1-2023

Social Influence on Risky Decision Making

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Abstract

Are people's risk preferences influenced by the preferences of others they interact with or observe? Traditionally, decision preferences were conceptualized as a stable, dispositional trait. However, recent research has demonstrated that there is a degree of malleability in preferences, with social influence having a particularly potent impact. To better understand the extent of social influence on risky decision-making, a mixed-study design was carried out that involved participants making a series of hypothetical monetary choices between smaller-certain and larger-risky rewards. Participants completed three blocks of the risky-choice task: (1) the *pre-exposure* block where choices were made without any social information, (2) the *exposure* block where participants observed the choice of a social other after each trial, and (3) the *post-exposure* block where participants once again made choices without any social information. Moreover, the preferences of the social other during the exposure block were experimentally manipulated to be the choices of either a risk-averse decision-maker or a risk-tolerant decision-maker. Two individual difference measures (social comparison orientation, decisional conflict) were also completed prior to the social exposure to investigate if some people are more susceptible to social influence than others. The results indicated that exposure to social information did impact participants' risk preferences. Specifically, whereas the two experimental conditions did not differ during the pre-exposure block, participants in the risk-tolerant social condition exhibited a significantly higher preference for risky rewards during the post-exposure block compared to the risk-averse social condition. Post-hoc analyses indicated that this difference between the two experimental conditions was driven by participants in the risk-tolerant condition significantly increasing their risky choices following the social exposure. For participants in the risk-averse social condition, although risky choices were reduced following the exposure block, this change

did not reach statistical significance. The individual difference analyses found that those who scored higher for decisional conflict were more likely to adjust their risk preferences following the social exposure. In contrast, there was no significant relationship between general social comparison tendencies and changes in risk preference. These findings support the idea that decision-making preferences are informed by the observed preferences of others and have implications for interventions that target risky behaviors in group settings.

Keywords: risky decision-making, risky choice, social influence, social comparison, decisional conflict

MONTCLAIR STATE UNIVERSITY

Social Influence on Risky Decision Making

by

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A Master's Thesis Submitted to the Faculty of

Montclair State University

In Partial Fulfillment of the Requirements

For the Degree of

Master of Arts

December 2022

College of Humanities and Social Sciences

Department of Psychology

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2022

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Social Influence on Risky Decision-Making

Individuals' risk preferences are central to the literature on decision-making (Frey Pedroni, Mata, Rieskamp, & Hertwig, 2017; Johnson, Bixter, & Luhmann, 2020; Mishra, 2014; Polman & Wu, 2020). Decisions involving risk are prevalent across a variety of consequential life outcomes. Risky choices are involved when choosing to save or invest, decisions regarding one's health, entering a new major or profession, making new friends or connections, or engaging in certain activities, such as extreme sports, gambling, or unlawful behaviors. The construct of risky decision-making has been studied across various disciplines, including economics, cognitive psychology, social psychology, health and medicine, and neuroscience, to name a few. Though fundamental theories have been established to explain how individuals make decisions involving risk, less is known about the extent decision preferences are informed by the decisions of others. The current study sought to provide valuable information regarding this important topic.

As human beings, social factors impact just about every decision we make. The power of social influence, which is the tendency for an individual to be affected by the beliefs or behaviors of others, has also been studied for decades in social and cognitive psychology. A particular topic of interest has been if individuals engage in riskier behaviors or act differently in group environments than by themselves. The majority of research investigating the domain of social influence suggests that the presence of others does affect risky behaviors (e.g., Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Gardner & Steinberg, 2005; O'Brien, Albert, Chein, & Steinberg, 2011; Simons-Morton et al., 2011). However, the extent of the influence on risky choices more generally remains unexplored. For instance, risky choice has often been studied in the experimental literature by having individuals make choices between a certain, smaller reward

or a chance at a larger reward with the risk of receiving nothing. While insight into a decision-maker's risk preference is important for understanding the processing of decisions involving risk, how social influence alters preferences on risky choices is also essential to know when making decisions. If social influence affects risky choice preferences, any model of the risky choice process would need to incorporate relevant social factors. More specifically, the current thesis investigated the influence of being exposed to the choice preferences of a social other on subsequent risky choice preferences in a controlled, laboratory setting.

Literature Review

Risky Decision-Making

Risky decisions involve outcome(s) that have some probability associated with their occurrence. In some situations, these probabilities are known to the decision maker prior to making their decision, in other instances these probabilities are uncertain and not known by the decision maker. The present literature on risky decision-making has many theories on how one makes decisions when presented with several choice options with varying levels of risk. A classic behavioral economic theory that helped model how individuals make decisions under risk is prospect theory (Kahneman & Tversky, 1979). Prospect theory branches from its predecessor, expected utility theory, which suggested that decision-makers rationalize the evaluation of all the potential gains and losses and choose the option that maximizes expected utility (i.e., the long-term expected gains of a reward option). Prospect theory is known as a more psychologically realistic alternative as it takes into account that people are not entirely rational when making decisions and have individual reference points determined by several factors, such as current

circumstances, past experiences, cultural norms, and having different preferences towards risk (Kahneman & Tversky, 1979).

This behavioral model explains how decision makers process information with certain cognitive bias and suggests that gains and losses are valued differently. Specifically, the fear of loss influences one to have a stronger preference to avoid losses even if the prospect of a reward option is equivalent or of a larger gain, termed as *loss aversion* (Gächter, Johnson, & Herrmann, 2022; Kahneman & Tversky, 1979; Sokol-Hessner & Rutledge, 2019). Likewise, prospect theory also identifies the idea of the *certainty effect*, which suggests that individuals favor choices that involve guaranteed gains compared to probable or risk outcomes (for a review, see Ramirez & Levine, 2013). However, individual decision-making is a subjective process that is dependent on the person. Individuals process risky decisions based on varying decision-making features. For instance, the evaluations of the risky outcome's worth, the probability of potential gains or losses (Rachlin, Logue, Gibbon, & Frankel, 1986), and valence (Sanfey, Loewenstein, McClure, & Cohen, 2006), which is the affective quality referring to the attractiveness or averseness of the choices to assess the course of action.

When probabilities of risky outcomes are known by the decision maker, the evaluation of the risky choices can be assessed by weighing the outcomes by their respective probabilities, creating an expected value (Kahneman & Tversky, 1979; Li, 2003; Von Neumann & Morgenstern, 1944). Expected value is a way to think about probable future outcomes numerically as it is a probabilistic term depicting the fitting outcome of a scenario. It is calculated by averaging all possible values each multiplied by the probability of its occurrence. The greater the expected value, the higher the attractiveness of the choice. Likewise, the subjective value of an outcome decreases as the probability of obtaining the outcome decreases.

