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Title	Investigating false memories among "winners" and "losers" in the prisoner's dilemma
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Publication date	2022-08-26
Original Citation	Greene, C. M., Donnelly, O., Garvin, C. and Murphy, G. (2022) 'Investigating false memories among winners and losers in the prisoner's dilemma', Memory, 30(10), pp.1334-1348. https://doi.org/10.1080/09658211.2022.2115515
Type of publication	Article (peer-reviewed)
Link to publisher's version	10.1080/09658211.2022.2115515
Rights	© 2022, Informa UK Limited, trading as Taylor & Francis Group. This is an Accepted Manuscript of an item published by Taylor & Francis in Memory on 26 August 2022, available online: https://doi.org/10.1080/09658211.2022.2115515 - https://creativecommons.org/licenses/by-nc/4.0/
Download date	2026-11-06 13:25:09
Item downloaded from	https://hdl.handle.net/10468/13697



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Investigating false memories among "winners" and "losers" in the Prisoner's Dilemma

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In press in 'Memory'

Abstract

Many legal cases hinge on evaluating the veracity of two versions of events ('he said, she said'). Expert witnesses are often called upon to testify on the malleability of memory, most often testifying for the defence. This may lead to the theoretically unfounded assumption that it is only victims who are vulnerable to distorted memories of a crime. Inspired by this question, we conducted a series of five experiments in which 2010 participants played a novel version of the Prisoner's Dilemma. Participants could either betray their partner in the game ('winners') or be betrayed by their partner ('losers'). We exposed participants to misinformation concerning the other player's statements to assess whether winners and losers may be differentially susceptible to false memories of the event in question. Across our experiments, including where real financial rewards were at stake, we found that winners were just as susceptible as losers to memory distortion. We highlight the need to consider the possibility of faulty memory affecting all parties to in legal cases, though further research is needed beyond this highly artificial paradigm.

Keywords

False memory; misinformation; Prisoner's Dilemma; expert witness

Introduction

Decades of research have provided clear evidence of the malleability of memory (see Loftus, 2003; Loftus, 2018 for reviews). This can have significant consequences in judicial settings; for example, memory errors may affect the ability of an eyewitness to accurately identify the perpetrator of a crime (Clark & Godfrey, 2009). Mistaken eyewitness identifications have led to countless wrongful convictions, many of which are documented in detail at https://innocenceproject.org/. The use of leading questions or other forms of post-event misinformation can also distort a witness's memory of the details of an event (Greene et al., 2021; Loftus & Palmer, 1974), and repeatedly interviewing a witness or suspect about a potential crime can even lead to the construction of entirely false memories (Loftus, 2004; Schacter, 1995; Shaw & Porter, 2015).

Research into motivated memory has demonstrated that memories of events tend to be reconstructed in line with our views about the world; for example, people are more likely to falsely remember fabricated scandals that reflect poorly on their political opponents (Frenda et al., 2013; Greene, de Saint Laurent, Murphy, et al., 2022; Greene et al., 2020) and more likely to report a memory for fabricated events that confirm their views on social issues like feminism (Murphy et al., 2021) and vaccination (Greene, De Saint Laurent, Hegarty, et al., 2022). Studies of hindsight bias show that judgements about past events are influenced by our knowledge of the outcome (Fischhoff, 1975; Roese & Vohs, 2012) and that this in turn is moderated by the valence of the outcome—that is, whether the individual views the event as having been positive or negative (Greene, Levine, et al., 2022). There is also evidence that memories of emotional events are coloured more by our current emotional state than how we actually reported feeling at the time (Levine et al., 2021; Schmidt et al., 2021). Thus, it seems plausible that we may be motivated to accept misinformation that reframes our past actions in a positive light, and that this might be moderated by the emotional valence of the situation. To evaluate this hypothesis, we created a scenario based on the Prisoner's Dilemma. Participants played a game whose outcome was fixed, leading to a positive or negative outcome. We

then presented misinformation about the other player's statements during the game and evaluated uptake of this information by "winners" and "losers".

The Prisoner's Dilemma: A model for misinformation acceptance in an adversarial situation

The Prisoner's Dilemma provides a situation in which participants must make a choice, with consequences for the other player in the game. In the classic version of this game (proposed by Merrill Flood, and then formalised by Albert W. Tucker in the 1950s), participants are presented with a scenario in which they and another player have been arrested for a crime, and are each offered a deal by the prosecutor. Participants must choose to either co-operate with the other player, by staying silent and refusing to speak to police, or to defect, and testify against their partner. Before making their choice, participants are informed about the potential outcomes. In general, the best outcome for an individual player is achieved if they defect while the other player co-operates, however if both players defect the outcome is worse than if they both co-operate. Much ink has been spilled on the most effective strategies for playing this game over multiple iterations (Axelrod, 1980a, 1980b), and it has been noted that players often choose to co-operate with one another even if it is not the most rational choice. A wide range of factors may affect players' willingness to co-operate; these include the relative value of the outcomes (Capraro et al., 2014), the sex (Dorrough & Glöckner, 2019; Rapoport & Chammah, 1965) or culture (Wong & Hong, 2005) of the player, how many rounds of the game they expect to play (Dreber et al., 2014), and whether or not communication between players is allowed (Kiesler et al., 1996).

In the present set of experiments (total N = 2010), we asked 1) whether people who 'won' or 'lost' in a Prisoner's Dilemma scenario were equally likely to report misinformation about what the other player had said about their intentions in the game, and 2) whether they would endorse that misinformation as a reason for their own actions. In each experiment, participants played a single round of the Prisoner's Dilemma. We then manipulated the outcome of the game: all participants who

chose to testify were subsequently told that the other player stayed silent, and that they had therefore won the game. In contrast, those who stayed silent were told that the other player testified against them, and that as a result they had lost the game. Participants were then presented with misinformation or assigned to a control group. In Experiments 1-3, participants who stayed silent were given the misinformation that the other player stated an intention to stay silent too, and thus cast in the role of victims who were betrayed by a partner. Those who chose to testify were given the misinformation that the other player intended to testify too, casting them in the role of wrongdoers whose actions may have been justified by their partner's statements. In each case, the misinformation provides a post hoc rationale for the participants' choice in the game, but the emotional valence of the outcome differed. Experiment 1 serves as a proof of principle, in which participants' judgements relate to hypothetical prison sentences that they or the other player must serve. In Experiment 2, we replicate this design but with real financial stakes, in the form of bonus payments tied to the outcome of the game. In Experiment 3, we consider the role of order effects as a possible explanation for our results. Experiments 4 and 5 provide a more robust test of the hypotheses by randomly assigning participants to receive misinformation that either supports or undermines a favourable account of the participant's behaviour.

