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Ostracism Reduces Reliance on Poor Advice from Others during Decision Making

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ABSTRACT

Decision making is rarely context-free, and often, both social information and non-social information are weighed into one's decisions. Incorporating information into a decision can be influenced by previous experiences. Ostracism has extensive effects, including taxing cognitive resources and increasing social monitoring. In decision making situations, individuals are often faced with both objective and social information and must choose which information to include or filter out. How will ostracism affect the reliance on objective and social information during decision making? Participants ($N = 245$) in Experiment 1 were randomly assigned to be included or ostracized in a standardized, group task. They then performed a dynamic decision making task that involved the presentation of either non-social (i.e. biased reward feedback) or social (i.e., poor advice from a previous participant) misleading information. In Experiment 2, participants ($N = 105$) completed either the ostracism non-social condition or social misleading information condition with explicit instructions stating that the advice given was from an individual who did not partake in the group task. Ostracized individuals relied more on non-social misleading information and performed worse than included individuals. However, ostracized individuals discounted misleading social information and outperformed included individuals. Results of Experiment 2 replicated the findings of Experiment 1. Across two experiments, ostracized individuals were more critical of advice from others, both individuals who may have ostracized them and unrelated individuals. In other words, compared with included individuals, ostracized individuals underweighted advice from another individual but overweighed non-social information during decision making. We conclude that when deceptive objective information is present, ostracism results in disadvantageous decision making. Copyright © 2015 John Wiley & Sons, Ltd.

KEY WORDS decision making; ostracism; advice

Consider the journey of a road trip to an unfamiliar place. Your global positioning system (GPS) indicates that according to its objective geographical information, you should turn right in three miles. The passenger in the car with you disagrees. He has made this journey before and claims that the best route is to continue two more miles and then turn left. As the driver, which information do you use? This example of objective and social information can generalize to other domains of decision making under uncertainty. For instance, when purchasing a vehicle, individuals could take into account objective indicators such as fuel economy, price, and reliability or the advice from friends or relatives. In investments, a person could try to predict the objective qualities of the market or consult an expert. The quality of the information sources in this uncertain situation could directly affect both one's current and long-term financial state. Thus, individuals must often choose whether to incorporate objective or social information into their decisions, and the degree to which such information is incorporated could be heavily influenced by prior social interactions. Given the importance of decision making, it is critical to understand how common daily phenomena, such as positive and negative social experiences, might impact how individuals incorporate social and objective information into their decision making schema. Misleading information, regardless of its form, can have dire consequences and may be worse than making a decision without having any information at all. Therefore, the purpose of the current investigation is to examine how social experiences may influence reliance on—or rejection of—misleading information during decision making.

People are often provided with information that may help or hinder their ability to make optimal decisions, and this information may be non-social or social in nature. In both cases, individuals need to evaluate the validity of the information provided by the different sources to make an optimal decision. Across decision contexts, non-social and social information can improve the decisions people make, if the advice or information is accurate, or hinder decisions if the information is misleading. Previous research has compared the effects of misleading non-social information on decision making with that of context-free decisions, where no additional information about each option is provided. Results have shown that people are more likely to use non-social misleading information when it is available, hindering optimal decision making (Byrne & Worthy, 2013; Cooper, Worthy, & Maddox, 2013). However, objective information might not always be the optimal information source. In the example of navigating to a location using a GPS device, a right turn could be the shortest distance but might not translate to shortest time or account for obstacles such as construction or rush hour traffic. Therefore, in some cases, social information may be a superior choice to optimize results, avoiding pitfalls an otherwise objective source might not account for.

The impact of misleading social or non-social information depends on the degree to which an individual actually uses

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the information to make a decision. Previous research suggests that advice discounting is contingent on one's assessment of the potential costs and benefits of the given advice (Schrah, Dalal, & Sniezek, 2006). For example, the individual may view the benefits of possible enhanced decision accuracy and shared responsibility for the decision as superior or inferior to the potential cost of greater effort expenditure for utilizing the advice. Whether or not the individual utilizes advice depends on whether he or she believes that the potential benefits outweigh the potential costs (Bonaccio & Dalal, 2006). While people tend to initially assume that advice is beneficial and following advice is intrinsically rewarding (Biele, Rieskamp, Krugel, & Heekeren, 2011), individuals can also choose to discount advice for several reasons. If individuals have justifications for arriving at a conclusion on their own with supporting evidence for their decision but do not have access to the advisor's reasoning for their recommendation, then they may choose to rely on their own decision (Yaniv & Kleinberger, 2000). Moreover, the advisor's expertise, confidence in their advice, the quality of their advice, the individual's trust in the advisor, and performance-contingent reward outcomes also influence whether that individual will use or discount another's advice (Bonaccio & Dalal, 2006). Research examining individuals' trust in human compared with computer-generated advice has shown that individuals tend to trust advice equally from humans and computers in context-free conditions, but this can be biased by the individual's knowledge of the domain, culture, and experience with computers (Waern & Ramberg, 1996). However, it is unclear whether previous social experiences influence advice utilization.