This is known as the probability weighting function, which is not a theory of risk but is used referenced within other theories of risk, i.e., the prospect theory, as a predictive measure for economic situations (Gonzalez & Wu, 1999). Prospect theory highlights that the worth of the outcome is subjective and contingent on varying contexts (i.e., preferences, age, socio-economic status, and education level) shaping risky choices (Kahneman & Tversky, 1979).

To illustrate different risk preferences, imagine a choice between a guaranteed reward of $40 or a 50% chance at a reward of $80 (50% chance of receiving $0). A rational, risk-neutral, decision-maker would be impartial toward the two rewards because the expected values for both rewards are the same (.5 x 80 = 40 and 1.0 x 40 = 40). However, when presented with similar binary monetary choices, researchers have observed different patterns of behaviors across individuals, ranging from a greater reluctance to take risks (risk aversion) to more risk-seeking patterns of decision-making (risk tolerance). Risk preferences are measured in the laboratory by having participants make a series of binary (usually hypothetical) monetary choices between a smaller-certain reward and a larger-risky reward. The magnitude of the rewards and the level of risk is varied across trials. A greater selection of the risky reward option can be used as a marker of risk tolerance. Prior research has associated increase selection of risky choices with chronic drug use (e.g., Lane, Yechiam, & Busemeyer, 2006; Monterosso, Ehrman, Napier, O'Brien, & Childress, 2001; Wittwer, Hulka, Heinimann, Vonmoos, & Quednow, 2016), pathological gambling (Kyonka & Schutte, 2018), and higher levels of chronic stress (Ceccato, Kudielka, & Schwieren, 2016).

There are some factors that have been found to modulate decision makers from being risk aversive to more risk tolerant. For instance, people are more likely to be risk tolerant when offered multiple opportunities to wager than if they were offered the option a single time

(Redelmeier & Tversky, 1992) and when the choices are framed as a certain loss or a possibility of a loss, even with the same expected value (Kahneman & Tversky, 1979; i.e., *reflection effect* and loss aversion). People dislike losing more than they like winning, hence the willingness to take risks to avoid the greater loss. Another example was observed by Markowitz (1952) who challenged the utility function by proposing it has inflection points around individuals' financial wealth. Prelec and Loewenstein (1991) expanded on this observation by noting the "*peanuts effect*," which describes how decision-makers become less averse to risk when playing with smaller payouts. Weber and Chapman (2005) examined the peanuts effect and found that the magnitude of the payout influences risk preferences as people will be less likely to choose the riskier gamble as the payout increases. Additionally, they found decision makers become less risk tolerant as the levels of probability increase which is explained by prospect theory, also termed the Allais common ratio effect (Kahneman & Tversky, 1979). Essentially, these are varying components that play a role when individuals process information to make a decision that involves risk.

Social Influence on Risky Decision-Making and Behaviors

Though much of the research on risky decision-making has focused on decisions made by individuals, social environments have also been recognized in prior research to impact decision-making behavior. To describe s*ocial influence*, the American Psychological Association (APA; 2022) online dictionary defined it as "any changes in an individual's thoughts, feelings, or behaviors caused by other people, who may be actually present or whose presence is imagined, expected, or only implied". A study by Knoll, Magis-Weinberg, Speekenbrink, and Blakemore (2015) was able to observe this effect as they conducted a study on 563 participating visitors of the Science Museum in London ranging from late childhood through adulthood to investigate

social influences on risk preferences. Participants rated risky scenarios of everyday situations (e.g., driving without a seatbelt) on a spectrum from low risk to high risk. Participants were then shown randomly generated ratings from either group of teenagers or adults, or their own ratings as the control group, and asked to rate the same scenarios again. Their results indicated that participants altered risk preferences after exposure to social information. Specifically, the researchers found that the changes in ratings gravitated toward the social information presented.

Social *conformity* describes how individuals adjust and align their beliefs and behavior to change according to the socially accepted conventions or standards of their group. Toelch and Dolan (2015) differentiate informational influence and normative influence as decision-making models of conformity. Informational social influence occurs when people have intentions or motive to make adaptive decisions that are beneficial for their current situation by using others as a source of information to gain knowledge. Individuals might do this to act appropriately and to avoid standing out from the group. Normative social influence occurs when people seek belongingness to the group or want to avoid social punishment and feel pressure to behave as others do elicited by social expectations or rules. It is usually out of fear of receiving rejection or criticism from others. The influence of social comparison can stem from that fear of being different and using the information given to make adaptive behaviors or decisions. People tend to like those who are similar to them, consequently relating to believing that to be liked by others, they must be similar to those around them (Baumeister, 2007; Ušto, Drače, & Hadžiahmetović, 2019). Individuals will still conform to be accepted by a group even if they privately disagree with the behaviors or beliefs of the group (Asch, 1951).

Social psychologists have explored conformity effects on individuals' attitudes and actions in controlled group environments discovering the phenomenon known as the *group*

polarization effect (Isenberg, 1986; McGarty, Turner, Hogg, David, & Wetherell, 1992; Van Swol, 2009). Group polarization describes how individuals in a group will tend to adopt a stronger or different position than their original position that is more aligned with the group opinion. For instance, if a decision maker joins an environment where people are more risk tolerant in their opinions or decisions, it amplifies the decision maker's own risk tolerance towards similar behaviors of the group. This impact of group polarization can skew in either direction depending on the context, from playing it safer to risk seeking, and occurs as group discussion leads the members to adopt similar beliefs or behaviors than their initial responses (Baumeister, 2007). The study of group polarization has often involved tasks that examine individual changes during risk-based decisions using hypothetical choice scenarios, behavioral observations, or self-reports of behaviors (Baumeister, 2007; Friedkin, 1999; Isenberg, 1986; Knoll et al., 2015; McGarty et al., 1992; Van Swol, 2009). Previous researchers observed a larger shift of being more risk-tolerant when in group settings, coining the now-discredited finding of the *risky shift,* which stated that groups generally behaved riskier than individuals would if they were alone. The *risky shift* has since been reconceptualized as the *choice shift* as the discovery that overall group attitudes differed from members' initial choices after group discussions encouraged motivation to study this behavior further. The *choice shift* recognizes that the attitudes of the individual can shift in either direction after a group interaction and is measured by collecting and comparing one's pre-discussion to post-discussion responses (Friedkin, 1999; McGarty et al., 1992).

