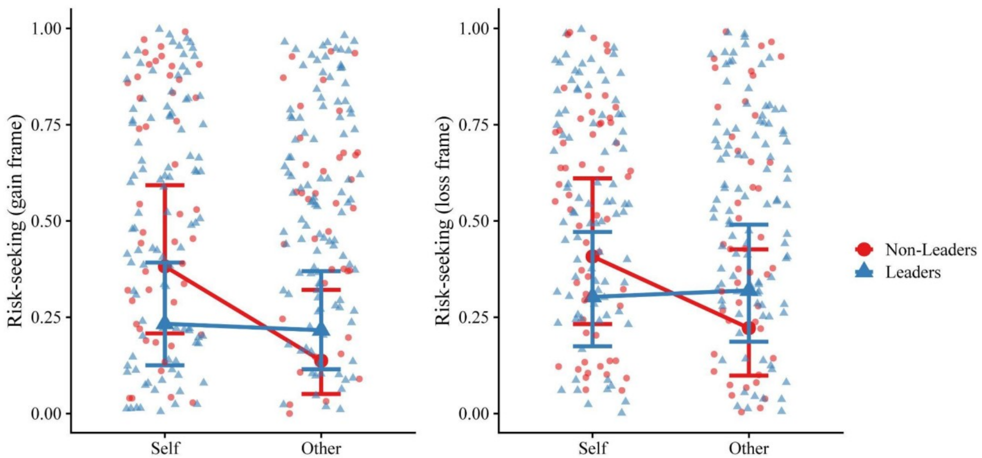
risk-seeking in any frame using the binary risk-seeking variable. Leadership status did not moderate these effects.

Exploratory Analysis

Does Leadership Status Moderate the Effect of Social Distance on Risk-Seeking?

Exploratory analysis indicated a significant interaction between social distance and leadership status (0 = not currently in a leadership position, 1 = currently in a leadership position) in predicting the binary measure of risk-seeking in both frames [gain frame: B = 1.26, p = .013, 95% CI = 0.27, 2.25; loss frame: B = 0.96, p = .027, 95% CI = 0.11, 1.81]. As shown in Figure 1, social distance reduced the likelihood of choosing the risky option among non-leaders in both frames. The interaction is not significant when using the continuous risk-seeking measure, but the pattern is the same [gain frame: B = 0.49, p = .152, 95% CI = -0.18, 1.17; loss frame: B = 0.63, p = .074, 95% CI = -0.06, 1.32].

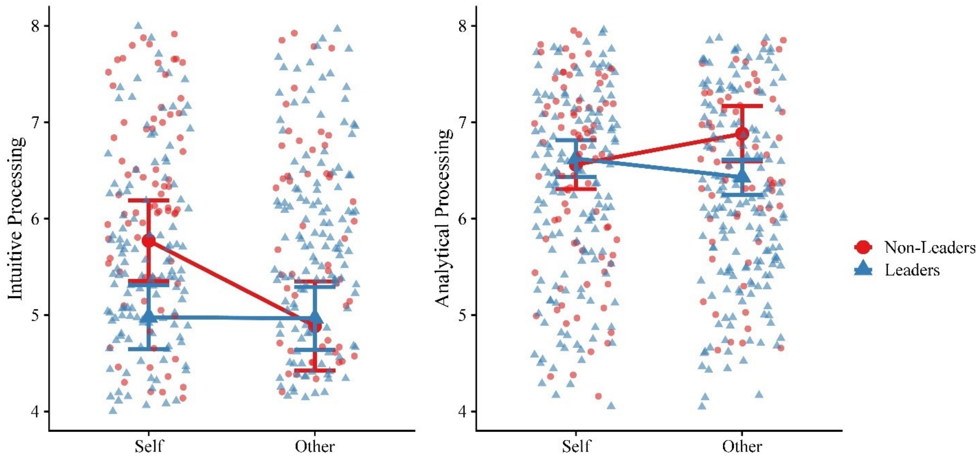
Figure 1. Interaction Between Social Distance and Leader Status in Predicting Risk-Seeking (Binary Variable)



Does Leadership Status Moderate the Effect of Social Distance on Information Processing?

Leadership status moderated the effect of social distance on intuitive processing (B = 0.87, p = .004, 95% CI = 0.29, 1.46) and analytical processing (B = -0.51, p = .031, 95% CI = -0.98, -0.05). Figure 2 shows that social distance reduced intuitive processing and increased analytical processing, respectively, but only among non-leaders.