One of the most powerful or evocative social experiences is ostracism, defined as being ignored and excluded. Moreover, individuals in Western cultures are more willing to trust strangers and, consequently, feel worse when rejected by strangers compared with those in Eastern cultures (Fiske & Yamamoto, 2005). Thus, the ostracism experience can result not only from being ignored and excluded by valued social others, but also by mere strangers, the latter of which we examine in the present study (Williams, 2007). Ostracism has robust and context-resistant effects on many psychological and physiological processes (Gonsalkorale & Williams, 2007; Eisenberger et al., 2003; Nezlek, Wesselmann, Wheeler, & Williams, 2012). Most results indicate ostracism is an undesirable experience. Ostracism can increase blood pressure, cortisol levels, inflammatory gene expression, and cytokine release (Murphy, Slavich, Rohleder, & Miller, 2013; Slavich, Way, Eisenberger, & Taylor, 2010; Stroud, Tanofsky-Kraff, Wilfley, & Salovey, 2000). Ostracism can also result in the basic psychological needs of belongingness, self-esteem, control, and meaningful existence being unmet (Zadro, Williams, & Richardson, 2004). These negative repercussions of ostracism may also extend to impaired cognitive processes. Previous research has shown that ostracism leads to significantly worse performance on reasoning tasks (Baumeister, Twenge, & Nuss, 2002). Specifically, individuals who were told that they would end up alone later in life performed worse on an IQ test and a test based on the Graduate Records Examination (GRE) Analytic and Reading Comprehension sections. While this might suggest ubiquitous cognitive detriments, decision making under uncertainty is a distinct cognitive process from reasoning tasks (e.g., Blackwood, Simmons, Bentall, Murray, & Howard, 2004; Geake & Hansen, 2005; Krawczyk, 2002; Volz, Schubotz, & Cramon, 2005), and we cannot infer from these findings that ostracism impairs decision making. Additionally, intelligence and memory retrieval tasks are non-social in nature, but decision making often involves social components. Therefore, the cognitive deficits associated with ostracism may not necessarily be generalized to cognitive tasks with a social context.

However, while ostracism appears to have sweeping negative effects, it is likely an adaptive mechanism that allows introspection into one's own behavior (Wesselmann, Nairne, & Williams, 2012). Being so context-resistant and pervasive in effect for both animals and humans (Lancaster, 1986; Nezlek et al., 2012; Raleigh & McGuire, 1986), ostracism is likely an indicator of a social problem that needs to be remedied. The cultural intelligence hypothesis proposes that humans have evolved particular cognitive skills, including comprehension, attention, memory, and social learning, which allow humans to thrive in a highly social environment (van Schaik & Burkart, 2011). Research comparing young children with apes and chimpanzees has shown that humans develop cognitive skills differently from other primates because of their unique social communication with other humans. For example, young chimpanzees learn cognitive skills that emphasize spatial relationships, object permanence, and relative quantities of objects (i.e., food items) through experience. In humans, these skills depend more on observation learning from other humans of the same culture, understanding social cues and gestures, and theory of mind (Herrmann, Call, Hernández-Lloreda, Hare, & Tomasello, 2007). This learning difference allows humans to acquire both physical and social cognition skills through social interaction. Therefore, understanding how inclusion status influences decision making is not only important psychologically but also furthers our knowledge of human evolution. If the response to ostracism is functional to survival, it should confer some benefit, which the literature implies. For example, ostracism can increase social monitoring, making individuals or groups more sensitive to social cues and information (Gardner, Pickett, & Knowles, 2005; Pickett, Gardner, & Knowles, 2004). This increased attention to social cues helps individuals or groups cautiously navigate their social environment and prevent further social pain. Information from a social context can be misleading, for example, receiving poor advice from a friend, and thus, it is possible that ostracized individuals are actually in an advantaged position because they are more critical of the information.

Moreover, ostracism may render social factors less important, in some cases, causing individuals to act more independently or even aggressively in order to re-assert control over their situation (Warburton, Williams, & Cairns, 2006; Williams, 2007; Zadro et al., 2004). As a result of a desire to avoid further rejection and increase a sense of control, ostracism may increase analysis of social information and decrease utilization of that information if it is judged as misleading. In contrast, being included has been shown to

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increase trust in previous task partners (Hillebrandt, Sebastian, & Blakemore, 2011). In summary, prior work hints that ostracism's impacts on decision making may be differential. While ostracism may confer some cognitive detriments, ostracized group members are likely focused on the consequences of the social contexts they are subjected to. The current study assesses whether this narrowed focus carries over to decision making and if it is moderated by information source.

In the current work, we examined how social interactions (inclusion or ostracism) affect choices when participants were provided with misleading non-social or social information. In Experiment 1, individuals completed either an ostracism or inclusion manipulation and then performed a decision making task in which participants received either misleading social (a former participant's poor advice) or objective information (biased reward feedback). A second experiment was conducted to replicate and extend the results we observed for individuals who were ostracized in Experiment 1. In Experiment 2, ostracized participants weighed social advice from an individual who was specifically stated not to have been one of the ostracizing agents in the ostracism manipulation portion of the experiment. We compared the performance of these participants to those from ostracized individuals who subsequently performed in the same non-social misleading information condition from Experiment 1. Thus, in Experiment 2, we again examined decision making performance of individuals in the ostracism condition who received social misleading information, except that participants were explicitly informed that the advice they received was from a previous participant who did not play Cyberball. To assess performance, we used a decision making task that has been shown be working memory-dependent and therefore should tax cognitive resources (Worthy, Otto, & Maddox, 2012). The information provided in both conditions was misleading in that relying on it hindered performance on the decision making task. We predicted that, because of taxed cognitive resources, ostracized individuals would perform worse than included individuals when non-social misleading information was given. We also hypothesized that, because of rejection of social information, ostracized individuals would perform better on the task when misleading social information was provided when the advice was from both a former participant who could have played Cyberball (Experiment 1) and an individual who was clearly not involved in ostracizing them (Experiment 2). This would suggest that ostracized individuals are more susceptible to misleading non-social information (feedback on their performance) but actually less susceptible to misleading social information (bad advice). In essence, this tendency to reject social information would confer a benefit in a social context.