These experiments were originally motivated by discussions around so-called "he said, she said" cases pertaining to allegations of sexual assault. In such cases, it is common for argument to revolve around what one party may or may not have said to the other. Did the complainant consent to sexual activity, but then deny this later? Did the accused promise to respect physical boundaries, but then renege on this promise once alone with the complainant? Judicial proceedings arising from such cases often rely on expert witnesses who speak to the nature of memory and how it may be distorted. In many cases, these witnesses have been instrumental in averting miscarriages of justice, however we were struck by evidence that memory experts are overwhelmingly likely to testify for the defence (Blackwell et al., 2020; Howe, 2013). Expert witnesses in these cases typically discuss the fragility of memory (Berkowitz

& Loftus, 2018), and defence counsel may rely on this testimony in arguing that that the complainant's account is unreliable. This led us to wonder whether the memories of complainants in these cases are in fact more fragile or susceptible to distortion than the memories of the accused. The experiments reported in this paper provide only a very distant analogue to such situations, and clearly cannot provide any direct evidence regarding the memories of people involved in sexual assault trials. Rather, our goal was to address the fundamental question of whether being cast as a "victim" or a "wrongdoer", even in a very artificial scenario, can have systematic effects on memory distortion for the event in question.

EXPERIMENT 1: Misinformation acceptance among "winners" and "losers"

In this experiment, we hypothesised that exposure to misinformation about potential reasons for a decision in the Prisoner's Dilemma would result in participants endorsing the suggested reason when asked to explain their choice. We expected this effect to be observed for both "winners" (defectors, who achieved a positive outcome in the game and were misled to believe that the other player had also stated an intention to defect) and "losers" (co-operators, who achieved a negative outcome in the game and were misled to believe that the other player had also stated an intention to cooperate). As this experiment was intended as an initial proof of principle, we did not make any predictions regarding the relative size of the misinformation effect among winners and losers. Similarly, while we preregistered an analysis of participants' tendency to freely report the misinformation provided to them, we did not preregister any hypotheses regarding this measure.

Methods

Design

This study employed a 2x2 between-subjects design. Participants were designated as defectors (losers) co-operators (winners) based on their initial choice in the prisoner's dilemma game (see Procedure). Participants were then randomly assigned to the misinformation or control condition. Misinformed co-operators were led to believe that the other player had stated an intention to co-operate, while misinformed defectors received the suggestion that the other player had stated an intention to defect. In fact, the other player had not given any indication of their intentions in the game.

Preregistration

The study design, hypotheses and analyses were preregistered at https://aspredicted.org/IEN_SCV. We preregistered a sample size of N=400, with the goal of including approximately 100 participants in each experimental cell. *A priori* power analysis indicated that this sample would provide 80% power

to detect small effects (Cramer's V = 0.2). Ethical approval for this study was granted by the Human Research Ethics Committee at [university name redacted].

Participants

Participants were recruited via the online platform Prolific (https://prolific.co) and through social media and direct recruitment. Prolific participants were paid at the standard rate of £5 GBP per hour, and only those who spoke English as a first language were eligible to participate. As sex differences in responses pattern in in the Prisoner's Dilemma have been observed (Dorrough & Glöckner, 2019; Rapoport & Chammah, 1965), we aimed to recruit a gender-balanced sample. Our final sample included 410 participants, with a mean age of 32.46 years (SD = 14.92, range 18-77). The sample included 199 (48.54%) males, 205 (50%) females, and six participants (1.46%) who selected 'other/prefer to self-identify'.

Materials and Procedure

The experiment was conducted online via Qualtrics (https://qualtrics.com). After providing consent and demographic information, participants were presented with a classic prisoner's dilemma scenario:

> *You and Player 2 are arrested and imprisoned. You are both in solitary confinement with no means of communicating. The prosecutors lack sufficient evidence to convict either of you on the major charge, but they have enough to convict you both on a lesser charge. Simultaneously, the prosecutors offer each of you a deal: You are given the opportunity to either betray Player 2 by testifying that they committed the crime, or to co-operate with Player 2 by remaining silent. The possible outcomes are:*
>
> - *If you both betray each other, each of you serves two years in prison*
> - *If you betray Player 2 but Player 2 remains silent, you will be set free and Player 2 will serve three years in prison*

- *If you remain silent but Player 2 betrays you, you will serve three years in prison and Player 2 will be set free*
- *If you both remain silent, both of you will serve only one year in prison (on the lesser charge)*

Prior to making their decision, participants were asked to read the following brief message, which was presented as having been written by the other player in the game. This message was developed in extensive pilot testing to produce a roughly equal proportion of co-operate and defect decisions. Importantly, 'Player 2' never states in this message whether they intend to stay silent or testify in the game.

Hi Player 1,

I am 27 years old and have just graduated with a Master's degree in Education. I am working as a teacher and love my job. I like being able to have a positive effect on the lives of my students. I commute to work in London, because the rent is too high to live near to the school where I work. Also, I would not be able to afford somewhere in London where I could keep my dog, Trixie, who I wouldn't dream of parting with. I enjoy reading in my free time. My favourite book is Donald Trump's 'The Art Of The Deal', and I try to follow his advice when I can. I have never played a game like this before, but I am sure it is going to be interesting! It is a good insight into how people react when faced with a moral decision that can have consequences in their own lives.

Sincerely, Player 2

Participants were given 30 seconds to read this profile before the page automatically advanced. A countdown timer was presented onscreen.

Participants then answer two Likert scale questions regarding their feelings about the game

1. Victim/wrongdoer scale: “After taking part in this task, people sometimes feel that they are a victim (i.e. that they were wronged by Player 2) or that they are a wrongdoer (i.e. that they wronged Player 2). Where would you say you fall on this scale?” (0-100, where 0 = “I am definitely a victim” and 100 = “I am definitely a wrongdoer”).
2. Betrayal scale: “After taking part in this task how do you feel about the morality of betraying your partner?” (0-100, where 0 = “Betraying your partner in this game is the wrong thing to do” and 100 = “Betraying your partner in this game is fine”).

After completing a set of filler maths questions, participants were told the outcome of the game. Participants who initially chose to testify against Player 2 were told, “Player 2 chose to stay silent - as you testified against Player 2, this means **they are now going to serve the full three years in prison, you will go free**“, while those who chose to stay silent were told, “Player 2 chose to testify against you - as you stayed silent, this means **you are now going to serve the full three years in prison, Player 2 will go free”.** Thus, defectors all achieved a positive outcome in the game and became “winners”, while co-operators received a negative outcome and became “losers”.

Participants were then presented with a series of nine questions about their decision and their recollection of Player 2’s profile. This questionnaire was intended to disguise our goal of implanting misinformation in the misinformed group, and included questions such as “What gender do you think Player 2 was?” and “Player 2 stated that they owned a dog. How much were you influenced by this when testifying against Player 2?”. Full details may be found at https://osf.io/vukx4/?view_only=bf850fd735d2440dafa4362e57e4308b. Misinformation was presented to participants in the misinformed conditions via an additional question placed in the middle of the questionnaire. The question presented to co-operators read, “**Player 2 stated in their profile that they would likely stay silent.** How much were you influenced by this when deciding to stay silent?”. The question presented to defectors read, **“Player 2 stated in their profile that they**

would likely co-operate with the police and testify against you. How much were you influenced by this when testifying against Player 2?" These questions were not presented to participants in the control groups.