The recent literature on social influence on risky behaviors has largely focused on adolescents and teenage samples (e.g., Albert, Chein, & Steinberg, 2013; Gardner & Steinberg, 2005; Simons-Morton et al., 2011; Silva, Chein, & Steinberg, 2016; Smith, Chein, & Steinberg,

2014). An example applied context of some of this previous research is on risky driving behaviors in group environments, with a finding being that individuals behave riskier with peers present than if they were alone in various driving simulation experiments (Albert et al., 2013; Chein et al., 2011; Gardner & Steinberg, 2005; Silva et al., 2016). Gardner and Steinberg (2005) investigated the developmental differences of peer influence on risky decisions and found that all ages in their sample took more risks and made more risky decisions when in a group setting than when alone. They had a total of 306 participants categorized into three age groups (i.e., adolescents, youth, and adults). The researchers administered two questionnaires with hypothetical scenarios to measure risky decision preferences and administered a behavioral task using a driving simulation game that required participants to decide whether to stop a car as the traffic light turned from green to yellow to accumulate points or risk running a red light and crashing into a brick wall, losing all the points. In the group condition, participants were able to discuss each scenario or question but responded independently and took turns playing the trials while the others were told they can advise the player on what to do. The findings were that those who completed the measures with peers took or chose more risks compared to those who completed the same measures by themselves. The behavioral task scores demonstrated that peer presence influenced adolescents and young adult participants to be increasingly riskier and caused the adult participants to be less risk averse when in a group as they were mostly averse to risky driving when alone.

A study conducted by Brunette and Cabantous (2015) investigated the effects of social influence on individual risk preferences by presenting participants with choices between a safe and a risky lottery for risk (i.e., known probabilities) and ambiguous (i.e., unknown probabilities) prospects either alone or in a group of three. They found that those in the three-person group,

even without interaction, were averse to risk but are less risk averse than when each member were alone. Smith et al. (2014) further explored effects of peer presence on risk-taking in a probabilistic gambling task among adolescents. In the task, participants were shown a series of wheels sectioned as a potential gain, loss, and neutral outcome and decided whether to play or pass on the offers. Within the task, players accumulated or loss hypothetical tokens by increments of ten and began with 100 tokens. The study found that compared to participants who completed the task alone, those who believed an anonymous peer was observing their decisions chose to play more, even when the probability of loss was greater. Overall, the presence of others has been shown to influence participants' decision-making or risky behaviors in these studies, leading participants to react differently in social environments compared to purely individual environments.

Social Influence on Intertemporal Choice

The above studies mainly focused on social influence on decision preferences in applied risky contexts through hypothetical scenarios or driving stimulations. The hypotheses for the current thesis also build off of more recent research that investigated social influence on decision-making more generally, particularly intertemporal choice. Intertemporal choices are similar to risky choices (Johnson et al., 2020), but the decisions are between a smaller, more immediate reward and a larger, more delayed reward. The extent that individuals discount the value of delayed rewards (i.e., prefer more immediate gratification) has been found to relate to many consequential life outcomes (e.g., Bickel, Odum, & Madden, 1999; Monterosso et al., 2001; Petry, 2001; Vadhan, Hart, Haney, van Gorp, & Foltin, 2009; Wiehler & Peters, 2015).

Emerging laboratory research has studied social influence on intertemporal decision preferences by measuring changes in participants' decisions following social interaction or exposure to the preferences of others (e.g., Bixter & Rogers, 2019; Bixter & Luhmann, 2020; Bixter, Trimber, & Luhmann, 2017; Calluso, Tosoni, Fortunato, & Committeri, 2017; Gilman, Curran, Calderon, Stoeckel, & Evins, 2014; Kedia, Brohmer, Scholten, & Corcoran, 2019; Moutoussis, Dolan, & Dayan, 2016; O'Brien et al., 2011; Schwenke, Dshemuchadse, Vesper, Bleichner, & Scherbaum, 2017; Thomas, Lockwood, Garvert, & Balsters, 2022; Tsuruta & Inukai, 2018; Weigard, Chein, Albert, Smith, & Steinberg, 2014). An example binary intertemporal choice in these types of laboratory studies would be a choice between $67 today or $88 in 35 days. Studies examining collaborative intertemporal decision-making have used a study design that consists of three decision-making blocks: (1) a pre-collaboration block where participants make a series of choices along, (2) a collaboration block where participants make choices together (e.g., in a dyad or a small group), and (3) a post-collaboration block, where participants once again make a series of choices individually (Bixter & Luhmann, 2020; Bixter & Rogers, 2019; Bixter et al., 2017). This study design allowed researchers to quantify social influence by measuring how decision preferences changed from pre- to post-collaboration. The results of these studies indicate the effects of social influence on choice preferences after social interaction. Specifically, individual group members' post-collaboration decision preferences were significantly more similar to one another compared to the baseline preferences exhibited during the pre-collaboration block (i.e., a social convergence effect: Bixter & Rogers, 2019; Bixter et al., 2017). These results demonstrate a degree of adaptability in individuals' intertemporal decision preferences, with individuals adjusting their preferences to be more aligned with the preferences of others they previously socially interacted with. Furthermore,

Bixter et al. (2017) found that those who self-reported less confidence in their intertemporal decision-making were more likely to adjust their choice preferences following collaboration, demonstrating a role of individual difference factors in the susceptibility to behavioral social influence.

One potential limitation of the collaborative decision-making study design is that researchers have no control over the decision preferences individuals will be exposed to during the collaboration block. That is, multiple participants sign up for a particular laboratory time slot, each with their own idiosyncratic decision preferences, who then go on to interact together during the collaboration block. This makes inferring causality of the social influence effects difficult. A remedy to this issue is for researchers to exert control over the decision preferences of a social other that participants are exposed to in a laboratory setting. That is, a collaboration block can be replaced with an exposure block where participants are simply exposed to the choices made by a social other. This can allow the researcher to control the nature of the decision preferences of the social other (e.g., to be someone that discounts future rewards a lot or a little). One such study was by Calluso et al. (2017) who focused on whether intertemporal choice preferences could be manipulated in certain directions (e.g., more present or future oriented). They had participants complete an intertemporal choice task to measure their baseline preference and be categorized into groups according to preferences (e.g., high or low discounters). Participants were then given the same task but observed a pattern of choices that were the opposite of their initial preferences being made and asked to express their choice again. The results indicated that participants who preferred immediate rewards when they were alone chose more delayed rewards as they were shown a selection of majority delayed rewards and vice versa for those who initially preferred delayed rewards. These findings support the power of influence

towards decision conformity and convergence based on the social information presented to individuals.