EXPERIMENT 1

Method

Participants

Undergraduate students ($N = 245$; age range 18–25 years) at a large southwestern university completed the experiment for course credit. Participants were randomly assigned to one of six conditions: ostracized non-social information ($N = 36$), ostracized social information ($N = 38$), included non-social information ($N = 35$), included social information ($N = 41$), ostracism no-information ($N = 50$), and a control condition with no inclusion status or misleading information manipulation ($N = 45$). One participant in the ostracism no-information condition had to be excluded because the Cyberball game did not load correctly and the participant was able to view only the players but not the ball. Therefore, only 49 participants were used for the analysis in this condition. Thus, four conditions resulted from the factorial combination of two inclusion status conditions (ostracized versus included) and two information context conditions (social versus non-social). The control and ostracism no-information conditions were included as comparison groups.

Procedure

Participants first completed the manipulation of ostracism or inclusion and then completed a decision making task in which participants made repeated decisions. As the participants made their decisions, they were exposed to either misleading social or nonsocial information.

Group task. Participants in the inclusion and ostracism condition completed the virtual ball-tossing game on PC computers using Cyberball ® (version 4.0) ostracism manipulation online (http://www1.psych.purdue.edu/~willia55/Announce/cyberball.htm; Williams, Cheung, & Choi, 2000; Williams & Jarvis, 2006; Williams, Yeager, Cheung, & Choi, 2012) on PC computers. Individuals were randomly assigned to participate in the inclusion or ostracism condition. Participants were told that they would be playing a game with two other players in an adjacent room. The instructions detailed the game as a non-competitive mental visualization task. Participants were instructed to imagine the immediate environment while playing the game, visualizing the ball, players, and surroundings. When they finished reading, the experimenter walked to the adjacent room to check to see if the other, non-existent participants were ready to begin playing (to enhance the plausibility of the deception). The game consists of three players that throw a ball among themselves repeatedly. In the game, two of three players are pre-programmed, computer-generated players. The third player is the human participant who can throw to either computer "player" by clicking an icon representing the player they want to throw the ball to. There were 30 total ball tosses in the game, lasting approximately 5 min. In the inclusion condition, participants received the ball a third of the time and thus received equal playing time as the other "players." In the exclusion condition, participants only received the ball twice, once from each player, throughout the 30 ball tosses and were ignored on the rest of the tosses.

Decision making task. We opted to use the dynamic decision making task to address our research question. This task emulates the "road trip dilemma" described in our introduction. Our participants were presented with objective or social

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information based on random assignment. This information proved to be misleading, regardless of information source condition, such as a poorly calibrated GPS (objective) or an uninformed passenger (social). This decision making task has been previously used in several studies to examine one's ability to deduce a decision strategy by choosing between options with immediate and long-term benefits (Byrne & Worthy, 2013; Gureckis & Love, 2009; Worthy, Gorlick, Pacheco, Schnyer, & Maddox, 2011; Worthy et al., 2012). The task is choice history-dependent in that the rewards participants receive depend on their decisions made on previous trials, which models real-world decision scenarios in which the consequences of one's actions depend on choices made previously. The reward structure for the task is shown in Figure 1. The *Increasing* option gives a smaller immediate reward on each trial. Rewards for both options increased as the Increasing option was selected more often. In contrast, the *Decreasing* option gives a larger immediate reward on each trial. Rewards for both options decreased as the Decreasing option was selected more often. Thus, the optimal strategy was to repeatedly select the Increasing option even though it always provided a smaller immediate reward. The Decreasing option might seem attractive initially, but it would ultimately result in lower values earned over the course of the task. Meanwhile, the Increasing option seemed low initially, but it resulted in better performance on the task long-term. The decision making process in such cases becomes more complex and realistic and involves one's ability to find the immediate and delayed advantages and disadvantages of each option.

Participants were presented with two decks, gaining points toward a predetermined goal with each choice. Point values increased or decreased by five-point increments. Participants started the task with 55 points if choosing the Increasing option first. The Increasing deck increased to 60 points, 65 points, and so forth until the deck value reached 80 points on the 11th consecutive selection (Table 1). Once 80 points was reached, the Increasing option repeatedly gave a value of 80 points until the Decreasing option was selected. Similarly, participants started the task with 65 points for the Decreasing option, which decreased to 60 points after the initial selection and continued to decrease to a minimum value of 40 points. Once 40 points were reached, participants repeatedly earned 40 points if they continued to select the immediately rewarding Decreasing option. Thus, selecting the Decreasing option repeatedly provided 40 points after it was selected 11 or more times in a row. Participants were shown the points earned upon selecting each option and their point total was updated.

Participants completed the decision making using Psychtoolbox for Matlab (version 2.5). They were instructed to repeatedly choose between two decks, which yielded points based on their selections. Participants were given a goal of earning 7200 points over the course of the 100 trials (equivalent to choosing the Increasing optimal option on 80% of trials). They were not given any information about the reward structure of each deck or the number of trials in the task. The decision making task lasted 10–15 min, depending on the rate at which the participant completed the task. Following completion of these tasks, participants were debriefed about the nature of the experiment.