The uptake of this misinformation was assessed in two ways towards the end of the questionnaire. The first item asked, "Did Player 2 mention whether they would stay silent or testify? If so, can you recall what they said?". Participants were invited to type their answer in an open text box. The second question asked participants to select the reasons for their decision from a list. Some options in this list were identical for both groups (e.g. "Because I thought it was the best strategy for success") while others were tailored to the participant's initial choice (e.g. "Because I believe in looking after other people"/"Because I believe in looking after myself"). For co-operators, this list included the misinformation item "Because Player 2 said they would stay silent too", while defectors' list included the item "Because Player 2 said they would testify too". An 'other reason' option was also provided, and participants were invited to type their reason into a text box.

The victim/wrongdoer and morality of betrayal scales were presented a second time, and participants were asked to play another round of the game against the same player. Participants were then fully debriefed, and asked some additional questions about their current recollections of Player 2's message. They also completed the victim/wrongdoer and betrayal scales a third time. These post-debriefing questions do not form part of the current report, but the data may be found at https://osf.io/vukx4/?view_only=bf850fd735d2440dafa4362e57e4308b.

Results

In their initial choice, 236 participants (57.56%) chose to co-operate with their partner and remain silent, while 174 (42.44%) chose to defect and testify against their partner. Details of responses in the second round may be found in supplemental materials.

Emotional responses to the game (manipulation check)

Detailed analysis of the questions regarding participants' feelings about the game (whether they felt like a victim or wrongdoer, and how they felt about the morality of betraying one's partner) can be found in supplemental materials. Briefly, the data for the victim/wrongdoer scale indicated that, on a scale from 0 (definitely a victim) to 100 (definitely a wrongdoer), participants who stayed silent (and therefore lost the game) felt more like a victim following the procedure (M = 32.95, SD = 18.55) than participants who chose to testify (and therefore won; M = 61.76, SD = 16.99, F (1) = 258.24, $p < .001$). Thus, our manipulation appears to have been successful in creating differently-valenced outcomes for winners and losers. Analysis of the morality of betrayal scale (0 = betraying your partner is wrong, 100 = betraying your partner is fine) indicated that participants who chose to stay silent felt that betraying their partner in the game was wrong (M = 23.31, SE = 1.59), whereas participants who testified against their partner were relatively neutral on this question (M = 52.65, SE = 1.59; $F(1,406) = 156.64$, $p < .001$, $\eta_p^2 = 0.28$).

Reporting of misinformation

Participants were first asked to report whether their partner had stated in their profile whether they intended to testify or stay silent, and if so, what they had said. Responses to this open-text question were coded with respect to the presence or absence of misinformation. In total, 14.37% of participants reported remembering that their partner said they intended to testify (sample responses included "They said they would testify against me" and "They would work with the police"), while 27.12% reported that their partner intended to stay silent (sample responses: "They said they would stay silent" and "They said they wouldn't betray their partner"). These false memories for the partner's decision were significantly influenced by misinformation condition in both groups. Among participants who stated their own intention to remain silent, those who received misinformation were significantly more likely to recall that their partner had also claimed that they would remain silent (44.92%) compared with those who were not misinformed (9.32%; $\chi^2(1) = 37.82$, $p < .001$, Cramer's V = 0.40).

Similarly, participants who intended to testify against their partner were more likely to report their partner making a similar statement if they had been misinformed (25.29%) than if they had not (3.45%; $\chi^2(1) = 16.86$, $p < .001$, Cramer's V = 0.31). The rate of false memories among misinformed participants was significantly higher among those who planned to stay silent than those who intended to testify ($\chi^2(1) = 8.32$, $p = .004$, Cramer's V = 0.20). See Figure 1A for details.

Selection of misinformation

Participants were then asked to indicate why they had chosen to stay silent or testify against Player 2, by selecting from a list of reasons. Among the choices were the statements "Because Player 2 said they would testify against me too" for those who initially stated an intention to testify, and "Because Player 2 said they would stay silent too" for those who had stated they would stay silent. Among participants who had chosen to testify, there was a strong effect of misinformation on the selected reasons: 21.84% of misinformed participants stated that Player 2's intention to testify had influenced their decision, compared with only 1.15% of control participants ($\chi^2(1) = 18.302$, $p < .001$, Cramer's V = 0.32). No such effect was observed among participants who had chosen to stay silent; the target reason was selected by 9.32% of misinformed participants and 5.05% of control participants ($\chi^2(1) = 1.58$, $p = 0.21$, Cramer's V = 0.08). Among misinformed participants, those who had chosen to testify were significantly more likely than those who had chosen to stay silent to select the misinformation as a reason for their decision; $\chi^2(1) = 6.28$, $p = .01$, Cramer's V = 0.18). See Figure 1B.

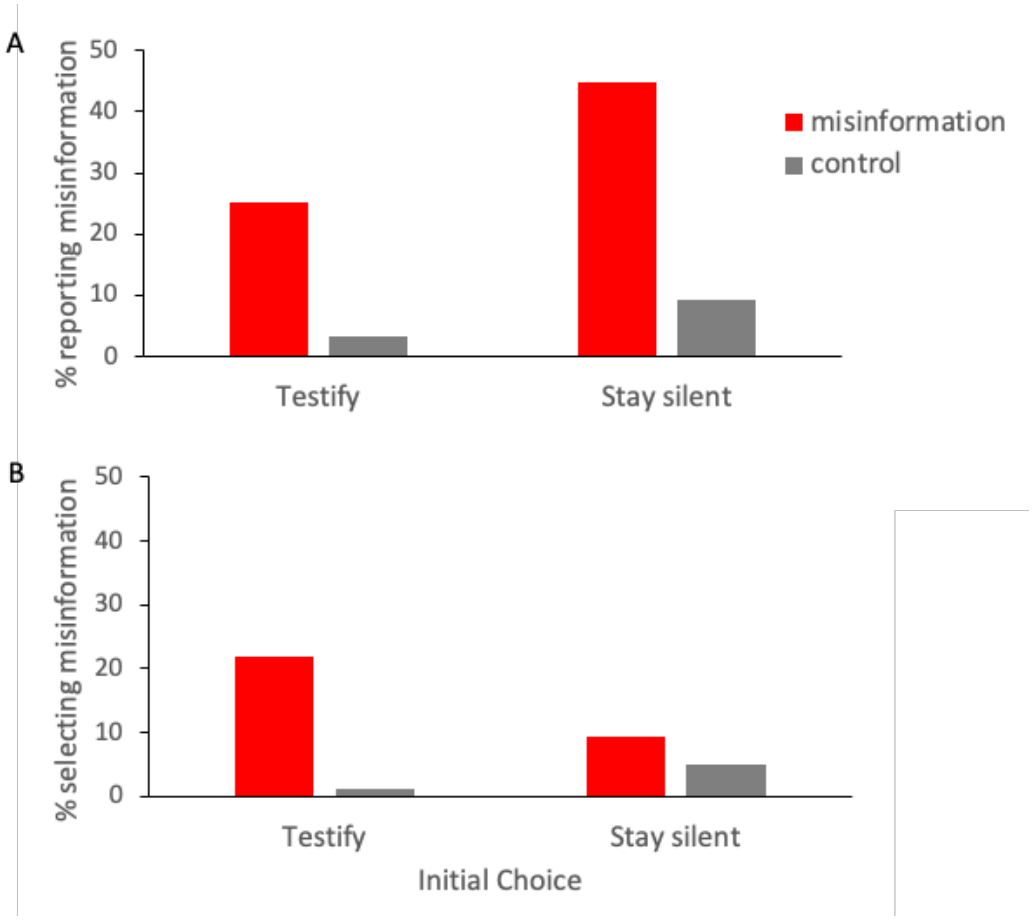


Figure 1. Percentage of participants in Experiment 1 who (A) reported the misinformation in an open-text question when asked whether Player 2 had stated whether they intended to testify (co-operate) or stay silent (defect), and (B) selected the misinformation from a list of reasons for their choice.