Overview of Current Study

The psychological processing and behavioral aspects of decision-making in individuals have been studied in research for decades, but less is known about the extent decision preferences are informed by the decisions of social others (i.e., the degree that decision preferences are socially contagious). In the risky decision-making realm, research on social influence has largely focused on applied contexts (e.g., group polarization scenarios, simulated driving environments). The goal of the current study was to investigate the impact of social influence on risky decision-making more generally in a controlled, laboratory environment (that helps strengthen causal conclusions). The study involved participants making a series of binary hypothetical monetary choices (between smaller-certain rewards and larger-risky rewards). Participants completed three blocks of the risky choice task: (1) the pre-exposure block where choices were made without any social information, (2) the exposure block where participants observed the choice of a social other on each trial, and (3) the post-exposure block where participants once again made choices without any social information. Moreover, the preferences of the social other during the exposure block were experimentally manipulated to be the choices of either a risk-averse decision maker or a risk-tolerant decision maker. This study design afforded the ability to test if exposure to the preferences of the social other significantly influenced the subsequent preferences of the participants, as well as testing if social influence is stronger in a particular direction (i.e., towards a risk tolerant social other or a risk averse social other). Our first hypothesis was:

Hypothesis 1: Exposure to the preferences of a social other will influence risky choice preferences, such that individuals exposed to the choice preferences of a risk-tolerant social other will exhibit more risk-tolerant choice preferences post-exposure compared to individuals exposed to the choice preferences of a risk-averse social other.

A secondary goal of the current study was to provide initial evidence regarding individual differences in susceptibility to social influence on risky decision-making. First, a general tendency to compare oneself to others has been found to vary across individuals and relate to various outcomes (Jiang & Ngien, 2020; Ruggieri, Ingoglia, Bonfanti, & Coco, 2021; Thau, Aquino, & Wittek, 2007). In the current context, it was hypothesized that individuals who self-reported stronger tendencies to compare their opinions and abilities to others would adjust their risky decision-making preferences more from pre- to post-exposure of the social information. The second individual difference factor explored in the current study was decisional conflict (related to decision confidence or certainty). Bixter et al. (2017) found that individuals with lower decision confidence were more likely to adjust their intertemporal choice preferences to align with the preference exhibited by other following social interaction. In the current study, it was hypothesized that individuals who self-reported more decisional conflict following the pre-exposure block would adjust their risky decision-making preferences more from pre- to post-exposure of the social information.

Hypothesis 2: Individuals scoring higher in social comparison orientation will exhibit a larger social influence effect on risky choice preferences.

Hypothesis 3: Individuals scoring higher in decisional conflict will exhibit a larger social influence effect on risky choice preferences.

Methods

Participants

The participants were 105 undergraduate students from Montclair State University (MSU) enrolled in psychology courses that involve earning SONA research credits. They were recruited through the MSU SONA system. Two participants were excluded due to technical difficulties that prevented them from completing the risky choice task. All results below are from the 103 remaining participants. Seventy-four percent of the participants were female (n = 76), 23% were males (n = 24), and 3% identified as another gender (n = 3). The age range was from 18 to 37 years old with an average of 19.52 (SD = 2.54). The race of the sample was 42.7% White, 35% Black or African American, 6.8% Asian, 6.8% more than one race, and 8.7% were from some other race. Additionally, 31.1% of the sample was Hispanic/Latino. The yearly household income of the sample was as follows: 13.6% less than $25,000, 12.6% $25,000-$49,999, 15.5% $50,000-$74,999, 24.3% more than $75,000, and 34% did not know for certain.

The study was approved by the Institutional Review Board at Montclair State University. Furthermore, the study was pre-registered with the Open Science Framework (OSF). The pre-registration included the study information, hypotheses, research questions, design plan, sampling plan, power analyses, study materials, and analysis plan. The pre-registration can be accessed at https://osf.io/nbgxf/.

Materials

Risky Choice Task

The risky choice task consisted of a series of hypothetical monetary choices between a smaller, certain reward and a larger, risky reward. For instance, a choice might be between a 100% chance of receiving $35 or a 50% chance of receiving $80 (with the other 50% chance of receiving $0). The task consisted of 32 unique choices. These choices were determined by the magnitude of the certain reward ($20, $35, $50, or $65), the probability/percent of the risky reward (50% or 60%), and the magnitude of the risky reward ($80, $95, $110, or $125). On each trial, the words "Which would you prefer?" were included at the top-center of the computer screen, the certain reward was presented in the middle-left of the computer screen, and the risky reward was presented in the middle-right of the computer screen (see Figure 1 for an example trial). Participants made their responses by pressing either the left arrow key (for the certain reward) or the right arrow key (for the risky reward). The presentation order of the 32 trials was randomized.

Participants completed three blocks of the risky choice task: the pre-exposure block, the exposure block, and the post-exposure block. In both the pre- and post-exposure blocks, participants made their choices without receiving any social information. That is, participants would be presented a choice between the certain and risky rewards, they would make their choice, and then a two-second inter-trial interval (ITI) would occur before the presentation of the subsequent choice. Participants were not provided information regarding the outcome of the risky reward if chosen. This was to prevent participants' choices from being influenced by the outcome of previous trials (e.g., "playing with house money").

FIGURE 1

RISKY CHOICE TASK

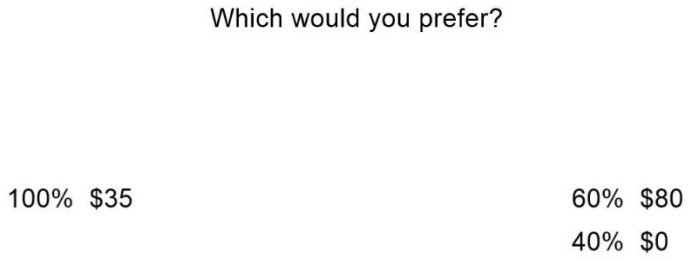
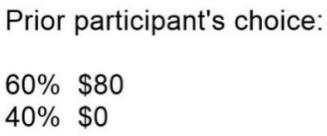


FIGURE 2

SOCIAL OTHER'S CHOICE



The intermediate exposure block was the same as the other two blocks, except that participants received social information after making each choice (see Figure 2 for an example trial). The choice of the social other was presented to the screen for five seconds after a participant made their choice. Participants were instructed that they would be presented the

choices of a randomly chosen prior participant who completed the task earlier after making each choice. In actuality, this social information consisted of the experimental manipulation. Participants were randomly assigned to be exposed to the choices of either a more risk-averse or a more risk-tolerant social other. The risk-tolerant "other" chose the risky reward 75% of the time and the risk-averse "other" chose the risky reward 25% of the time. The precise choices of the social other were determined by establishing a cutoff based on the expected value difference (EVD) of the trial choice. The EVD of an individual trial could be estimated by the following formula:

$$EVD = (probability\ of\ risky\ reward * risky\ reward) - certain\ reward$$

As an example, if the choice were between a certain $35 and a 50% chance of receiving $80, the EVD of the trial would be +$5 (i.e., (.5*$80) - $35). Positive EVD imply that the risky reward has the higher expected value; negative EVD imply that the certain reward has the higher expected value. The risk-tolerant other was constructed to choose the certain reward only on the eight trials that had an EVD less than -2 (and choose the risky reward on the 24 trials with an EVD greater than or equal to -2). Conversely, the risk-averse social other was constructed to choose the certain reward on the 24 trials that had an EVD less than +28 (and choose the risky reward on the 8 trials with an EVD greater than or equal to +28).