Non-social information condition. Participants in the non-social information condition were instructed that they would see how many points they would have gotten, or foregone rewards, had they selected from the other deck on each trial

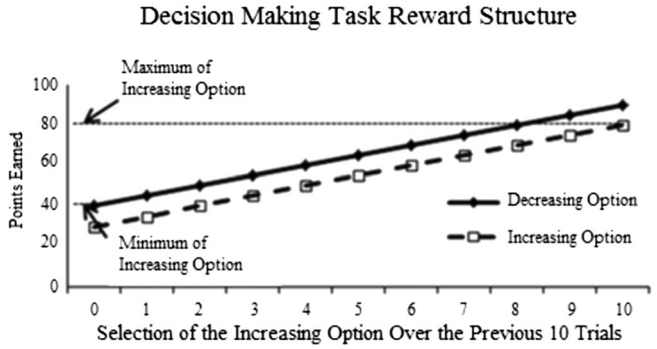

Figure 1. Decision making task reward structure. Rewards were a function of the number of times participants selected the Increasing option over the previous 10 trials. If participants selected the Increasing option on all 10 of the previous trials, then they would be at the right-most point on the *x*-axis. If they selected the Decreasing option on all 10 of the previous 10 trials then they would be at the left-most point on the *x*-axis. There is a consistent 10-point difference in rewards given for the Increasing (dotted line) and Decreasing (solid line) options. When making a selection, the points earned progresses one unit to the right (Increasing; higher reward) or the left (Decreasing; lower reward). The foregone reward displayed is the corresponding value on the other line. When switching between decks, the corresponding value on the other line is earned first, and then points earned increases or decreases in accordance with the new selection

Table 1. Point values given based on deck selections

Increasing option selections		Decreasing option selections	
Increasing option	Decreasing option	Increasing option	Decreasing option
55	65	55	65
55	65	55	65
60	70	50	60
60	70	50	60
65	75	45	55
65	75	45	55
70	80	40	50
70	80	40	50
75	85	35	45
75	85	35	45
80	90	30	40
80	90	30	40
80	90	30	40

Pattern of points earned in the Increasing optimal task for the Increasing and Decreasing options if the Increasing option is repeatedly selected (left) or if the Decreasing option is repeatedly selected (right). Participants begin with 55 points for the Increasing option and 65 points for the Decreasing option. If the Increasing option is repeatedly selected, individuals will earn 80 points on each trial after the first 10 trials. If the Decreasing option is repeatedly selected, individuals will earn 40 points on each trial after the initial 10 trials. Thus, repeatedly selecting the Increasing option leads to a 40-point advantage compared with the Decreasing option. Switching between decks follows the same pattern.

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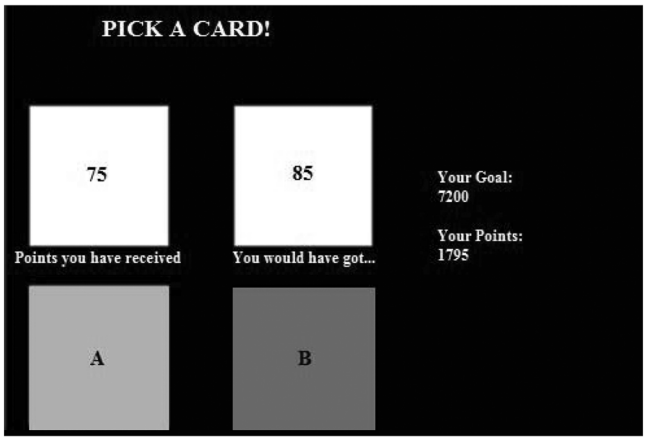
(Byrne & Worthy, 2013; Otto & Love, 2010). For example, after selecting their deck, if they earned 40 points by selecting the Decreasing option, they were informed that they would have received only 30 points had they selected the Increasing option. This information was misleading because it biased participants toward the sub-optimal option (as the Increasing option offered less on each individual trial). Figure 2a shows a sample screenshot from the foregone rewards misleading information condition in the experiment. The Decreasing deck always offered 10 points more on each trial but would decrease in progressive selections. However, selecting the Increasing option repeatedly would lead to an increase in points earned on each selection, from 35 points to 40 points and so forth until it reached the maximum value of 80 points. Showing the reward for the non-chosen option makes the larger immediate rewards provided by the Decreasing option more salient and can bias individuals into selecting the disadvantageous option.

Social information condition. Participants who completed the social information condition were given the following instructions:

> This task may seem challenging at first, so in order to help you figure out the strategy to earn enough points to meet the goal, we are going to tell you the previous participant's strategy recommendation.
> The participant you were paired with recommends that: The card on the right is better because it offers more points in the long-run than the other deck.

Their partner's advice was a poor recommendation in which they advised choosing the Decreasing deck, the immediately rewarding, sub-optimal option. Figure 2b depicts a sample screenshot from the social misleading information condition. They were not told whether or not their partner was successful on the task. The Decreasing deck was the sub-optimal deck for all participants, and thus, this social misleading information was designed to bias participants toward the sub-optimal option if it were followed. The hypothetical partner's advice was provided both in the instructions and throughout the duration of the task at the bottom of the screen. Thus, the social information was fixed throughout the task.