Figure 2. Interaction Between Social Distance and Leader Status in Predicting Information Processing

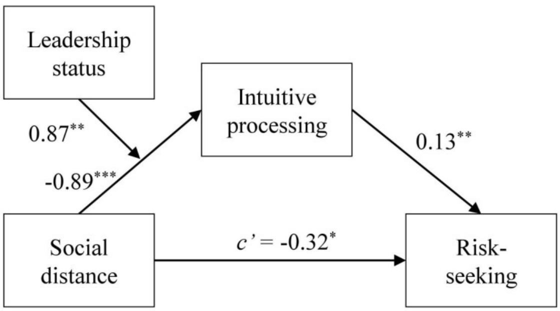


Simple slopes analysis indicated a negative and significant effect of social distance on intuitive processing among non-leaders (B = -0.89, p < .000), and a negative but insignificant effect among leaders (B = -0.01, p = .941). Moreover, although not significant, social distance produced a positive but insignificant effect on analytical processing among non-leaders (B = 0.32, p = .102), and a negative but insignificant effect among leaders (B = -0.19, p = .152).

Does Leadership Status Moderate the Indirect Effects via Information Processing?

Leadership status moderated the mediating effect of intuitive processing, such that the mediating effect was significant among non-leaders (index of mediation = -0.11, 95% CI = -0.21, -0.02) but not among leaders (index of mediation = 0.001, 95% CI = -0.05, 0.06). Using the binary choice variable as the dependent variable produced the same results. Figure 3 shows the moderated mediation model.

Figure 3. Moderated Mediation Model



Analytical processing did not predict risk-seeking in either frame (gain frame: B = -0.01, p = .922, 95% CI = -0.12, 0.11; loss frame: B = -0.07, p = .224, 95% CI = -0.19, 0.04) and did not mediate the effects of social distance (index of mediation = 0.000, 95% CI = -0.01, 0.02). Leadership status did not moderate these effects. These results remained the same across the continuous and binary variables of risk-seeking.

Direct and Indirect Effect of Social Distance on Response Time

Finally, I also explored whether social distance impacted response time during the task (i.e., the number of seconds spent on making a choice) through changes in information processing. Intuitive processing should predict lower response time whereas analytical processing should predict greater response time.

Social distance did not significantly impact response time in either frame (gain frame: *B* = 10.25, *p* = .168, 95% CI = -4.30, 24.81; loss frame: *B* = -9.85, *p* = .178, 95% CI = -24.15, 4.46). Consistent with the correlation results, in the loss frame, intuitive processing predicted lower response time (*B* = -4.88, *p* = .021, 95% CI = -9.01, -0.74) whereas analytical processing predicted greater response time (*B* = 5.89, *p* = .028, 95% CI = 0.64, 11.13). These associations were not significant in the gain frame but were nevertheless in the same direction (intuitive processing: *B* = -2.92, *p* = .171, 95% CI = -7.10, 1.26; analytical processing: *B* = 3.51, *p* = .197, 95% CI = -1.82, 8.84).

Neither intuitive nor analytical processing mediated the effect of social distance on response time. Nevertheless, leadership status moderated the mediating effect of intuitive processing on response time in the gain frame. The mediating effect of intuitive processing was significant among non-leaders (index of mediation = 4.42, 95% CI = 0.57, 10.35) but not among leaders (index of mediation = 0.07, 95% CI = -2.12, 1.85). Leadership status did not moderate the mediating effect of analytical processing.

Discussion

Decision-makers who made decisions on behalf of others processed information less intuitively compared to those who made decisions for themselves. This reduction in intuitive processing in turn predicted lower risk-seeking. These results suggest that social distance triggers a switch from risk-as-feeling to risk-as-analysis (Slovic & Peters, 2006). Finally, these effects only emerged among non-leaders (vs. leaders). Those who were currently in leadership positions appeared largely indifferent to whether the decision concerned others or themselves.

Despite much research on self-other differences in risky decision-making, very little is known about the underlying mechanisms. Researchers have speculated that social distance changes how decision-makers process information. This study is one of the first to test this idea.