The three blocks of the risky choice task allowed the hypotheses of the current study to be tested. Specifically, the pre-exposure block allowed baseline risk preferences to be measured, the exposure block involved the experimental manipulation of being exposed to the preferences of a social other that was either risk-averse or risk-tolerant, and the post-exposure block allowed risk preferences to be assessed after experiencing the experimental manipulation.

Decisional Conflict

Following the pre-exposure risky choice block, participants completed six self-report items that were adapted from the Decisional Conflict Scale (O'Connor, 1995). The participants were instructed to think about the choices they made during the pre-exposure block and rate how strongly they agreed or disagreed with the items (see Table 1 for the individual items). Responses were made using a 1 to 5 response scale, with 1 "strongly disagree" and 5 "strongly agree." The decisional conflict scores derive from the two subscales of decision uncertainty and perceived effective decision-making. The Cronbach's alpha in the current sample was acceptable for the overall scale (α = .742), questionable for the decision uncertainty subscale (α = .665), and poor for the perceived effective decision-making subscale (α = .540).

TABLE 1

DECISIONAL CONFLICT SCALE

Decision Uncertainty
1. These decisions were hard for me to make
2. I was unsure what to do in these decisions
3. It was clear what choice was best for me (reverse scored)
Perceived Effective Decision Making
4. I feel I made informed decisions (reverse scored)
5. I would expect to stick with my decisions (reverse scored)
6. I am satisfied with my decisions (reverse scored)

Note: Adaptation of the Decisional Conflict Scale from O'Connor (1995) with a response scale ranging from 1 "strongly disagree" to 5 "strongly agree."

Social Comparison Orientation

Prior to the risky choice task, participants completed the Iowa-Netherlands Comparison Orientation Measure (INCOM) from Gibbons and Buunk (1999). The measure consists of eleven self-report items that assess social comparison tendencies (see Table 2 for a complete list of

items). The scale produces an overall social comparison tendency score as well as two subscales measuring ability comparisons (items 1-6) and opinion comparisons (items 7-11) to others. Responses were made on a 1 to 5 scale, with 1 as 'I disagree strongly' and 5 as 'I agree strongly'. The Cronbach's alpha in the current sample was acceptable for the overall score (α = .735), the ability subscale (α = .714), and not acceptable for the opinions subscale (α = .443).

TABLE 2

THE IOWA-NETHERLANDS COMPARISON ORIENTATION MEASURE (INCOM)

Ability Comparison	
1.	I often compare how my loved ones (boy or girlfriend, family members, etc.) are doing with how others are doing.
2.	I always pay a lot of attention to how I do things compared with how others do things.
3.	If I want to find out how well I have done something, I compare what I have done with how others have done.
4.	I often compare how I am doing socially (e.g., social skills, popularity) with other people.
5.	I am not the type of person who compares often with others. (reverse scored)
6.	I often compare myself with others with respect to what I have accomplished in life.
Opinion Comparison	
7.	I often like to talk with others about mutual opinions and experiences.
8.	I often try to find out what others think who face similar problems as I face.
9.	I always like to know what others in a similar situation would do.
10.	If I want to learn more about something, I try to find out what others think about it.
11.	I never consider my situation in life relative to that of other people. (reverse scored)

Note: Iowa-Netherlands Comparison Orientation Measure (INCOM) from Gibbons and Buunk (1999) with response scale ranging from 1 "I disagree strongly" to 5 "I agree strongly."

Demographics

A background questionnaire was administered to collect participants' gender, age, ethnicity, race, and yearly household income (see Table 3).

TABLE 3

STUDY PARTICIPANT DEMOGRAPHICS

Characteristic	*n*	*%*
Gender		
Male	24	23.3%
Female	76	73.8%
Not listed	3	2.9%
Race		
American Indian/Alaskan native	0	0.0%
Asian	7	6.8%
Black or African American	36	35.0%
Native Hawaiian or Pacific Islander	0	0.0%
White	44	42.7%
More than one race	7	6.8%
Not listed	9	8.7%
Ethnicity		
Hispanic	32	31.1%
Not Hispanic	71	68.9%
Yearly household income		
Less than $25,000	14	13.6%
$25,000 to $49,999	13	12.6%
$50,000 to $74,999	16	15.5%
More than $75,000	25	24.3%
Do not know	35	34.0%

Note: Participants' gender, age, ethnicity, race, and yearly household income.

Procedure

Participants volunteered through SONA (a website used to recruit students for various psychological studies on campus). Upon entering the laboratory, participants read and signed an informed consent form. They then completed the demographic questionnaire and the social comparison orientation scale (Gibbons & Buunk, 1999). Participants were then escorted to an individual computer station where they first completed the pre-exposure block of the risky choice task. Participants were naive to the true nature of the study and did not receive any information that they would subsequently be exposed to the choices of a social other. This helped ensure that the pre-exposure block of risky choice trials could act as a baseline measure of participants' risk preferences. Immediately following the pre-exposure block, participants were presented with the six modified items of the Decisional Conflict Scale (O'Connor, 1995) on the computer. This was so that decisional conflict was measured in participants prior to the experimental manipulation in the subsequent exposure block.

In the second (exposure) block, participants were provided instructions that informed them of the social information. Specifically, they received the following instructions:

> *In the next block of the study, you will be completing a task similar to the one you just previously completed. However, this time there is the chance that you will be shown on each trial the choice that was made on that trial by another participant who completed the task at an earlier time. That is, after you make your choice, you would be shown for a few seconds the choice that was made by this prior participant. This other participant would be randomly chosen from the pool of participants who have previously completed the task.*

> *Now, there are two "Players" for this block of the study (Player A and Player B). If you get assigned to be Player A, the next block of the study will look the same as the previous block you just completed. However, if you get assigned to be Player B, following each of your choices you will be exposed to the choice made by the prior participant (who would be Player A). As an example, following your choice you would be presented with a screen that looks like the following figure* [an example trial presentation was included].
>
> *Once you begin the task, the computer will randomly assign you to be either Player A or Player B. If you are assigned to be Player A, your choices during this block of the study will be shown to a future participant. However, if you are assigned to be Player B, you will simply observe the choices made by a previous participant. Also, if you are Player B, your choices during this phase of the study will never be shown to a future participant.*

After the exposure block started on the computer, participants were then led to believe that the computer would randomly assign them to Player A or Player B. In fact, participants were also presented with the following text: *You have been assigned to be Player B. This means that you will observe the choices made by a prior participant, but no future participant will observe your choices*. This description of the two Player roles was included to help increase the believability that the choices of the social other came from another participant. Moreover, the universal assignment to the Player B role was so that participants would make their choices without being concerned that their choices would subsequently be presented to somebody else (which could create a social desirability effect).