(a)



(b)

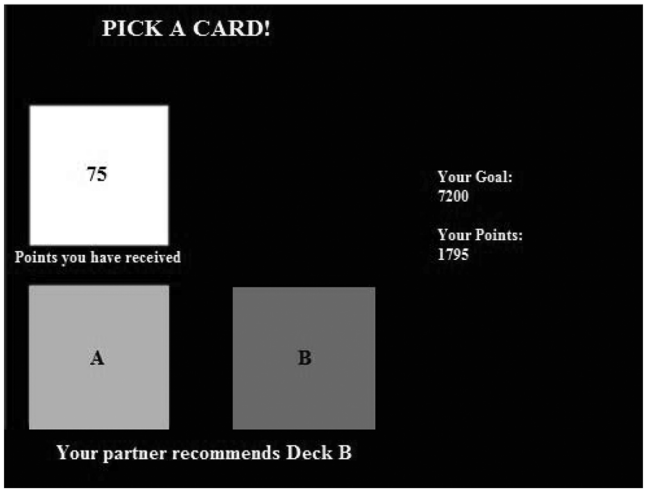


Figure 2. (a) Sample screenshot from the non-social context condition of the decision making task in which participants were shown what they "would have got" had they selected the other option. (b) Sample screenshot from the social context condition in which participants were informed that their partner recommended Deck B

RESULTS

In order to gage how participants performed on the decision making task, the total proportion of Increasing option selections over all 100 trials was computed and used as the dependent variable. The proportion of Increasing deck selections was directly proportional to the amount of points earned, $r = .99$, $p < 0.01$. Therefore, using proportion of Increasing option selections and total points earned on the task as the dependent variable yielded identical results.

To examine the impact of ostracism on decision making based on context, we conducted an analysis of variance on the proportion of Increasing option selections with inclusion status (ostracized versus included) and context (social versus non-social) as between-subject factors. There was no main effects for either inclusion status or context, $p > .10$, indicating that both inclusion status and context conditions independently did not lead to differences in performance. Critical to testing our predictions, there was a significant interaction between ostracism condition and context, $F(1, 146) = 10.95$, $p = .01$, $\eta^2_p = 0.07$. Simple effects analysis revealed that, given misleading non-social information, ostracized participants ($M = .27$, $SD = .30$) were more susceptible to misleading information and performed worse than included participants ($M = .43$, $SD = .27$), $t(69) = 2.43$, $p = .02$, $d = .56$. In contrast, given misleading information in a social context, included individuals ($M = .28$, $SD = .22$) relied more on the social information and performed worse than ostracized participants ($M = .40$, $SD = .28$), $t(77) = -2.21$, $p = .03$, $d = .50$. When comparing the ostracized conditions, individuals in the social information condition chose the advantageous option significantly more frequently than individuals in the non-social information condition, $t(72) = -2.01$, $p = .05$, $d = .47$. The opposite pattern of results was observed in the included condition; individuals in the non-social information condition outperformed those in the included condition, $t(74) = 2.75$, $p < .01$, $d = .63$.

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To determine whether the context conditions were successful in influencing decision making performance, we conducted separate independent samples *t*-tests where we compared performance in each experimental condition with performance in the control condition using a Bonferroni correction of $\alpha = .0125$. Results indicated that individuals in the social context inclusion condition chose the optimal Increasing option significantly less than individuals in the control condition ($M = .51$, $SD = .21$), $t(84) = -5.02$, $p < .001$, $d = 1.08$. Similarly, individuals in the non-social context ostracism condition also selected the Increasing option significantly less frequently than those in the control condition, $t(79) = -4.28$, $p < .001$, $d = .94$. Participants in the social context ostracism condition showed a marginally significant difference from the control condition in selection of Increasing optimal option selections such that the ostracized individuals in the social context condition selected the optimal Increasing option less than those in the control condition, $t(81) = -1.94$, $p = .06$. Participants in the non-social context inclusion condition did not significantly differ from control ($p = .16$).[1] Taken together, however, the results clearly demonstrate that included participants relied more on the misleading information and performed relatively worse on the decision making task when the context was social, whereas ostracized individuals performed worse when provided with non-social misleading information (Figure 3a).

We also conducted a repeated measures analysis of variance to determine whether there were differences in learning over time between groups. The proportion of Increasing options selected for each block of 25 trials was used as the dependent variable. Figure 3b shows the learning curves over time for each ostracism group and context condition. Results revealed a significant interaction between ostracism condition and context for learning the decision strategy over time, $F(3, 438) = 3.10$, $p = .03$, $\eta^2_p = .02$. Included individuals in the social context and ostracized individuals in the non-social context learned the optimal decision strategy at a slower rate than included individuals in the non-social context and ostracized individuals in the social context. In order to rule out the possibility that ostracized individuals simply perform worse than included individuals, we compared the ostracized social and non-social information conditions with an ostracized condition where participants were not given any information, similar to the control condition. The results of the one-way analysis of variance demonstrated a significant difference between groups, $F(2, 120) = 7.84$, $p = .001$ $\eta^2_p = .12$. Simple effects analysis revealed that ostracized participants who received non-social information ($M = .27$, $SD = .30$) performed worse than ostracized participants who received no information during the decision making task ($M = .49$, $SD = .21$), $t(59.39) = -3.93$, $p < .001$, $d = .85$. There was no significant difference between the ostracized no-information and social information conditions, $p = .10$.[2] Overall, these results provide evidence that ostracized individuals perform worse during decision making because of reliance on misleading non-social information, and not simply a general deficit due to the ostracism experience.