Intuitive processing predicted greater risk-seeking in the gain frame (also in the loss frame but not significantly) and mediated the effect of social distance on risk-seeking in the gain frame. Some readers might find this result surprising given the well-documented finding that people are risk-averse in the gain frame and risk-seeking in the loss frame. Since these tendencies are thought to arise from intuitive processing, one might expect intuitive processing to predict lower risk-seeking in the gain frame and greater risk-seeking in the loss frame.

The idea that intuitive processing might increase risk-seeking is, however, not new. For instance, both subjective and physiological arousal—which I conceptualize as a source of intuition–have been associated with greater risk-seeking (Galentino et al., 2017; Jahedi et al., 2017; Mano, 1992; Sullivan et al., 2021; Yechiam & Telpaz, 2011). Galentino et al. (2017) reasoned that arousal might alter sensitivity to reward, thereby orienting people towards risky options because they are associated with greater reward. Across a series of studies, Yechiam and Telpaz (2011) found a positive association between arousal and risk-seeking in the gain frame, but not in the loss frame.

Moreover, these effects were moderated by leadership status. Specifically, the direct effect of social distance on information processing and the indirect effect on risk-seeking only emerged among participants who were not in a leadership position at the time of the experiment. These results suggest that leaders' information processing and choices are more invariant to whether the decision concerns themselves or others. The results are consistent with previous studies. Lo and Repin (2002) found that physiological responses (blood pressure and skin conductance) of professional traders to actual markets influenced the traders' decision-making. This effect was stronger among novices than experienced traders, indicating that emotions are particularly important in relatively novel situations that require cognitive effort.

Not only do the current results identify boundary conditions of self-other differences in the decision-making literature, but it also provides valuable insight for organizations that frequently deal with risks. Managers may want to consider how social distance can be leveraged to facilitate more analytical decisions among less experienced decision-makers.

Furthermore, the current findings are in line with previous studies that have found that social distance reduces risk-seeking (e.g., Fernandez-Duque & Wifall, 2007; Garcia-Retamero & Galesic, 2012; Stone et al., 2013; Zhang et al., 2017; Zikmund-Fisher et al., 2006). According to the social value analysis model (Stone & Allgaier, 2008), self-other differences in risky decision-making depend on the social value of risk. In contrast to low-impact situations, people do not value risk in monetary and high-stakes situations (Beisswanger et al., 2003; Stone et al., 2013), such as the scenarios used in the current study. If this is the case, then intuition and arousal might predict lower risk-seeking in low-stake situations. Future studies are needed to examine how the current findings generalize to such situations.

Finally, the current study proposed that social distance triggers a switch from intuitive to analytical processing due to a reduction in arousal. However, social distance did not significantly reduce arousal, although the effect was in the predicted direction. Nevertheless, consistent with the idea that intuition is driven by emotional responses (e.g., Dane & Pratt, 2007), arousal was positively associated with intuitive processing. In addition, both arousal and intuitive processing predicted greater risk-seeking.

Conclusion

This study uncovers the information-processing mechanisms underlying the effect of social distance in decisions involving risk. Social distance reduced intuitive processing and risk-seeking, but only among non-leaders. These results offer important theoretical and practical insight into the role of psychological distance in decision-making.

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Chapter 5: General Discussion

Revisiting the Research Gaps

This dissertation contributes to the literature on emotions and decision-making involving risk by examining the role of emotion regulation via self-distancing and the underlying cognitive-processing mechanisms. The next sub-sections describe how the findings from three articles address the three research gaps outlined in Chapter 1.

Research Gap 1: The Role of Self-Distancing in Decision-Making

First, the current dissertation provides insight into how a specific tactic of reappraisal—self-distancing—impacts decision-making (research gap 1). In the studies that manipulated self-distancing, participants were not instructed to minimize their emotions, and they received no information about how to approach the tasks; they were simply instructed to adopt a distant perspective. These articles thus demonstrate the generalizability of findings from previous studies that have explicitly instructed participants to regulate their emotions. Such instructions increase the risk of demand effects as participants' responses and choice behavior might follow the expectations implicitly suggested by the design (Webster et al., 2022).

The findings from Article 3 demonstrate that the effects of self-distancing on risk-seeking and information processing may also emerge in contexts where decision-makers decide on behalf of someone else rather than themselves (i.e., social distance). They suggest that the effects of self-distancing on information processing and decisions involving risk are not limited to situations where individuals are directly applying self-distancing to regulate their own emotions but can also apply to situations where individuals make decisions for others.

