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Observing others' behavior and risk taking in decisions from experience

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Abstract

This paper examines how observing other people's behavior affects risk taking in repeated decision tasks. In Study 1, 100 participants performed experience-based decision tasks either alone or in pairs, with the two members being exposed to each others' choices and outcomes. The tasks involved either equiprobable gains and losses or frequent small gains and rare large losses. The results indicated that, in both risk types, the social exposure increased the proportion of risky selection, but its effect was stronger in the rare-loss condition. In Study 2 the rare-loss task was administered to 32 study participants, with a target individual observing the choices of a paired individual. The results showed that observing others, rather than being observed, led to the pattern of increased risk taking. The findings of the two studies indicate the importance of distinguishing different types of risky situations and shed light on contradictory findings in the literature.

Keywords: risky shift, social learning, foregone payoff

1 Introduction

The effect of the social environment on *individual* decision making is important because many naturally occurring individual behaviors are conducted in the presence of others. This area of investigation is often studied in the field of social learning (see e.g., Casey & Rozin, 1989; Galef, 1995; 1996; Laland, 1996; Reebs, 2000) which is focused on situations in which individuals have the opportunity to learn from others' experience. Studies in this field tend to address situations where actions differ in their objective value but this information is not shared among all individuals. Therefore, observing others' behavior adds important information about the "right" action to follow. Hardly any empirical research in this field has focused on the interesting problem where the main difference between alternatives is their associated *risk (or variance)*.

Another field of study relevant to the current context is the study of group behavior, in which groups are typically asked to reach a consensus. Studies of group behavior have addressed the question of social influence on risk taking. The main finding in this line of research is that groups tend to hold more extreme risk attitudes than those of their individual members. This finding is typically referred to as the group polarization (or groupthink) phenomenon (see Isenberg, 1986 for a comprehensive review).

Surprisingly, little research has been devoted to *individual* risk taking decisions in a social context in which people are able to observe aspects of each other's behavior (a situation we refer to as social exposure). The research conducted has yielded mixed results. Blank (1968) found that in a repeated choice task exposing three individuals to each others' outcomes facilitated risk taking, compared to choices made alone (see also Teger & Pruitt, 1967). Conversely, Blaskovitch, Veach, and Ginsburg (1973) in an experimental game of blackjack found no effect of social exposure (see also Clark & Willems, 1969). Mixed findings also appear in relevant applied studies. The presence of co-acting individuals was found to increase risky street crossing in a computerized task but only for adolescents and not for adults (Gardner & Steinberg, 2005) yet it facilitated more risky crossing in field studies (Hamed, 2001; Himanen, & Kulmala, 1988). Still, these mixed findings are usually ignored and this research area is often briefly discussed as an extension of the group polarization phenomenon observed in consensual decisions (e.g., Clark, 1974; Myers, Bach & Schreiber, 1974).

The goal of the current study is to clarify the effect of social exposure in two types of risk taking situations involving losses. One type comprises cases in which gains and losses are equally likely. The other type involves asymmetry in the likelihood and magnitude of gains and

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losses, particularly that comprising typical small gains and rare large losses. A robust behavioral regularity in experience-based decision making is that, when expected values are similar, people choose according to the alternative that produces the best outcomes most of the time (Estes, 1976a, b; Barron & Erev, 2003; Yechiam & Busemeyer, 2005, 2006). Accordingly, people are more likely to select risky alternatives producing rare losses (and typical gains) than those producing equiprobable gains and losses, a phenomenon which is indeed widely observed (Barron & Erev, 2003; Hertwig, Barron, Weber, & Erev, 2004).