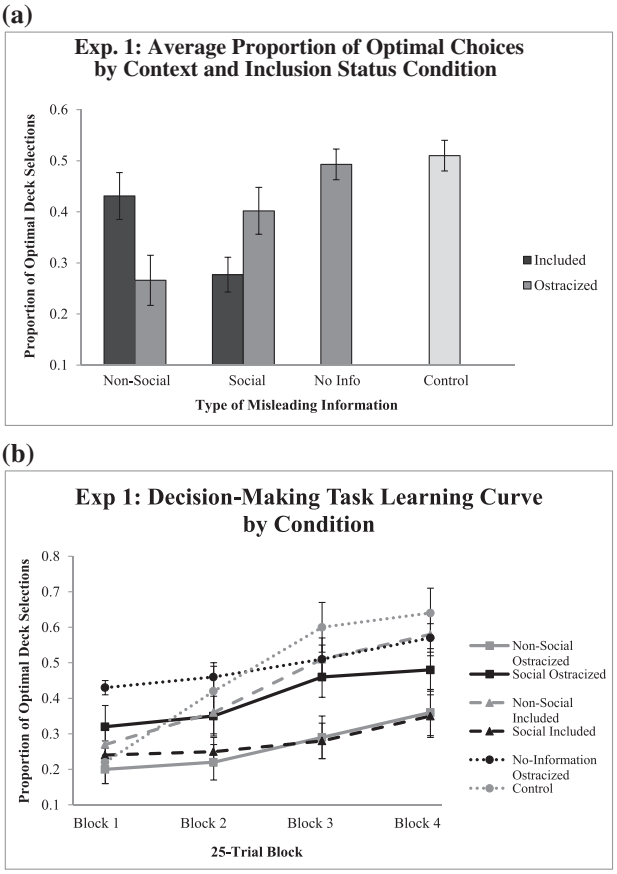

Figure 3. (a) Average proportion of total times included and ostracized participants in Experiment 1 selected the Increasing optimal deck moderated by type of misleading information, non-social or social. The ostracized no-information condition and control groups are also shown. (b) Learning curves for decision strategy selection by ostracism and context condition in Experiment 1. The ostracism, no-information, and control groups are also shown. Decision strategy selections are represented by the average proportion of total times participants selected the optimal Increasing option for each 25-trial block. Error bars represent standard errors of the mean

[1]Because these non-significant results may be important in determining whether social interaction in general, either positive or negative, detrimentally affects decision making, we conducted post hoc power analyses using the statistical program JMP version 11.2 to assess whether these conditions had sufficient power to detect an effect of negation. Using the observed means and standard deviations for the control compared with the included, non-social information condition ($N = 80$), the power was determined to be .42. In order to detect a medium effect size ($d = .50$; Cohen, 1977), a sample size of 64 would have been needed. For the control versus the ostracized, social information condition comparison ($N = 83$), the power level was .70, given the observed means and standard deviations. Because of the limited statistical power, it possible that the sample size in these conditions may not have been sufficient to detect a significant difference between groups. Thus, we cannot rule out the possibility that social interactions detrimentally influence decision making.

[2]A post hoc power analysis ($N = 87$) using the observed means and standard deviations demonstrated that we had a power level of .51. Consequently, it is possible that limited power contributed to the null findings for the ostracized no-information and social information comparison; however, given this level of power, we observed a large ($d > .80$; Cohen, 1977) detrimental effect of non-social information on decision making performance. Although there is still a possibility that there is a small or medium effect of social information on ostracized individuals' decision making performance, we can conclude that the effect is not comparable in magnitude with that of the ostracism, non-social information condition.

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DISCUSSION

The results of Experiment 1 suggest that social experiences influence how individuals utilize information when making decisions. While individuals who were socially included depended on the social information (advice) more than the non-social information (foregone reward feedback) when making decisions, ostracism led to the opposite effect. Ostracized individuals tended to base their decisions on the misleading non-social information more than social information. Furthermore, because ostracized individuals who received no information, neither social nor non-social, during the decision making task performed better than ostracized information who received non-social information, we can conclude that ostracism does not result in overall cognitive impairments when making decisions. Instead, ostracism specifically moderates the type of information that individuals attend to when making decisions—reliance on objective information relative to social information.

One possible limitation to the methodology, however, is that the current instructions for the social information condition leave open the possibility that the advice they are receiving during the decision making task is from one of the participants who ostracized them during the Cyberball game. Because participants were only instructed that the advice was from a participant who already completed the decision making task, it may have been unclear whether the advice was from a new social agent or an ostracizing agent. If ostracized participants assumed that the advice was from an ostracizing agent, then the results of Experiment 1 may only extend to ostracized individuals discounting advice from ostracizing agents, rather than discounting social information in general. In order to address this possibility and to test whether the effects of ostracism on decision making replicate, we conducted a second experiment. In Experiment 2, participants in the social information condition were informed that the advice they are receiving is from an individual who did not play Cyberball. This social information condition with the modified instructions was then compared with an ostracized, non-social information condition identical to the same condition from Experiment 1.

EXPERIMENT 2

Method

Participants

Undergraduate students ($N = 105$; 58 female students, age range 18–21 years) at a large southwestern university completed the experiment for course credit. Participants were randomly assigned to either the ostracized, social information ($N = 52$) or ostracized, non-social information condition ($N = 53$).