This broadens the scope of potential applications of self-distancing in decision-making contexts. Construal level theory (Trope & Liberman, 2010) proposes that social, temporal, and physical distance influence people's cognitive processing of events in the same way. Thus, theoretically speaking, an increase in distance along any of these dimensions should produce similar effects.

Research Gap 2: Regulation of Discrete Emotions (Fear and Anger) and Risk-Taking

The current dissertation also shows that the impact of emotion regulation on decisions involving risk might vary depending on which emotion is being regulated. There is an extensive line of research showing that emotions of the same valence and arousal produce opposite effects on judgments and decisions (Lerner et al., 2015; Raghunathan & Pham, 1999). In the domain of risk, studies based on the appraisal tendency framework (Lerner et al., 2015) have focused on fear and anger, finding that anger leads to more risk-taking (Gambetti & Giusberti, 2012; Habib et al., 2015; Lerner et al., 2003; Lerner & Keltner, 2001; Tsai & Young, 2010). The current dissertation provides some evidence indicating that the regulation of these emotions can also produce diverging effects on risk-taking (Articles 1 and 2).

In addition, Articles 1 and 2 examined the regulation of incidental fear and anger. In Article 1, self-distancing reversed the negative influence of fear on risk-taking. Self-distancing moderated the positive relationship between anger and risk-taking in only one of three studies in Article 1. In Article 2, self-distancing reduced the positive effect of anger on risk-taking in the Iowa Gambling Task in both experiments but did little to change the effect of fear.

Research Gap 3: The Cognitive-Processing Mechanisms

Most importantly, this dissertation sheds light on the information-processing mechanisms underlying the effect of self-distancing on risk-seeking (research gap 3). Researchers have long suggested that emotional influences on risky decisions are driven by changes in how people process information. Influential theories like the affect heuristic (Slovic et al., 2007) and risk-as-feelings hypothesis (Loewenstein et al., 2001) propose that people assess risks by either consulting their emotions and gut feelings or by carefully considering objective information such as the probability of outcomes.

However, theories make contradicting predictions. While valence-based models suggest that emotional influences on information processing are determined by valence, discrete emotion models propose that emotions of the same valence can produce opposite effects on information processing (e.g., Lerner et al., 2015).

The current dissertation draws on neurocognitive research to propose that such influences are mainly determined by physiological arousal, a core dimension of emotion that has been relatively underexplored in the decision-making literature. Specifically, the current dissertation proposes that irrespective of valence and emotions' cognitive and motivational properties, increases in arousal should increase intuitive processing and/or decrease analytical processing.

Articles 2 and 3 tested whether intuitive and analytical processing mediated the effect of self-distancing on risk-seeking. Article 2 additionally examined whether physiological arousal drove the changes in information processing. Self-distancing reduced intuitive processing in Articles 2 and 3 and increased analytical processing in Article 2. In addition, Article 2 showed that these changes in information processing were driven by a reduction in physiological arousal.

Moreover, the findings from Article 2 provide insight into how emotion regulation, through changes in information processing, improves learning and adaptability to uncertainty. Unlike Article 1, Article 2 used an experience-based task where participants had to play many trials and learn the outcome probability of different options through trial and error. In the task used in Article 2 (the Iowa Gambling Task), participants are hypothesized to rely on emotional markers that develop from implicit learning which they then use to estimate the long-term expected value of choice alternatives (Bechara et al., 1994, 1997).

The findings from Article 2 suggest that emotion regulation through self-distancing might help decision-makers pick up on these emotional markers that help them adapt to uncertainty by reducing the influence of incidental emotions that are irrelevant to the task.

Notably, Article 2 showed that the effects of emotion regulation and information processing gradually strengthened across trials. Self-immersed angry participants were the slowest to learn the payoff structure in the task—they consistently chose the riskiest and least profitable options. In contrast, self-distanced angry participants were the quickest learners. Self-distancing (vs. self-immersion) mattered less for fear, perhaps because the risk aversion that comes with fear pays off in the Iowa Gambling Task.

Finally, Article 3 also found that the effects of social distance on risk-seeking and information processing only emerged among non-leaders. Leaders' decision-making process was largely unaffected by changes in social distance.