Yet note that the same principle predicts that, when a risky alternative produces rare losses, information concerning others' behavior would increase risk taking. In this situation, others' choice outcomes increase the salience of (or the awareness to) the differences between the typical favorable outcome from the risky alternative and the typically unfavorable outcome from the safe alternative. For instance, consider a laboratory decision task consisting of a safe alternative S producing \$10 in each trial, and a risky alternative R producing \$20 in 9 out of 10 selections and –\$90 in the remaining selections. The task is repeated, and payoffs are contingent on the option chosen. If an individual has decided to stop selecting R, then he/she is no longer supplied with additional evidence that the obtained outcome from S (\$10) is worse than R's (\$20) most of the time. In a social situation however, others who take risk (and pick R) are naturally continuing to transmit this information to the decision maker, and are thus likely to increase the level of risk taking.

Results consistent with this hypothesis were reported in studies that examined the effect of obtaining feedback from unselected choice alternatives (i.e., foregone payoffs) compared to obtaining feedback from selected ones only. In decision tasks with a risky alternative producing rare negative outcomes (and common favorable outcomes), individuals provided with foregone payoffs are continually presented with the favorable outcomes of this alternative. Indeed, foregone payoffs increase the level of risk taking in such tasks (Yechiam & Busemeyer, 2005; 2006; see also Ert & Erev, 2007). However, this effect has not been observed for risky alternatives producing equally likely gains and losses, such as betting on a color in a roulette wheel (Grosskopf, Erev, & Yechiam, 2006; Haruvy & Erev, 2002; see also Charness & Grosskopf, 2004). The latter pattern is explained by the fact that, when a risky alternative is equally likely to produce gains and losses, then its outcomes are not better most of the time, and adding foregone payoffs does not change that fact.

Our main argument is that similarly to the effect of foregone payoffs, being exposed to others' choices and outcomes in a decision task would increase risk taking in tasks involving rare losses. Two controlled laboratory studies were conducted to examine this prediction. Study 1 evaluated the effect of mutual exposure to other people's choices in decision tasks involving rare or equiprobable losses. The results showed that, while social exposure increased risk taking in both decision tasks, it had a larger effect in the rare loss condition. Study 2 investigated the processes that lead to risk taking in the social context, showing that observing others, rather than being observed, facilitates the effect observed in Study 1.

2 Study 1: Rare versus equiprobable losses

The current study was designed to evaluate the moderating effect of risk type on the association between social exposure and risk taking. For this purpose we examined individuals' behavior in two decision problems as follows (1 Ag = 0.25 cent):

Problem 1/20	
S (Safe)	Lose 2 Ag.
R (Risky)	Lose 30 Ag with a probability of 0.05 (1 in 20). Lose 1 Ag otherwise.
Problem 1/2	
S (Safe)	Lose 2 Ag.
R (Risky)	Lose 4 Ag with a probability of 0.5 (1 in 2). Lose 1 Ag otherwise.

Notice that, in both choice problems option R has a lower expected value (–2.5) than option S (–2). However, in Problem 1/20 option R is associated with losses in 5% of the trials, compared to 50% in Problem 1/2. Problem 1/20 is accordingly referred to as the "Rare-loss" task, while Problem 1/2 is referred to as the "Equiprobable-loss" task.

In order to evaluate the effect of social exposure on risk taking we compared two conditions in each experimental task. In the baseline "No-exposure" condition participants made decisions individually and their feedback was restricted to the obtained payoffs. We contrasted this condition with an "Exposure" condition in which each participant made decisions individually but saw a real time image of another participant's screen. Thus, participants were exposed to each others' choices and outcomes. We hypothesized that this social exposure would increase risk taking only in the Rare-loss task.