Experiment 1 Discussion

The results from Experiment 1 demonstrate that both winners (defectors, who testified against Player 2 and received a positive outcome) and losers (co-operators, who remained silent and received a negative outcome) appear to be susceptible to misinformation. The data suggest the possibility of a dissociation between the spontaneous reporting of misinformation, and the selection of that information as a justification for behaviour. These results are intriguing, however the consequences for participants are entirely hypothetical. It is not clear from this experiment that the same pattern of results would pertain in situations where a given choice might result in an actual loss or gain to the participant. Thus, Experiment 2 replicated the design of Experiment 1, but with real financial stakes.

EXPERIMENT 2: Misinformation acceptance in a game with real consequences

In this experiment, we predicted that exposure to misinformation about Player 2's intentions would lead to false memories in both winners (defectors who were misled to believe that the other player stated an intention to defect) and losers (co-operators who were misled to believe that the other player stated an intention to cooperate). In line with the results from Experiment 1, we also predicted that winners would be more likely than losers to select the misinformation as a reason for their decision.

Methods

Design

The 2x2 experimental design was identical to that described in Experiment 1. The study design, hypotheses and analyses were preregistered at https://aspredicted.org/KLB_5BS.

Participants

A total of 400 participants were recruited from Prolific, including 198 males (49.5%), 201 females (50.25%) and one participant who preferred to self-identify. The mean age was 38.58 years (SD = 13.74, range = 18-82).

Materials and procedure

The procedure for Experiment 2 was identical to that for Experiment 1, with two exceptions. First, the possible outcomes of the game referred to real financial rewards rather than hypothetical prison sentences. Participants were paid for their participation at the base rate of £5 GBP per hour, and were informed that they could earn bonus payments in accordance with the following outcomes:

- *If you both betray each other, each of you will earn a 15% bonus on top of the basic payment for this study*

- *If you betray Player 2 but Player 2 remains silent, you will earn a 45% bonus and Player 2 will get no bonus*
- *If you remain silent but Player 2 betrays you, you will get no bonus and Player 2 will earn a 45% bonus*
- *If you both remain silent, each of you will earn a 30% bonus*

The ratio of the outcome values was maintained from Experiment 1 (1:3:2). For ethical reasons, all participants were awarded the maximum bonus of 45% at the end of the study, regardless of their choice in the game. Participants were led to believe that Player 2 was another randomly selected participant on Prolific, and that bonus payments would be made after both participants had completed the experiment and we had compared their responses. To maintain this illusion, we inserted a 3 second 'loading message' gif before Player 2's message appeared, and asked participants to write their own introductory message to Player 2.

The second change was the positioning of the first set of Likert scale questions, addressing the participants' emotional response to the game. In Experiment 1, these were placed immediately after participants made their choice, in order to evaluate baseline responses. In Experiment 2, we wanted to investigate the immediate impact of the misinformation on participants' emotional sense about the game and their own status in it. Thus, we placed the first set of scales after participants had been informed about the outcome of the game (but before the presentation of misinformation) and the second set after the presentation of misinformation.

Results

In Experiment 2, 230 participants (57.50%) chose to co-operate with their partner and remain silent, while 170 (42.50%) chose to defect and testify against their partner.

Emotional responses (manipulation check)

As in Experiment 1, responses to the two Likert scale questions indicated that participants who chose to co-operate with their partner ("losers") felt considerably more victimised than defectors ("winners") upon hearing the outcome of the game, and were more likely to believe that betraying one's partner in the game was morally wrong. These emotional responses were unaffected by the presence or absence of misinformation; see supplemental materials for more details.

Reporting of misinformation

As in Experiment 1, responses to the open text question were coded manually, and the proportion of participants who reported the misinformation was computed. A significant misinformation effect was observed for both co-operators (χ^2 (1) = 63.07, p < .001, Cramer's V = 0.52) and defectors (χ^2 (1) = 16.07, p < .001, Cramer's V = 0.31). As predicted and replicating Experiment 1, misinformation was more likely to be reported by losers than winners: Among those who were misled, 47.49% of co-operators reported the misinformation, compared with only 17.44% of defectors (χ^2 (1) = 19.85, p < .001, Cramer's V = 0.32). See Figure 2A for details.

Selection of misinformation

Turning to the participants' reasons for their decision, a significant misinformation effect was observed among defectors, whereby participants who received the misinformation were more likely to select that option from a list of reasons than participants in the control group (misled: 18.6%; control: 0%. χ^2 (1) = 6.28, p = .01, Cramer's V = 0.09). No significant misinformation effect was observed among participants who chose to remain silent (misled: 8.85%; control: 4.27%. χ^2 (1) = 1.97, p = .16, Cramer's V = 0.005). Among misled participants, those who chose to testify were significantly more likely to select misinformation as a justification for their decision than those who remained silent (χ^2 (1) = 4.09, p = .04, Cramer's V = 0.14). See Figure 2B for an illustration.

Our preregistered hypotheses for Experiment 2 were therefore supported: both "winners" and "losers" demonstrated a misinformation effect in recalling their partner's intentions in the game. Co-operators were more likely to report the misinformation in an open text question, while defectors were more likely to select the misinformation as a reason for their own choice.