In the third (post-exposure) block, participants were instructed that they would complete a block of trials that were similar to the first (pre-exposure) block. Once finished, participants were thanked, given a debriefing form informing them of the true nature of the study, and were granted their SONA credits.

Data Analysis and Assumptions Check

The main dependent variable of interest was preference for risk on the choice task. This was operationalized by calculating the proportion of trials that the risky reward was chosen. As a result, preferences could range from 0 to 1, with higher values implying greater tolerance for risk. Separate estimates of risk preferences were estimated for each of the three blocks of the risky choice task (the pre-exposure, exposure, and post-exposure blocks).

Risk preferences were then entered into a 2 X 3 mixed-ANOVA with experimental condition (risk-tolerant social other vs. risk-averse social other) as the between-subjects factor and risky choice task block (pre-exposure, exposure, and post-exposure) as the within-subjects factor. Post-hoc tests were then performed to measure the difference between the two experimental conditions at each of the three risky choice task blocks. The standard $p < .05$ criteria was used for determining statistical significance.

Hypotheses 2 and 3 relate to the relationship between the individual difference measures (social comparison orientation, decisional conflict) and social influence on risky choice. As a behavioral measure of social influence, the absolute difference was calculated between participants' risk preferences during the pre-exposure and post-exposure blocks. Larger values on this metric imply a greater change in preferences from pre-social exposure to post-social

exposure. Bivariate correlations were then performed relating the behavioral social influence scores to both the social comparison orientation and decisional conflict measures.

Statistical assumptions were tested prior to all main analyses. First, the normality assumption was tested for the risk preferences dependent variable during the pre-exposure block (i.e., the baseline measure prior to the experimental manipulation). The Shapiro-Wilk statistic was not significant (p = .266), as were the skewness (z = -1.56, p = .119) and kurtosis statistics (z = 0.05, p = .958). Moreover, no extreme outliers were observed based on inspecting a boxplot. Similar results were found for the two individual difference measures, with the Shapiro-Wilk statistic being non-significant for the social comparison orientation measure (p = .319) and the decisional conflict measure (p = .056). For the mixed-ANOVA, the Levene's Test of Equality of Variances was met for the risk preferences dependent variable prior to the experimental manipulation (p = .774), the Mauchly's Test of Sphericity was met (p = .070), and Box's Test of Equality of Covariance Matrices was higher than the recommended p-value cutoff of .001 (p = .024).

Results

Descriptive Statistics

Descriptive statistics for the main study variables are included in Table 4. During the pre-exposure risky choice block, participants chose the risky reward 57.55% of the time on average. This helps ensure that baseline risk preferences were far from a ceiling or floor effect that would mitigate any chance for social influence.

Table 4 also includes descriptive statistics for the pre-exposure risky choice block broken down by trial parameters. These patterns of risk preferences ensure that participants responded to

changes in trial parameters appropriately. Specifically, as the magnitude of the certain reward increased ($20, $35, $50, and $65), the preference for the risky reward decreased monotonically. These descriptive differences were confirmed through a significant repeated-measures ANOVA $F(3, 306) = 126.55$, $p < .001$, $\eta p2 = .55$, with the pairwise comparisons between all four certain reward values being statistically significant (all $ps < .001$).

As the magnitude of the risky reward increased ($80, $95, $110, and $125), the preference for the risky reward increased monotonically. These descriptive differences were confirmed through a significant repeated-measures ANOVA, $F(3, 306) = 42.58$, $p < .001$, $\eta p2 = .30$, with the pairwise comparisons between all four certain reward values being statistically significant (all $ps < .01$).

Finally, preference for the risky reward was higher when the probability of the risky reward was .60 compared to when the probability was .50. This difference was confirmed by a paired-samples t test, $t(102) = 5.59$, $p < .001$, Cohen's $d = .55$.

TABLE 4
DESCRIPTIVE STATISTICS

	Descriptive Statistics		
	n	*M*	*SD*
SCO	103	3.4342	.52855
DC	103	2.4984	.65117
Risky Choice Task			
Pre-Exposure Block	103	.5755	.19931
Exposure Block	103	.6265	.20772
Post-Exposure Block	103	.6214	.21612
Pre-Exposure Block			
Certain $20	103	.8167	.24242
Certain $35	103	.7027	.27010
Certain $50	103	.4551	.28107
Certain $65	103	.3277	.26552
Risky $80	103	.4672	.21363
Risky $95	103	.5255	.22846
Risky $110	103	.6214	.25272
Risky $125	103	.6881	.25954
50% Probability	103	.5006	.25553
60% Probability	103	.6505	.22627

Note: SCO = social comparison orientation measure. DC = decisional conflict measure.

TABLE 5
RISK PREFERENCES THROUGHOUT STUDY BLOCKS

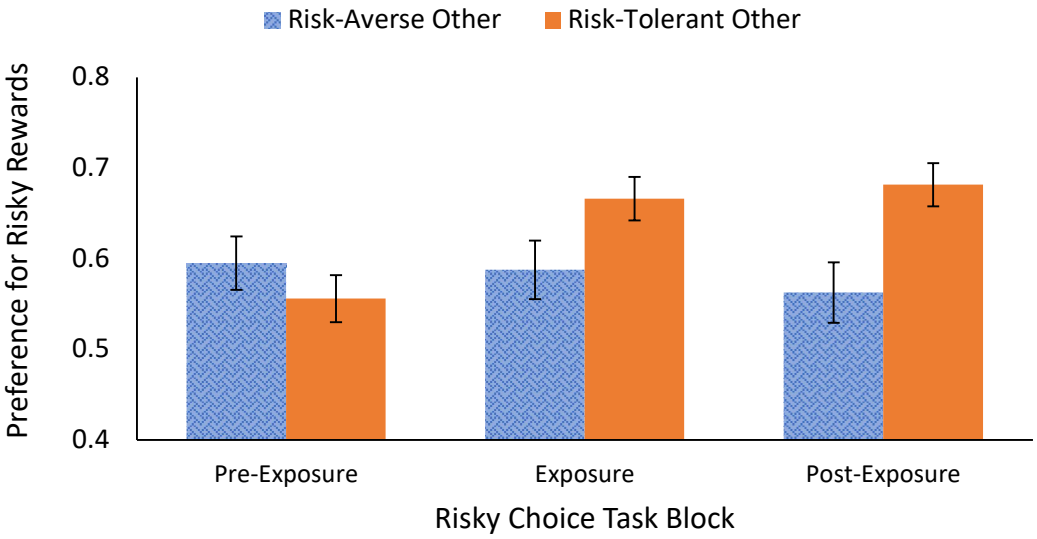
Blocks	Conditions	
	Risk-averse other	Risk-tolerant other
	M	*M*
Pre-exposure	.595	.556
Exposure	.588	.666
Post-exposure	.563	.681

Social Influence on Risk Preferences

To investigate if exposure to social information influenced risk preferences, a 2 (social influence condition) X 3 (risky choice block) mixed-ANOVA was conducted. Figure 3 includes the risk preferences across the three blocks for the two experimental conditions. As can be seen, there was a statistically significant interaction between the experimental condition and risky choice block, $F(2, 202) = 14.874$, $p < .001$, $\eta p2 = .13$. This interaction supports Hypothesis 1 and indicates that social information during the exposure phase did have an impact on risk preferences.