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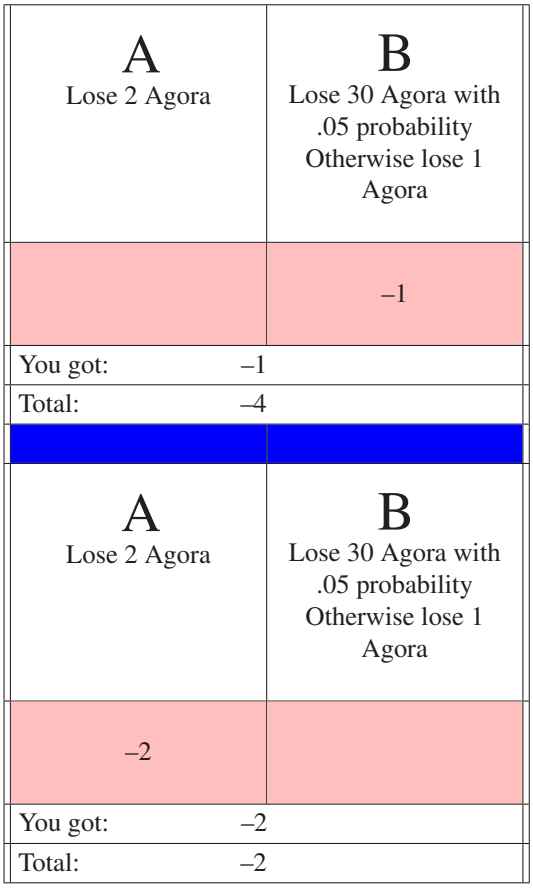

Figure 1: The layout of the decision task used in the present experiments. The top window comprises the participant's task. The bottom window shows the task of the paired participant in the Exposure condition.

2.1 Design and procedure

Participants began the experiment with an amount of money (of NIS 40) which they faced losing. Each participant played only one of the two choice tasks. The participants were asked to make 400 repeated choices between two alternatives (S and R) presented as virtual unmarked buttons on the screen (see Figure 1). Following Yechiam and Busemeyer (2005) the accurate probabilities and payoffs contingent upon pressing a button were constantly displayed above each button.[1] The allocation of the two choice alternatives (S and R) to the right and left buttons was fixed for each participant, and the assignment to left or right was randomly chosen. Payoffs were contingent upon the button chosen and were calculated independently on each trial as indicated above. Two types of feedback immediately followed each choice: (1) The payoff for the choice, which appeared on the selected button and below it until the next button was selected, and (2) an accumulating payoff-counter that was displayed constantly.

As noted earlier, two social exposure conditions were compared: In the No-exposure condition participants made decisions individually, on a computer station partitioned from other stations, and their feedback was restricted to the obtained payoff. We contrasted this condition with an Exposure condition where participants made decisions individually but saw each other's choices and outcomes on their computer screen. Participants were informed that they would be watching the task of the person sitting behind them on the bottom part of their screen and that this person would be watching their task. In order to make the experiment similar to real situations that involve co-acting individuals, we did not impose limitations on the timing of choices (see Maule, Hockey, & Bdzola, 2000). The complete instructions for the participants appear in the Appendix section.

In all of the experimental conditions the task was performed individually in groups of six. The participants sat in randomly allocated positions in two opposing rows of three computers (at a distance of about 2 meters from one another). The computers were all separated by dividers. In the Exposure condition each two participants sitting behind one another were shown the top half of each others' screens (See Figure 1). For this purpose, we used Win-VNC 3.3, which captures a target screen at a rate of 10–15 times per second. The paired partners did not make their decisions at the same time, but rather each participant performed the task at his/her own pace.

Participants. One hundred students at the Technion, Israel Institute of Technology (54 men and 46 women) participated in the experiment. The participants' age ranged from 19 to 28 (average of 23.1). They were paid a sum of NIS 28 to NIS 34 ($1 = NIS 4.5), depending on their success in the experimental task. Fifty participants were assigned to each of the two experimental tasks. Within each task 30 participants were assigned to the No-exposure condition and 20 participants were assigned to the Exposure condition, with equal proportions of men and women in each condition.

Analysis. The results were analyzed using Mixed ANOVA, with task (Rare vs. Equiprobable losses) and experimental condition (Exposure vs. No- Exposure) as between subject factors and trial block (8 blocks of 50 trials) as the within subject factor. In order to stabilize the variances and make the data more compatible with the standard homogeneity of variance assumption of the ANOVA, we conducted the analysis of variance using logit transformations (Logit(p) = ln [p/(1-p)]).