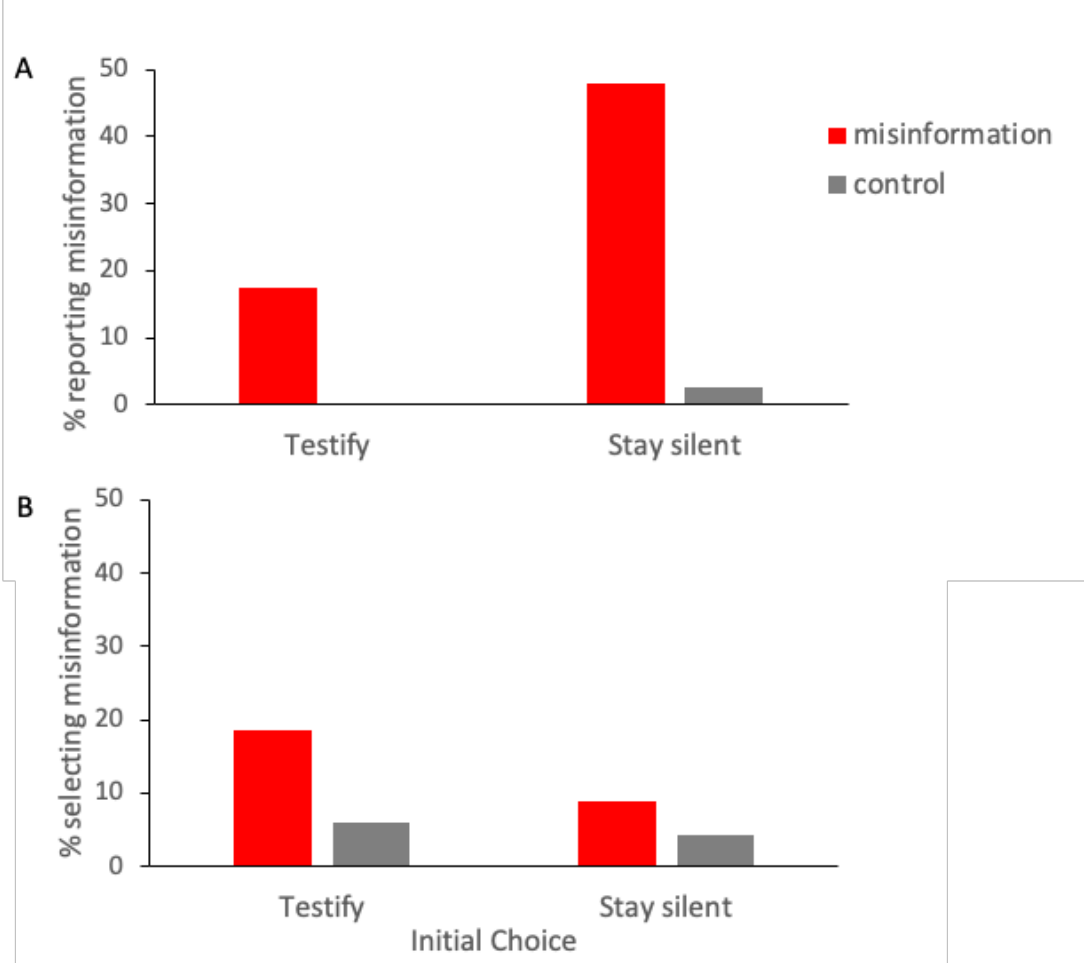


Figure 2. Percentage of participants in Experiment 2 who (A) reported the misinformation in the open text question, and (B) selected the misinformation as a reason for their choice.

Experiment 2 discussion

The results from Experiment 2 closely mirrored those of Experiment 1, and demonstrated high rates of misinformation acceptance among both winners and losers in a game with real financial stakes. The

results from Experiments 1 and 2 suggest that participants who are cast as the victim in the Prisoner's Dilemma situation (by choosing to co-operate and then being betrayed by their partner) are more likely to falsely remember that their partner had lied to them about their plans. In contrast, those who were cast as the wrongdoer (by testifying against their partner) were more likely to use the misinformation as a justification for their behaviour. These results are however confounded by the fact that the two outcome measures – the open text question assessing reporting of misinformation, and the multiple-choice question assessing selection of misinformation as a reason for behaviour – are always presented in the same order. This leaves open the possibility that the differences in response to the two question types may be influenced by order effects. To test this possibility, we replicated Experiment 1 with the order of these questions reversed.

EXPERIMENT 3: Accounting for order effects

This experiment was a direct replication of Experiment 1, however the order of presentation of the two key outcome variables (reporting and selection of misinformation) was reversed. We aimed to establish whether the following effects observed in Experiment 1 were preserved:

1. A significant misinformation effect in the open-text reporting question for both defectors (winners) and co-operators (losers), such that misled participants report more misinformation than control participants
2. A significantly higher rate of misinformation reporting in the open-text question for misled co-operators than misled defectors
3. A significant misinformation effect in the selection of misinformation for defectors only, such that misled participants are more likely than controls to select the misinformation as a reason for their choice
4. A significantly higher rate of misinformation selection among misled defectors than misled co-operators

Methods

Design

The 2x2 experimental design was identical to that in Experiments 1 and 2. This experiment was preregistered at https://aspredicted.org/XF6_RWS.

Participants

400 participants (201 female; 197 male; 2 other/prefer to self-identify) were recruited from Prolific and paid at the standard rate of £5 GBP per hour. The participants ranged from 18-77 years of age, with a mean of 36.79 (SD = 12.45).

Materials and procedure

The materials and procedure were identical to those in Experiment 1, with the exception that the open-text question ("Did Player 2 mention whether they would stay silent or testify? If so, can you recall what they said?") was presented after the multiple-choice question, in which participants selected their reasons for testifying/staying silent.

Results

In total, 166 (41.50%) of participants chose to testify against their partner, while 234 (58.50%) chose to stay silent.

Reporting of misinformation

As Figure 3A shows, misled participants in both groups reported misinformation in the open text question at significantly higher rates than participants in the control conditions, revealing a strong misinformation effect. Among participants who chose to testify, 39.29% reported misinformation, compared with 0% of participants in the control group (χ^2 (1) = 40.21, p < .001, Cramer's V = 0.47).

Among participants who chose to remain silent, 52.94% in the misled group reported the misinformation, compared with only 9.57% in the control group (χ^2 (1) = 50.89, p < .001, Cramer's V = 0.49). The rate of misinformation reporting among misled participants was slightly higher among losers than winners, but the effect was small and barely reached significance (χ^2 (1) = 3.68, p = .05, Cramer's V = 0.13).

Selection of misinformation

Turning to the selection of misinformation as a reason for choosing to testify or stay silent, a misinformation effect was observed in both groups: among participants who chose to testify, 26.19% of misled participants selected the suggested reason ("because Player 2 said they would testify too"), compared with 1.22% of control participants (χ^2 (1) = 21.68, p < .001, Cramer's V = 0.36). Similarly, among participants who chose to stay silent, 19.33% of misled participants selected the suggested reason ("because Player 2 said they would stay silent too") compared with 7.83% of control participants (χ^2 (1) = 6.55, p = .01, Cramer's V = 0.17). Misled winners were slightly more likely to select the misinformation than misled losers, but, in contrast with Experiments 1 and 2, the difference was not significant (χ^2 (1) = 1.34, p = .25, Cramer's V = 0.08). See Figure 3B.