Procedure

For the social information condition, the procedure was the same as in Experiment 1 with one exception. In the instructions, participants were explicitly informed that their partner was a participant who had completed the experiment in the previous time slot (i.e., their partner performed the experiment the hour before the current participants), and that their partner did not play Cyberball but only completed the card task that they are about to complete. The non-social information condition was identical to Experiment 1 and was included as a control for the ostracized, social information condition to test whether the effects of ostracism from Experiment 1 replicate. Because the purpose of Experiment 2 was to determine whether ostracism reduces reliance on advice from other individuals who had not been involved in the ostracism incident, we only assigned individuals to the ostracism condition of the group task. Results were then compared with the included conditions from Experiment 1.

RESULTS AND DISCUSSION

An independent samples *t*-test was performed to test for differences between the ostracized social and non-social information groups. The results of this analysis indicated that ostracized individuals in the social information condition ($M = .37$, $SD = .23$) chose the advantageous option significantly more frequently than ostracized individuals who were given misleading non-social information ($M = .25$, $SD = .25$), $t(103) = 2.48$, $p = .02$, $d = .50$. Figure 4 depicts the difference in learning performance and selection of the Increasing option for the ostracized social and non-social information conditions.

Furthermore, an analysis of variance was conducted to compare the ostracized, social and non-social information conditions in Experiment 2 with the included conditions from Experiment 1. Results revealed a significant inclusion status condition by context condition interaction, $F(1, 176) = 13.30$, $p = .001$, $\eta^2_p = 0.07$. There was no main effect of inclusion status or context, $p > .10$. Simple effects tests demonstrated that given misleading information in a social context, included individuals ($M = .28$, $SD = .22$) relied more on the

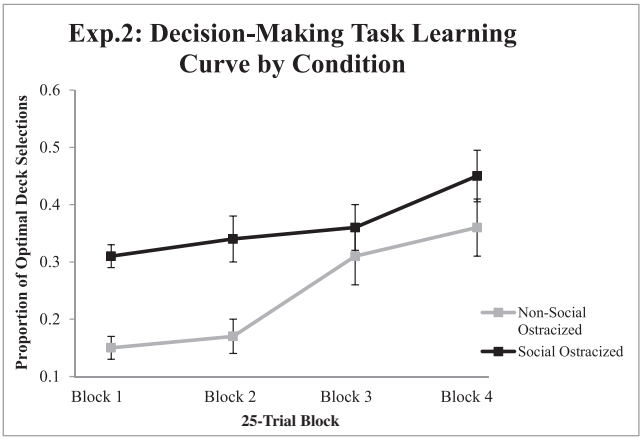

Figure 4. Learning curves for decision strategy selection for the ostracized social and non-social misleading information conditions in Experiment 2. Decision strategy selections are represented by the average proportion of total times participants selected the optimal Increasing option for each 25-trial block. Error bars represent standard errors of the mean

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social information from a previous participant that was unrelated to the ostracism manipulation than and performed worse than ostracized participants ($M = .37$, $SD = .23$), $t(91) = -2.00$, $p = .05$, $d = .42$. Compared with the control condition from Experiment 1, both the ostracized, social information condition $t(95) = -3.13$, $p < .01$, $d = .64$, and the ostracized non-social information conditions, $t(96) = 5.47$, $p < .001$, $d = 1.13$, in Experiment 1 selected the optimal option less often.[3] Thus, ostracism experiences may lead to detrimental decision making performance relative to no social experiences prior to making a decision.

To compare the ostracized, social information condition from Experiment 1 where the involvement of the partner giving advice in Cyberball was left ambiguous with the ostracized, social information condition in Experiment 2 where participants where explicitly informed that their partner did not play Cyberball, we conducted an independent samples *t*-test. Results showed that there was no significant difference between the ostracized, social information condition in Experiment 1 ($M = .40$, $SD = .28$) and Experiment 2 ($M = .37$, $SD = .23$), $p = .51$. Ostracized individuals thus do not weigh misleading advice from a person who may have ostracized them differently from an individual who was clearly not involved in their ostracism experience.

The results of Experiment 2 replicate the results of Experiment 1 for both the ostracism social and non-social context conditions. Individuals who had been ostracized still relied more on objective information compared with social advice when making decisions, even when they were specifically informed that the advice offered was from an individual who had not played Cyberball and, therefore, was not a part of the ostracism experience. These findings provide strong evidence that relative to misleading objective information, ostracism reduces reliance on advice from social agents, regardless of whether the social agent was involved in the ostracism experience or not. Because the advice given in the present study was misleading, discounting social information resulted in advantageous performance during decision making.

GENERAL DISCUSSION

Optimal performance on this decision making task required ignoring misleading information and instead attending to the task choice outcomes. Across two experiments, the present investigation revealed that in a non-social context, ostracized individuals relied more on the misleading information than included individuals and made sub-optimal decisions; in a social context, ostracized individuals relied less on the misleading social information and performed better on the decision making task. These findings are consistent with the idea that ostracism leads to increased reliance on non-social information, but less utilization of misleading social information during decision making. Importantly, the findings further suggest that ostracism does not result in ubiquitous cognitive decrements but instead can actually improve decision outcomes in particular contexts. While ostracism, using the life-alone paradigm, has been shown to cause declines in intelligent thought and reasoning ability (Baumeister et al., 2002), we find that ostracism actually conferred an advantage during decision making when social misleading information was present relative to when objective information was present. Ostracized individuals were better at ignoring bad advice from others.