[1] This is similar to a real-world condition in which the decision maker has reasonable priors.

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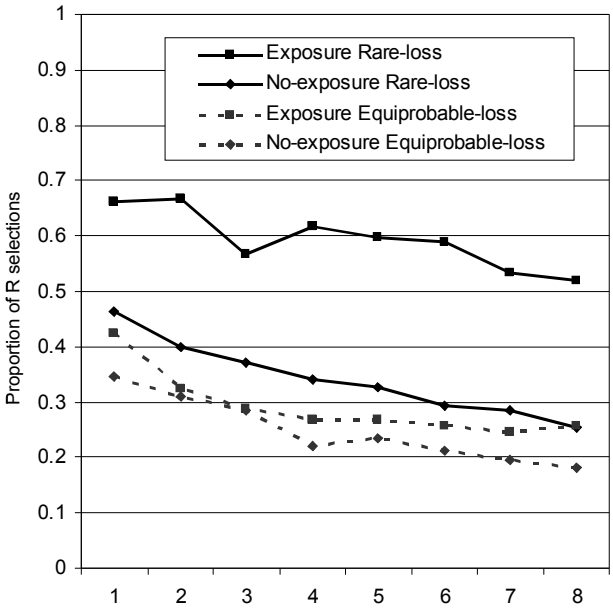

Figure 2: Study 1 results. Selections from the risky alternative (option R) as a function of time (8 blocks of 50 trials) in the Rare-loss task and the Equiprobable-loss task under two conditions, Exposure and No-exposure.

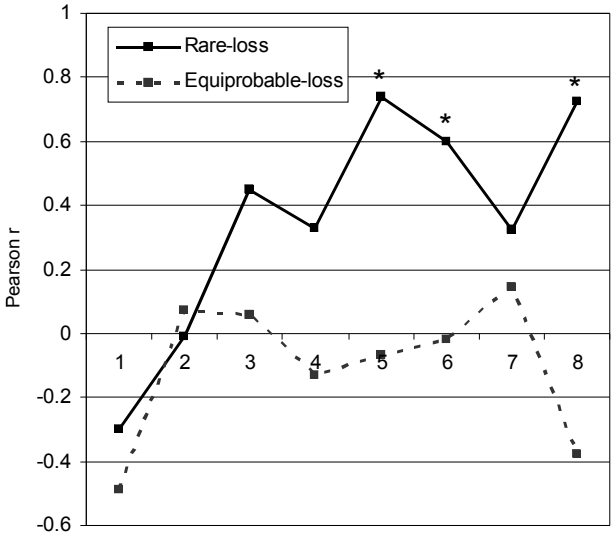

Figure 3: Study 1 results. Pearson correlations between choices of paired partners in the Exposure condition: A comparison of the Rare-loss task and the Equiprobable-loss task. Significant correlations are denoted by stars.

2.2 Results

Figure 2 presents the proportion of selections from the risky alternative (option R) in the two experimental tasks, in each condition. The figure shows that the social exposure manipulation increased the proportion of R choices under both tasks, but its effect was larger in the Rare-loss task. The results of the statistical analysis revealed the expected significant interaction between task type and experimental condition, $F(1, 96) = 2.76$, $p = .05$ one tailed, $MSE = 54.05$. Additionally, the results showed a main effect of social exposure, $F(1, 96) = 5.30$, $p = .02$, $MSE = 54.05$. Also, consistent with previous studies, the results showed more risk taking in the Rare-loss task than in the Equiprobable-loss task $F(1, 96) = 7.71$, $p = .01$, $MSE = 54.05$. No interaction effects with trial block were observed.