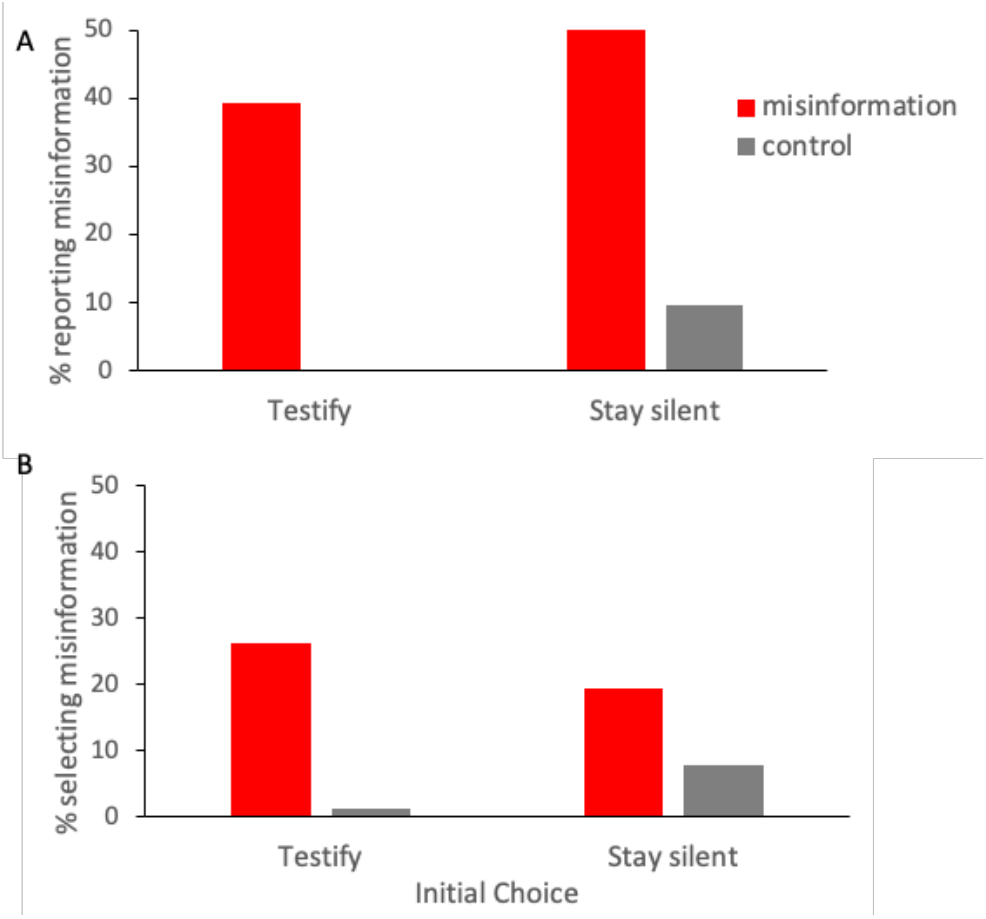


Figure 3. Percentage of participants in Experiment 3 who (A) reported the misinformation in the open text question, and (B) selected the misinformation as a reason for their choice.

Experiment 3 discussion

The results of this experiment demonstrate that the misinformation effect is reliably detected for both winners and losers, regardless of the order in which the reporting and selecting questions are asked. The overall rate of misinformation reporting among misled participants was higher in this experiment (approximately 46% compared with 30-35% in Experiments 1 and 2), probably as a result of the second presentation of misinformation in the multiple-choice question, which was here displayed prior to the open-text question.

Experiments 1 and 2 suggested that losers may be more likely to spontaneously *report* misinformation, while winners might be more likely to *select* it as a reason for their behaviour, however this

dissociation was considerably weaker in Experiment 3, suggesting that the effect might be a methodological artefact. Any such conclusion is also confounded by the fact that our experiments to date have only presented a single type of misinformation to each group: losers (co-operators)were misled to believe that Player 2 stated an intention to co-operate, while winners (defectors) were led to believe that Player 2 said they would defect. In Experiment 4, we provide a more robust test of our hypotheses by fully crossing the contents of the misinformation presented to participants.

EXPERIMENT 4: Fully-crossed presentation of misinformation

In Experiment 4, participants were equally likely to be presented with misinformation that Player 2 stated an intention to co-operate or defect, regardless of their own initial choice. In designing this experiment, we initially conceptualised the misinformation as reflecting either favourably or unfavourably on participants. The 'favourable' misinformation was the same as that presented to misled participants in Experiments 1-3; co-operators (losers) were led to believe that Player 2 testified against them, and that they were therefore betrayed and victimised in the course of the game. Defectors (winners) were led to believe that Player 2 also stated an intention to testify; as a result, the participant is less guilty of wrongdoing, as they have not betrayed their partner. 'Unfavourable' misinformation was conceptualised as less congenial to the participants. Co-operators (losers) were led to believe that Player 2 had stated an intention to defect all along; thus, the participant is not a victim, but rather the architect of their own misfortune, as they failed to take account of Player 2's statement. Finally, defectors (winners) were led to believe that Player 2 stated an intention to stay silent. Thus, the participant is portrayed as a malicious wrongdoer, who intentionally betrayed a partner who had stated an intention to cooperate. We hypothesised that participants would be more likely to recall favourable misinformation. Specifically, we predicted that co-operators would be more likely to report the misinformation that Player 2 stated an intention to co-operate rather than defect, and defectors would be more likely to report the misinformation that Player 2 stated an intention to defect rather than cooperate. We expected to see a similar pattern of results in the selection of

reasons for the participant's choice: co-operators would be more likely to select "because Player 2 said they would stay silent" than "Because Player 2 said they would testify", while defectors would be more likely to select "Because Player 2 said they would testify" than "because Player 2 said they would stay silent". Finally, in line with the results from Experiments 1 and 2, we predicted a larger effect of favourability for co-operators in the reporting of misinformation, and for defectors in the selection of misinformation as a reason for behaviour.

Methods

Design

This experiment employed a 2 (choice: testify vs. stay silent) x 2 (misinformation: Player 2 said they would testify/Player 2 said they would stay silent) between-subjects design. There was no control group in this experiment. This experiment was preregistered at https://aspredicted.org/V12_MGH.

Participants

400 participants were recruited from Prolific and paid at the standard rate of £5 per hour. The sample included 200 males, 197 females and 3 participants who selected 'other/prefer to self-identify'. The age of the participants ranged from 19 to 76 years, with a mean of 38.09 and standard deviation of 13.47.

Materials & Procedure

The materials and procedure were identical to Experiment 1, with the exception that participants were randomly assigned to receive the misinformation that Player 2 stated an intention to co-operate or to defect.

Results

In this experiment, 243 participants (60.75%) chose to stay silent, while 157 (39.25%) chose to testify against their partner.

Reporting of misinformation

We initially hypothesised that participants would be more likely to report 'favourable' than 'unfavourable' misinformation in the open-text question. To our surprise, the expected pattern of results was observed only for co-operators (favourable: 39.02%, unfavourable: 25.83%; (χ^2 (1) = 4.82, p = .03, Cramer's V = 0.14), while the opposite pattern was observed for defectors (favourable: 23.75%, unfavourable: 37.66%; χ^2 (1) = 3.58, p = .06, Cramer's V = 0.15). Further examination of these data revealed that participants were in fact more likely to report the misinformation that Player 2 intended to stay silent (rather than testify), regardless of their own status as co-operator or defector (χ^2 (1) = 8.23, p = .004, N = 400, Cramer's V = 0.15); see Figure 4A. Collapsing across misinformation type, there was no significant difference in the rate at which winners and losers reported misinformation (χ^2 (1) = 0.16, p = .68, N = 400, Cramer's V = 0.02).