The improved performance of ostracized individuals in social contexts relative to non-social contexts is consistent with the idea that ostracism enhances social attentiveness and sensitivity to social cues (Gardner, Pickett, & Brewer, 2000; Pickett et al., 2004). Specifically, ostracism leads participants to be more critical of the impact of that cue; in this case, ostracized individuals learn that the social advice cue was misleading and thus ignore it compared with included individuals. Ostracized individuals' decreased reliance on social information is also in line with reactions to ostracism that increase one's autonomy and control over a situation (Maner, DeWall, Baumeister, & Schaller, 2007). Additionally, because the included individuals in the social context struggled to identify the optimal strategy relative to the ostracized, social context condition, these results suggest that inclusion may not always be beneficial in decision making. It appears that inclusion does not inspire an individual to quickly identify and solve an adaptive problem; there is little incentive for individuals to focus on social details when they have already fulfilled their need to belong. As such, being included in a group when the group members give poor advice can put individuals at risk of not questioning misleading information, negatively influencing decision making. This may help explain why group outsiders can occasionally thrive because they are more critical of traditional group behavior.

The findings of this study provide strong evidence that ostracism influences decision making strategies, depending on whether the context is social or non-social. These results provide clear support for our assertion that the nature of information provided has strong effects on decision making performance following social interactions. Thus, following an ostracism experience, individuals may approach an uncertain situation, such as investing or making a major purchase, with less openness to social information and may instead prefer to use objective information. Previous research has shown the possibility of being included back into a group leads individuals to become more socially compliant, and thus our results apply under conditions when re-admittance is not possible (Carter-Sowell, Chen, & Williams, 2008).

The lack of a main effect for context condition supports prior findings showing that individuals tend to trust human and computer advice similarly (Waern & Ramberg, 1996). Previous research has also demonstrated that knowledge of a domain and justification for choosing one's own decision over an advisor's leads to advice discounting (Waern & Ramberg, 1996; Yaniv & Kleinberger, 2000). Our results extend these findings and show that social experiences prior to an advice-taking situation also affect whether one utilizes or discounts advice. It appears that ostracism leads to enhanced

[3]In contrast to the limited power between the control and ostracized, social information condition in experiment 1, in this experiment, the power level was .93.

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advice utilization when that information is non-social but increased advice discounting when the information is social in nature. One possible explanation for this effect is that previous social experiences may semantically prime for the same type social processing in a subsequent task. This may lead to an anchoring effect whereby positive social experiences bias individuals to rely heavily on social information, while negative social experiences bias individuals to anchor their decision on non-social information. However, as we did not directly test for priming and anchoring effects, we cannot definitively conclude that social priming and anchoring account for our findings, and future work should examine this effect.

This finding also supports the cultural intelligence hypothesis and suggests that humans may have special decision making strategies that integrally depend on social communication. For example, climbing the social ladder, making connections to further one's career, and collaborating with others are unequivocally beneficial in many situations. In other contexts, however, it may be more advantageous to forge one's own way. We show that whether one chooses to make decisions based on social factors or work independently can be influenced by social experiences. Future work should be aimed at the direct role of the cultural intelligence hypothesis on decision making.

Limitations

While our conclusions regarding inclusion status are aimed at decision making, we note that decision making tasks other than the choice history-dependent decision making task we used in the present work may reveal a different pattern of results, and more research should explore the effects of inclusion status on how information is utilized during decision making. A limitation to our findings is that non-social misleading information updated during the task to reflect misleading information in real time. Meanwhile, the social misleading information was static across trials. While this may be considered a weakness to our design, we note that there was no main effect of performance between the tasks. As such, there is no evidence that the dynamic non-social information was any more effective or made the task easier than the social misleading information.

Additionally, one issue for the null findings observed in the comparisons between the control condition and the inclusion, non-social information condition and the control condition compared with the ostracized, social information condition in Experiment 1 is a possible lack of sufficient power. While the difference between the control condition and ostracized, social information condition was marginally significant in Experiment 1, this difference reached significance in Experiment 2. Thus, there is evidence that ostracism may hinder decision making performance relative to no social experiences. However, because of the modest sample size in the included, social information condition and the subsequent restricted power, it is possible that both ostracism and inclusion experiences may be detrimental in decision making performance. One avenue for future research, therefore, is to examine whether both positive and negative social experiences lead to decrements in decision making ability relative to not having any social interactions at all. We note, however, that social interactions are so prevalent in everyday life that many decisions that individuals make are often preceded, and thus influenced by, social exchanges with others.

Finally, it is important to consider the external validity of these results in real-world contexts. Because participants in our experiment were making decisions that did not have any real personal risk or benefit to them, decision making in other situations, such as making a major purchase or investment, may lead to different results. It is possible, for example, that the effects of ostracism may be specific to reward-based or long-term decision making processes. Thus, additional research on ostracism and various decision making situations should be conducted to determine which types of decision making contexts may be affected by ostracism experiences.

Conclusions

Interacting with others and making decisions are both integral and inescapable facets of humans' daily lives. When making decisions, there are many factors to consider, including both social and non-social information. Because social interaction is so inherently essential to our everyday functioning, it seems natural that social dynamics and decision making would influence one another. Although inclusion is a desirable state, we find that ostracism can serve an adaptive function when faced with misleading social information compared with objective information, steering us back on track to avoid social pitfalls in the way of our goals. Inclusion enhances reliance on social information, even when it leads to poorer decisions. Therefore, our findings suggest that one's social experiences influence not only the way in which one interacts with others but also the way they use information and make decisions in both social and non-social contexts.

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