Additionally, we calculated the correlations between the choices of the paired partners in the Exposure condition.[2] Although based on small samples, these associations are interesting as they reflect the influence of the information concerning partners' choices. The results, presented in Figure 3, show an interesting discrepancy between the two tasks: In the Rare-Loss task the associations between paired participants were positive, this being statistically significant in the final blocks. In contrast, the associations were smaller and non-significant in the Equiprobable-loss task. This finding supports the hypothesis that in the Rare-Loss task participants are especially sensitive to social information in the form of others' choices and outcomes.

We also examined whether the correlation between paired participants in the Exposure condition changed significantly with task experience. For this purpose, we compared the correlations in the first and second half of the task, using the procedure devised by Steiger (1980) to test differences between dependent correlations. For the Rare-losses task the correlation in the second half was significantly larger than in the first half ($\chi^2 = 4.15$, $p = 0.04$). In contrast, for the Equiprobable-loss task the correlations were not significantly different in the two halves of the task ($\chi^2 = 0.02$, $p = 0.86$).

In summary, the results suggest that there was a generalized effect of social exposure on risk taking for both rare and equiprobable losses. However, the effect was larger in the Rare-Loss task. Moreover, in this task more similarity was observed between paired participants' choices, and the similarity increased with task experience. Accordingly, the effect of the social exposure on risk taking appears to be moderated to some extent by the risk type.

[2]Note that the choices of the participants were not synchronized. However, the average completion time in the Exposure condition was 21.7 minutes and the average difference between partners was only 47.8 seconds (SD = 71 sec.) indicating that overall paired partners made their choices at a similar pace. It is in fact interesting that despite the noise due to possible time lags, the associations for the Rare-Loss task were actually quite high.

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3 Study 2: Uncovering social exposure — observing others vs. being observed

Our initial hypothesis suggested that the effect of social exposure, demonstrated in Study 1, is brought about by being informed of others' payoffs. Yet this experiment did not show conclusively that receiving the information produces the enhanced risk taking. It could be that being observed by another individual and being the source of the other's social information is the factor that enhances risk taking. Perhaps, for example, an individual who is watched by another person does not wish to be perceived as a "chicken" who refrains from selecting an alternative that is more risky but commonly favorable (for similar accountability biases, see Ariely & Levav, 2000; Ratner & Kahn, 2002; but see Weigold & Schlenker, 1991; Zajonc, Wolosin, Wolosin, & Loh, 1970, for reversed findings). The goal of the present experiment was to compare the effect of being the target of the social exposure to the effect of being its source.

We therefore examined the Rare-loss task (1/20 Problem) using the following design: One participant in each randomly formed dyad was able to view the choices and outcomes of the paired participant whereas the paired participant was told that the first participant would be able to view his/her choices and outcomes but that he/she would not be able to view the first participant's choices and outcomes. These conditions were termed "Information-observer" and "Information-source." respectively. Based on the predicted influence of the salience of the common outcome, the effect observed in the Rare-loss task was expected to emerge in the "Information-observer" condition only.

3.1 Design and procedure

The study used the same exact setting as in Study 1 with the exception of the social exposure manipulation. Participants in the Information-observer condition were able to view the choices and outcomes of another participant, but knew that their actions were not being observed. Participants in the Information-source condition could not view others' choices and outcomes but were told that another participant would be watching their choices (the instructions and initial demonstration appear in the Appendix section).

Participants. A new sample of 32 Technion students was recruited (16 men and 16 women). The participants' age ranged between 19 and 30 (average of 23.2). The participants were paid a sum of NIS 28 to NIS 32, depending on their success in the experimental task. Participants were randomly assigned to the two experimental conditions with an equal proportion of men and women in each condition.