Selection of misinformation

The predicted effect of favourability on the selection of the misinformation as a reason to testify or stay silent was observed for co-operators (losers), but not for defectors (winners). Participants who initially chose to remain silent were more likely to select the misinformation that Player 2 stated an intention to remain silent too (13.01%) than the misinformation that Player 2 intended to testify (0.83%; χ^2 (1) = 13.84, p < .001, Cramer's V = 0.24). In contrast, participants who initially chose to testify against their partner were equally likely to select the misinformation that Player 2 intended to testify (10%) or stay silent (11.69%; χ^2 (1) = 0.12, p = .73, Cramer's V = 0.03; see Figure 4B).

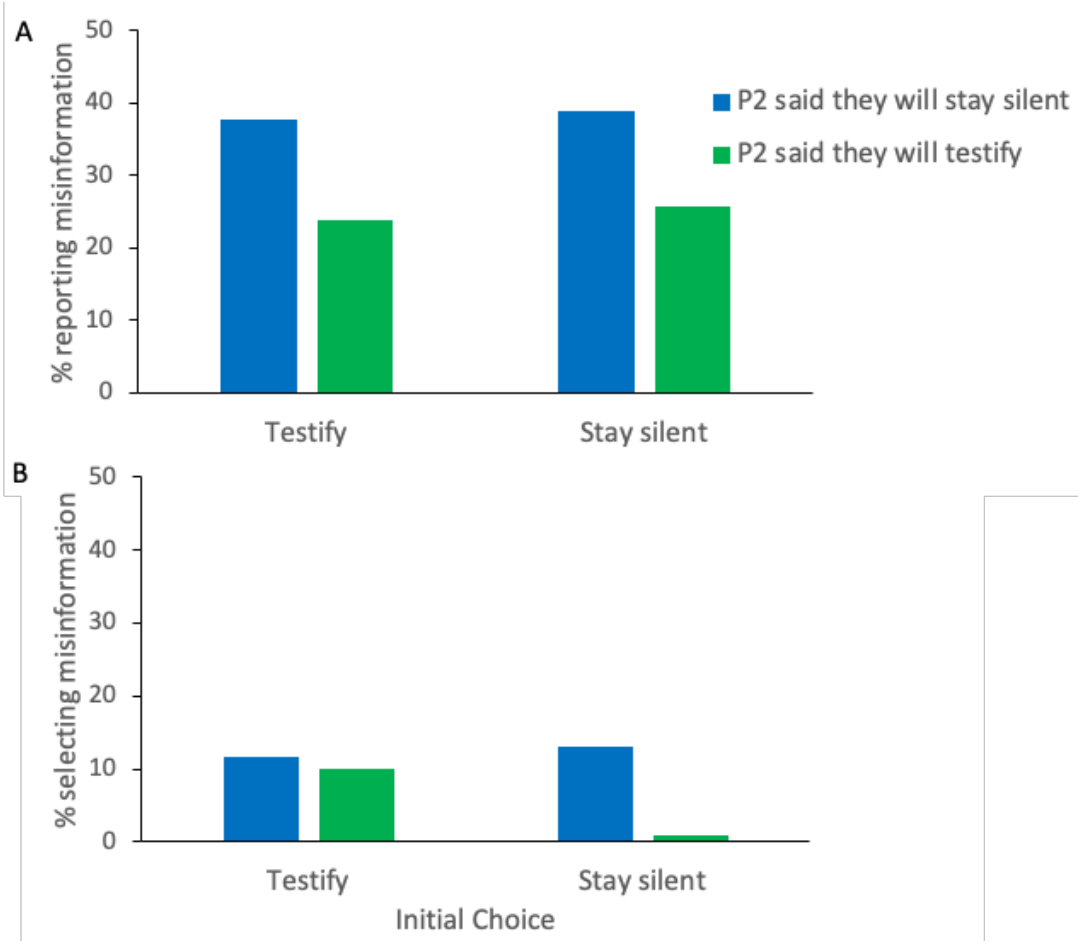


Figure 4. Proportion of participants in Experiment 4 who (A) reported the misinformation that Player 2 stated an intention to stay silent or testify in the open-text question, and (B) selected the misinformation that Player 2 stated an intention to stay silent or testify as a reason for their choice.

Experiment 4 discussion

Experiments 1 and 2 (and, to a lesser extent, Experiment 3) had suggested that co-operators—the "losers" in those experiments—were more likely to report misinformation in open-text questions, while defectors—the "winners"—were more likely to use the misinformation to justify their behaviour. Experiment 4 instead demonstrates that this dissociation is simply a methodological artefact, likely arising from the plausibility of the misinformation. Participants were generally more likely to report misinformation saying that Player 2 intended to co-operate rather than defect. These results show that the favourability of the misinformation to one group over another does not appear

to affect susceptibility; rather, both winners and losers are equally susceptible to misleading information about the event, but some forms of misinformation are simply more likely to result in false memory than others.

EXPERIMENT 5: Changing possible reasons for testifying or staying silent

In Experiments 1-4, the reasons offered to participants as possible explanations for their behaviour were tailored to participants' original choice; thus, participants who chose to testify were offered options such as 'because I disliked Player 2' and 'because I believe in looking after myself', while participants who chose to stay silent were offered choices such as 'because I liked Player 2' and 'because I believe in looking after other people'. To rule out the possibility that these decoy reasons may have influenced the rate at which is information was selected across conditions, we conducted a straight replication of Experiment 4 in which all participants were offered the same set of decoy reasons, in addition to the misinformation they had earlier encountered.

Methods

Design

The 2x2 experimental design was identical to that in Experiment 4.

Participants

400 participants were recruited from Prolific and paid at the standard rate of £5 per hour. The sample included 195 males, 200 females and 5 participants who selected 'other/prefer to self-identify'. The age of the participants ranged from 19 to 79 years, with a mean of 37.57 and standard deviation of 12.88.

Materials & Procedure

The materials and procedure were identical to Experiment 4, however the possible reasons offered for the decision were no longer tailored for co-operators and defectors. Each group was shown the same list, with the addition of the specific piece of misinformation they received, as follows:

- Because I thought it was the best strategy for success
- Because of Player 2's personality
- Because of Player 2's interests
- Because of Player 2's job
- **Because Player 2 said they would [stay silent/testify]**
- Because it was the right thing to do
- Other reason (please specify)

Results

In this experiment, 220 (55%) of participants chose to stay silent, while 180 (45%) chose to testify against their partner.

Reporting of misinformation

The results for the reporting of misinformation are very similar to those observed in Experiment 4, with a greater proportion of participants reporting the misinformation that Player 2 said they would remain silent (43%) than the misinformation that Player 2 would testify (22.5%), regardless of initial choice; χ^2 (1) = 19.08, N = 400, p < .001, Cramer's V = 0.22; see Figure 5A). There was no significant difference in the rate of misinformation reporting between defectors and co-operators (χ^2 (1) = 0.05, p = .82, Cramer's V = 0.01).