FIGURE 3

ILLUSTRATES RISK PREFERENCES THROUGHOUT BLOCKS



Note: Illustrates the change in risk preferences after being exposed to risk-averse and risk-tolerant conditions throughout the blocks

To examine the significant interaction further, pairwise comparisons between the two experimental conditions were performed for each trial block. The data showed that risk preferences were similar during the pre-exposure block for the risk-averse ($M = .60$, $SD = .21$)

and risk-tolerant (M = .56, SD = .19) social conditions (p = .321). During the exposure block, preference for the risky reward was lower in the risk-averse (M = .59, SD = .23) compared to the risk-tolerant (M = .67, SD = .17) condition, although this difference was marginally significant (p = .055). For the post-exposure block, risk preferences were significantly different between the risk-averse (M = .56, SD = .24) and the risk-tolerant (M = .68, SD = .17) conditions (p = .005). These results demonstrate that risk preferences were not different between the two experimental conditions at baseline, but differences emerged after observing the choice preferences of others during the exposure block.

Another way to explore the significant interaction further is by comparing risk preferences across trial blocks for each experimental condition. For the risk-averse social condition, although preference for the risky reward did decrease numerically following the exposure block, none of the three trial blocks significantly differed from one another (all ps > .16). Conversely, for the risk-tolerant social condition, preference for the risky reward was significantly higher during the post-exposure block than both the pre-exposure and exposure blocks (all ps < .001). The difference between the exposure and post-exposure blocks was not significant (p = .425). These results demonstrate that for the risk-tolerant condition, exposure to the choice preferences of a risky decision maker did significantly increase preference for the risky reward, which was sustained into the post-exposure block. For the risk-averse condition, exposure to the choice preferences of a risk-averse decision maker did not significantly decrease the preference for the risky reward. This asymmetry in social influence was not hypothesized a priori, but possible explanations for it are included in the Discussion below.

There were a number of participants (n = 30) who had risk preferences during the pre-exposure block that were outside the range of preferences exhibited by the social other during the

exposure block. That is, participants who chose the risky reward option less than or equal to 25% or greater than or equal to 75% of the time. As a robustness check, the above mixed ANOVA was performed restricting the sample to the participants that exhibited risk preferences during the pre-exposure block that were within the range of the two social others. The patterns of results were the same as the above results. Specifically, the interaction between experimental condition and risky choice block remained statistically significant, $F(2, 142) = 10.410$, $p < .001$, $\eta p2 = .13$). Moreover, the patterns of significance for the various pairwise comparisons remained the same as above.

Individual Differences

The following analyses focus on the relationships between the individual difference measures (social comparison tendencies, decisional conflict) and the behavioral measure of social influence (i.e., the absolute difference between participants' risk preferences during the pre-exposure and post-exposure blocks). See Table 6 for the Pearson correlations between the individual difference measures and the behavioral measure of social influence. As can be seen, there was no significant relationship between behavioral social influence and overall social comparison tendency ($r = .02$, $p = .835$). Furthermore, behavioral social influence did not significantly correlate with either the abilities ($r = -.03$, $p = .742$) and opinions ($r = .10$, $p = .303$) subscales of the social comparison tendency measure. These results demonstrate that Hypothesis 2 was not supported; behavioral social influence on risk preferences was not related to a general tendency to compare oneself to others.

Behavioral social influence on risk preferences was related to decisional conflict. This included the overall measure of decisional conflict ($r = .27$, $p = .007$), as well as the decisional

uncertainty (r = .24, p = .015) and decisional effectiveness (r = -.23, p = .019) subscales. These results support Hypothesis 3 and demonstrate that individuals with higher decisional conflict during the pre-exposure block were more likely to adjust their risk preferences following the exposure block (i.e., demonstrated increased behavioral social influence).

TABLE 6

CORRELATIONS BETWEEN INDIVIDUAL DIFFERENCE MEASURES AND BEHAVIORAL MEASURE OF SOCIAL INFLUENCE

	Correlations					
	SCO	SCO Ability	SCO Opinions	DC	DC Uncertainty	DC Effective
Pearson Correlation	.021	-.033	.103	.265**	.238*	-.230*
Sig. (2-tailed)	.835	.742	.303	.007	.015	.019
N	103	103	103	103	103	103

Note: Using a Pearson correlation analysis, the absolute change of risk preferences from Block 1 to Block 3 was compared to the individual difference measures.

SCO = social comparison orientation measure. DC = decisional conflict measure.

$^{*}p < .05$, two-tailed. $^{**}p < .01$, two-tailed.

Discussion

The goal of the present study was to investigate the extent a person's risky decisions change after being exposed to the choices made by another in a controlled, laboratory environment. The main hypothesis was that if social influence affects decisions involving risk, then individuals' choice preferences will gravitate towards the experimentally manipulated risk preferences of the social others they were exposed to. Overall, exposure to social information did have an impact on risk preferences. When making a series of choices between certain and risky monetary rewards, the average preference for risky rewards was similar in both experimental

conditions prior to the social information exposure. However, preferences significantly diverged after being exposed to the choices of the social others. Specifically, the findings suggest that participants who were shown the decisions of a risk-tolerant social other chose the risky rewards significantly more often during the post-exposure block compared to participants in the risk-averse condition.

The current study also investigated if certain individual difference variables relate to behavioral social influence on risky choice. Behavioral social influence on risky choice did not correlate with a general tendency of someone to compare themselves to others, as measured by the Iowa-Netherlands Comparison Orientation Measure (Gibbons & Buunk, 1999). These results suggest that social influence on risky choice may not be tied to a general social influence or comparison disposition, but may be more tied to the decisional context. Along those lines, a measure of decisional conflict (O'Connor, 1995) that was completed following the pre-exposure block of the risky choice task did relate to subsequent changes in individual risk preferences. Those who reported greater uncertainty and less effectiveness in their risky choices during the pre-exposure block were more likely to adjust their risk preferences following the exposure of the choice preferences of the social other. These results support findings from Bixter et al. (2017) that those expressing less confidence in their intertemporal decisions were more likely to adjust their preferences to align with others following group interaction.