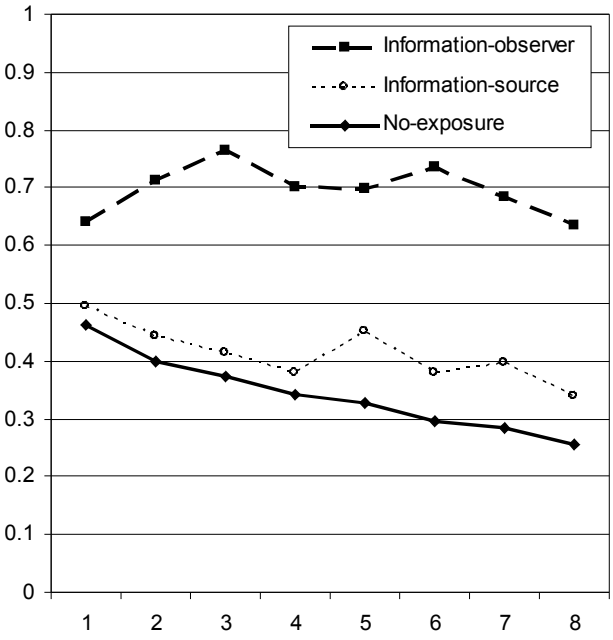

Figure 4: Study 2 results (Rare-loss task): Selections from the risky alternative (option R) as a function of time (8 blocks of 50 trials) in two experimental conditions: Information-observer and Information-source. The No-exposure condition from Study 1 is included as a benchmark.

Analysis. The analysis followed that of Study 1 (with no task condition). Logit transforms were conducted as indicated above.

3.2 Results

Figure 4 presents the proportion of selections from the risky alternative (option R) in the two experimental conditions. The results of the statistical analysis showed a significant difference between the two conditions, $F(1, 30) = 5.67$, $p = .02$; $MSE = 62.32$, with participants in the Information-observer condition making more risky selections than in the Information-source condition.

Figure 4 also includes the individual (No-exposure) condition from Study 1 as a benchmark. A comparison with this condition shows that the participants in the Information-source condition chose quite similarly to participants in the No-exposure condition of Study 1 (0.41 R choices compared to 0.34 in the No-exposure condition).[3]

[3]The association between paired partners' performance was on average 0.31 (NS). It increased from 0.22 in the first half of the task to 0.38 in the second half, although not significantly ($\chi^2 = 1.96$, $p = 0.16$). It is interesting to note that, while not statistically significant, the trend

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Taken together, the results demonstrate that in the Rare-loss task observing the choices and outcomes of others is a necessary condition for the effect of the social exposure on risk taking.

4 Discussion

Study 1 showed that being exposed to others' choices and outcomes had a two-pronged effect on risk taking. First, there was a general increase in risk taking as a result of social exposure, regardless of risk type. A similar effect was observed in young adults' variety seeking in the presence of peers making the same decisions (Ariely & Levav, 2000; Ratner & Kahn, 2002). It could be attributed to what young adults, particularly students, perceive as the social desirable norm in this kind of situation. Interestingly, our results have shown that, when exposure is "one-sided," as in the Information-source condition in Study 2, a positive effect of the social context on risk taking is not observed (other studies have shown that this situation can even lead to risk aversion; Weigold & Schlenker, 1991; Zajonc et al., 1970). Possibly, in this situation one's feelings of what is expected and how one is judged are more conservatively biased.

Secondly, in addition to the generalized effect there appears to be a task-specific effect of social exposure. Study 1 results have shown that social exposure was especially pertinent when the risky alternative produced rare but substantial penalties (and favorable common outcomes). In this task environment, the similarities between participants exchanging social information was found to increase over trials, and risk taking levels were more elevated than in a task involving equiprobable losses. This was explained based on the simple idea that people are sensitive to outcomes that are commonly rewarding, and tend to pick risky alternatives that produce these outcomes. Accordingly, if others' behavior makes this characteristic of a risky alternative more salient, this creates a risky shift in mutually exposed individuals.