That leaders differ from non-leaders in how they approach risks for other people is an interesting example of principal-agent relations in decision-making (Eisenhardt, 1989). Leaders, as agents, are often responsible for making decisions that affect other people and therefore may be more attuned to the risks and potential consequences of their actions. In contrast, non-leaders may be more focused on their own interests and may take more risks when making decisions for themselves. This finding also suggests that in high-stakes and stressful decisions that require careful and analytical processing, less experienced decision-makers might benefit from incorporating advice from socially distant others, perhaps especially from more experienced others.

General Limitations and Future Directions

Replicability First

High-powered replications are needed to establish the reliability of the findings reported here. In particular, studies will need to test the robustness of the hypothesized differential effect of fear and anger on decision-making involving risk. While the findings from this dissertation suggest that self-distancing has an overall effect on cognitive processing and risk-taking, the hypothesis that the regulation of fear and anger leads to different effects on risk-taking received mixed support.

One explanation might have to do with the fact that discrete incidental emotional influences only emerge in very specific conditions (see Han et al., 2007). For instance, the "matching constraint" principle states that the appraisals underlying emotions must map onto the decision itself (Han et al., 2007). Thus, the differential effects of fear and anger should influence decisions involving risk as such decisions are associated with the emotions' underlying appraisals of uncertainty and control. It is possible that the description-based tasks in Article 1 did not achieve such a match—although, Lerner and Keltner (2001) used this type of task in their original study documenting the differential effects of fear and anger.

Moreover, the "deactivating conditions" principle states that incidental emotional influences disappear when people become aware of inputs to their decision-making process. Although both articles (Articles 1 and 2) that examined incidental fear and anger included a cover story as in previous studies, most participants correctly guessed in an open-ended question that the experiment concerned emotional influences on decision-making.

Moreover, recent meta-analyses have provided weak evidence in favor of the proposed differential effects of fear and anger on judgments and decisions involving risk. In a meta-analysis of 28 experimental studies on the effects of discrete incidental emotions on decision-making under risk and uncertainty, Bartholomeyczik et al. (2022) found no difference between fear and anger. Another meta-analysis by Ferrer et al. (2020) found that anger led to opposite effects on risk depending on whether the anger was integral or incidental. The effect of fear on risk, on the other hand, was consistent, although only when integral.

Overall, these meta-analyses point to the need for replication studies to identify the generalizability of differential effects of fear and anger and the specific conditions that either amplify or dampen such effects.

Venturing into the Field

The studies that comprise the current dissertation relied on hypothetical scenarios. Future studies are needed to examine how emotions and emotion regulation strategies like self-distancing impact decisions involving risk and uncertainty in natural settings. Qualitative studies might offer a useful way to gain rich and in-depth insight into these processes. Case studies, which are particularly useful in theory development and testing (Eisenhardt & Graebner, 2007), can be used to observe how individuals in high-reliability organizations (e.g., hospitals) experience and manage their emotions to navigate risk and uncertainty.

For instance, Fenton-O'Creevy et al. (2011) conducted a qualitative study examining the impact of emotions and emotion regulation on performance among traders in investment banks. Their findings provided important insight into how adaptive emotion regulation through reappraisal improved traders' ability to engage in analytical processing and how this impacted their performance.

In addition, studies may want to examine how emotion-regulation strategies like self-distancing might be more or less adaptive depending on specific situational demands. For instance, some researchers have suggested that in highly stressful situations, reappraisal (which subsumes self-distancing) can be ineffective and costly and that people resort to other simpler strategies (Sheppes et al., 2009; Sheppes & Meiran, 2007, 2008).

It is plausible that cognitive techniques such as self-distancing turn are less effective in very stressful decision-making situations, due to the increased burden on cognitive resources. In other words, tools like self-distancing might fail when they are most needed. However, research indicates that self-distancing is a relatively effortless strategy (Moser et al., 2017; Webster et al., 2022), suggesting that it should be relatively easy to apply in highly stressful and cognitively taxing environments.

Concluding Remarks

The current dissertation provides insight into how emotion regulation via self-distancing influences decisions involving risk and uncertainty, while also unpacking the information-processing mechanisms. Taken together, the findings suggest that decision-makers who adopt a self-distant perspective (vs. a self-immersed perspective) are less susceptible to incidental emotional influences (fear and anger), rely less on their intuition, and take fewer risks.

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