Our findings are consistent with recent research that has found a significant effect of social influence on various types of judgments and decisions (e.g., Albert et al., 2013; Bixter & Rogers, 2019; Bixter & Luhmann, 2020; Bixter et al., 2017; Brunette & Cabantous, 2015; Calluso et al., 2017; Chein et al., 2011; Chung, Christopoulos, King-Casas, Ball, & Chiu, 2015; Gardner & Steinberg, 2005; Gilman et al., 2014; Kedia et al., 2019; Knoll et al., 2015; McGarty

et al., 1992; Moutoussis et al., 2016; O'Brien et al., 2011; Schwenke et al., 2017; Silva et al., 2016; Simons-Morton et al., 2011; Smith et al., 2014; Thomas et al., 2022; Tsuruta & Inukai, 2018; Weigard, et al., 2014). A convergence effect has been demonstrated in intertemporal decision-making, where individual group members' preferences begin to align more following collaborative interaction (e.g., Bixter et al., 2017; Bixter & Rogers, 2019). These prior findings would predict that individual risk preferences should adjust to align with the preferences of social others, which was what was found in the present thesis. Furthermore, prior research has also found that behavioral social influence on decision-making can be found even if direct social interaction does not occur, but participants are merely exposed to the decisional preferences of others (Bixter & Luhmann, 2020; Chung et al., 2015; Gilman et al., 2014; Kedia et al., 2019; Knoll, Leung, Foulkes, & Blakemore, 2017; Knoll et al., 2015; Suzuki, Jensen, Bossaerts, & O'Doherty, 2016; Thomas et al., 2022). These results help demonstrate that social influence can be a particularly relevant factor in the decision-making process, which means future models and theories of individual decision-making should more directly incorporate the social context of judgments and decisions.

An asymmetrical social influence effect was observed in the present study. Specifically, exposure to the preferences of a risk-tolerant social other significantly increased risky choices. Conversely, though exposure to the preferences of a risk-averse social other did lead to a reduced preference for risky rewards, this reduction did not reach statistical significance. This asymmetry effect was not hypothesized *a priori*, due to prior research in the intertemporal decision domain that found social influence occurred similarly in both the patient and impatient direction (Bixter et al., 2017). Though not hypothesized, the asymmetrical effect of social influence on risky choice does have some prior support in the literature. A study by Knoll et al. (2017) replicated

the findings of Knoll et al. (2015) on age-related differences in social influence on risk perception by further investigating the direction of influence. They had 590 participants divided into five age groups ranging from ages eight to fifty-four. Participants were asked to rate the riskiness of everyday situations to collect initial risk perception. After providing their initial ratings, participants were exposed to fictitious ratings from either group of teenagers or adults and asked to rate the same situation again. They were then asked a third time to re-rate the situation without social information. The study found that participants were more influenced to moderate their risk perceptions by the group that was closest to their age. More specifically, they note asymmetric trends that younger participants' risk perceptions were strongly influenced by teenagers who rated a situation as riskier, leading participants to align their ratings to the groups' ratings. In contrast, adults were more influenced by the adult group when rating a situation as less risky than the participant. Due to the current study's sample being largely late adolescents or younger adults, we also found that risky-related social information had a stronger influence on individual decision preferences. It will be important for future research to replicate the current study design with different age groups to see if different patterns of social influence are similarly observed in the risky decision-making context.

Another recent study by Reiter, Suzuki, O'Doherty, Li, and Eppinger (2019) explored if peer observation of a risky decision-making behavior affects risk preferences. They had 86 participants separated into two age groups (i.e., teenage and adult) and then had them complete a risky choice task between a risky gamble and a safer guaranteed bet. After collecting initial preferences, participants observed a confederate make either risk-seeking or risk-averse choices on the same choices after being asked again. A strong risk contagion effect, which depicts how individual risk preferences are modulated by observing and learning from other's decisions, was

reported by teenagers that observed risk-seeking preferences from their peers and not when shown risk-averse preferences. These recent studies report a similar type of asymmetrical effect under peer contexts which was not hypothesized a priori.

Reiter et al. (2019) also reported that high social network sizes were associated with a stronger peer effect on risk preference while observing a risk-seeking other. This supports the idea that people's social networks and contacts influence the risk preferences and behaviors of individuals. Social influence on risky decision-making is particularly important for adolescents who are still developing and are particularly impacted by their social environment (Yang et al., 2016). Furthermore, the pull towards risk-tolerant preferences being stronger than the influence of risk-averse behavior can have negative implications on behaviors. If this asymmetrical effect holds up upon replication, it will have practical implications. For example, in situations that involve risky behaviors with potential harmful outcomes, riskier individuals in small group environments (e.g., teenage social circles) may impact the group to a greater extent than the more cautious individuals.

Limitations and Future Directions

A limitation to this study is that the risky choice task was conducted with hypothetical monetary choices. Most studies on risky decision-making, including the current study, use either hypothetical scenarios or decisions with real but small consequences. Hypothetical decisions for laboratory outcomes may not be similar to decisions made in the real-world as it excludes the potential lack of economic incentive on real-world choices. Though prior research in the intertemporal decision domain has generally found no difference when comparing participants' choices for hypothetical vs. real rewards (e.g., Madden, Begotka, Raiff, & Kastern, 2003;

Madden, et al., 2004), it will be important for a future study to replicate the present findings with real rewards. It is also important to investigate the duration of social influence. In the current study design, the blocks were completed sequentially within a single laboratory session, making it difficult to infer if adjusted preferences would sustain over time. Conducting a study where participants come back a week later and complete the same risky choices without social information would be able to further investigate the duration of these social influence effects.

It would also be informative to see if these social influence effects extend to reporting of actual risky behaviors. With the growth of risky digital payment systems like cryptocurrencies being easily accessible for everyone, future research should investigate effects of social influence on decisions regarding investing in various financial markets. Due to the asymmetrical social influence effect on risky decision-making observed in the current thesis, future research should also focus on potential peer influence effects for engaging in risky behaviors like driving under the influence, consuming recreational or illicit drugs, practicing unsafe sex, or other activities that may result in injuries. Finally, additional individual difference factors need to be explored that are found to relate to susceptibility to behavioral social influence (similar to decisional conflict regarding risky choices found in the current results). Identifying other individual differences that render one susceptible to social influence would be helpful if attempting to screen for at-risk individuals. The findings of this study provide insight into the impact of social influence on risky choices and lay the groundwork for future research to investigate further boundary conditions for the effects of the social environment on individual decision-making.

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