Study 2 results ruled out an alternative explanation for the enhanced effect of social exposure in the Rare-loss task, that of an accountability bias (i.e., wanting to appear to make the commonly favorable choice). In this study, the enhanced risk taking pattern appeared when a decision maker observed another's behavior but disappeared when the person merely got the information that he or she was being watched. This supports our assertion that the social exposure effect in the Rare-loss task results from the exposure to the information concerning others' choices and outcomes.

is somewhat similar to that observed in study 1.

Our study's most important contribution is in highlighting the need to differentiate different types of risks with respect to the predicted effect of the social environment. Previous studies of individuals' choice behavior in social contexts have not made that difference. For instance, the study of Blaskovitch and his colleagues (1973) used a task that is more closely similar to an equiprobable-losses task. Consistent with our results, only a weak effect of social exposure was found in their study.

One important limitation of the study is that it did not analyze the factors that lead people to be sensitive to common outcomes, leading to the difference between different risk types. There are several plausible explanations for why people would overweight common outcomes, ranging from motivational explanations such as lack of self control (since the common outcome is also more immediate on average; Muraven & Baumeister, 2000) to accounts based on memory limitations (see Hertwig et al., 2004; Yechiam & Busemeyer, 2005).

Another limitation of the study is that we did not control the participants' choices using yoked participants whose choices are predetermined (see e.g., Zajonc et al., 1970). We did not use an artificially manipulated social environment because our goal was to predict the spontaneous tendency of people to take risk in situations involving social information, under different incentive structures. Such spontaneous tendencies are important for predicting the behavior of people in real-world situations involving an exchange of social information, with drivers and pedestrians being two examples.

4.1 Potential implications

Although our study focused on laboratory tasks in which it is easy to assess the choice outcomes, we believe that the current findings can also shed light on naturally occurring risks, if their incentive structure is properly analyzed. For instance, consider the choice whether to cross the street in a risky manner. When the likelihood of an accident is large, as can be simulated using a computerized task, our findings predict that the social context would have a relatively small effect (consistent with the findings of Gardner and Steinberg, 2005). In contrast, when the likelihood of an accident is small, as is typically the case in urban environments, a larger effect of social context is predicted (this is consistent with the findings of Hamed, 2001 and Himanen & Kulmala, 1988). Our findings suggest that, when risky behaviors lead to common favorable outcomes, then social information becomes an important factor that promotes risk taking.

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Appendix: Instructions

"Your payment for this experiment is NIS 40. From this amount you will incur losses based on your performance. Losses will be accumulated during 400 trials. In the top part of the screen in front of you there are two buttons, A and B. Your task is to choose between these two buttons by pressing any of them. You can press a button multiple times (as many times as you like) or switch between buttons (as many times as you like). The payment for your selection will appear on the chosen button (and below the two buttons)".

Study 1: In the Exposure condition participants were additionally instructed as follows:

"In addition, you will be able to see what the participant sitting behind you is doing in the task. The choices of this participant and his/her outcomes will appear on a window at the bottom of the screen. Your choices and outcomes will also be viewed by this participant.".

Study 2: In the Information-observer condition participants were next instructed:

"During the experiment you will be able to see what the participant sitting behind you is doing in the task. The choices of this participant and his/her outcomes will appear on a window at the bottom of the screen. However, the participant who sits behind you will not be able to see what you are doing."

In the Information-source condition participants were next instructed:

"During the experiment the participant who sits behind you will be able to see what you are doing. Your choices and your outcomes will appear on his/her screen. However, you will not be able to see what he/she is doing."

In both studies and under all conditions this was followed by a demonstration, using a bogus task that produced zeroes on each selection, that the choices and outcomes on one screen could be seen on the paired screen.

Participants in both studies were then given a description of the payoffs in their respective task (1/20 or 1/2 Problem):

"One of the two buttons leads to a sure loss of 2 Ag. In the other button there is a probability of 1 in 20 (1 in 2) to lose 30 (4) Ag and otherwise you lose 1 Ag. In this second button this means that in each and every trial (press of a button) there is a chance of losing 30 (4) Ag. The chances are determined by a random lottery in each and every trial".

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