Selection of misinformation

The overall rate of selection of misinformation was lower than in previous experiments, suggesting that the change in available options did influence the tendency to adopt the misinformation as a

reason for behaviour. Full details of the frequency with which the various reasons for behaviour were selected in each experiment can be found in supplemental materials. As a result of this reduction in misinformation selection, cell counts in some conditions are low enough to challenge the reliability of statistical analysis, and the following results should be interpreted with caution. In general, however, the results mirror those from Experiment 4. As Figure 5B demonstrates, co-operators (losers) selected only the misinformation that Player 2 intended to remain silent (9.09%, vs. 0% for the misinformation that Player 2 intended to co-operate; χ^2 (1) = 10.48, p = .001, Cramer's V = 0.22). In contrast, defectors (winners) selected either form of misinformation as a reason for their behaviour: 5.56% selected the reason 'because Player 2 said they would testify', while 2.22% selected the reason 'because Player 2 said they would stay silent' (χ^2 (1) = 1.34, p = .25, Cramer's V = 0.09).

Given the low rates of misinformation selection in Experiments 4 and 5, and our consequent lack of confidence in the reliability of these analyses, we conducted an exploratory analysis in which the data from these two experiments were combined. The results of this analysis reflected those reported separately in Experiments 4 and 5: co-operators who selected misinformation as a reason for their decision overwhelmingly tended to choose the option "Because Player 2 said they would stay silent" (13.01%) rather than "Because Player 2 said they would testify" (0.83%; (χ^2 (1) = 13.84, N = 243, p < .001, Cramer's V = 0.24). In contrast, defectors were equally likely to choose either option ("Because Player 2 said they would stay silent: 11.69%; "Because Player 2 said they would testify": 10%; (χ^2 (1) = 0.12, N = 157, p = .73, Cramer's V = 0.03).

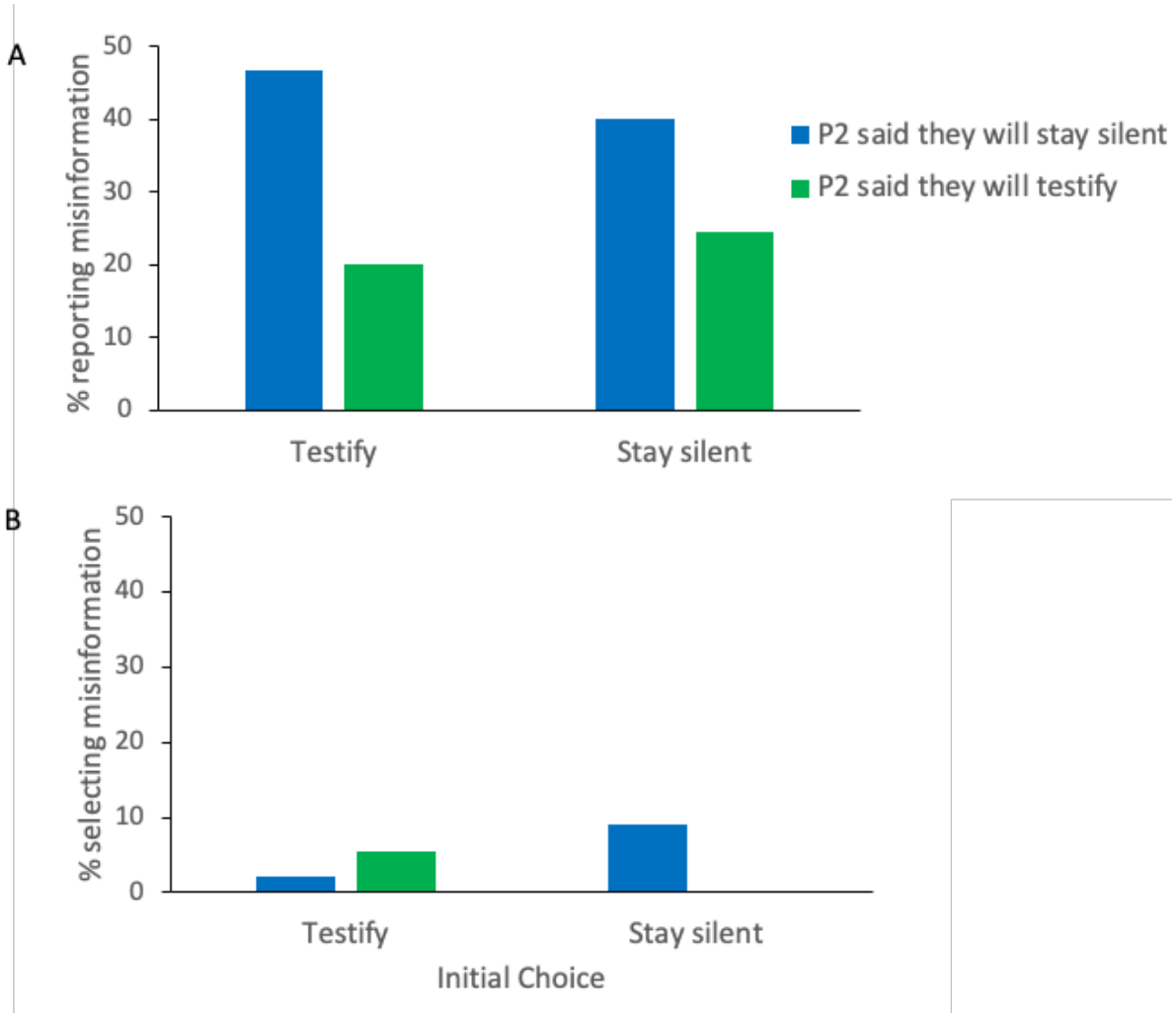


Figure 5. Proportion of participants in Experiment 5 who (A) reported the misinformation that Player 2 stated an intention to stay silent or testify in the open-text question, and (B) selected the misinformation that Player 2 stated an intention to stay silent or testify as a reason for their choice.

GENERAL DISCUSSION

The aim of this paper was to investigate susceptibility to misinformation among "winners" and "losers" in the Prisoner's Dilemma. Across five experiments, we demonstrated that both defectors (winners) and co-operators (losers) tended to fall for misinformation at roughly similar rates, even when real-world consequences were at stake. Some initial evidence (from Experiments 1 and 2) that losers were more likely to report misinformation did not hold up to closer inspection. Rather, participants in this set of experiments were simply more likely to report the misinformation that Player 2 intended to co-operate rather than defect, regardless of their initial choice in the game. When the contents of the misinformation presented to participants was fully counterbalanced across conditions, no difference in reporting was observed between co-operators and defectors, with approximately 30% of the participants in each group reporting the misinformation provided to them. The specific rates at which misinformation is reported is likely to vary as a factor of the plausibility of the provided information, which will be situationally specific (Hinze et al., 2014; Pezdek et al., 1997). Overall however, we have no evidence that the emotional valence of the outcome affected memory distortion: "losers" in our scenario were no more likely to suffer from memory distortions than "winners", despite feeling significantly more victimised by the end of the procedure.

Across all five experiments, participants were much more likely to spontaneously report remembering the misinformation (average: 35.64%, range: 31.5-46%) than they were to provide it as a reason for their behaviour (average: 13.02%, range: 4.2-22.8%). In Experiment 1 we had initially thought of these as two different methods of evaluating misinformation acceptance (reporting vs. selection), but in fact there are probably different mechanisms at play. The rate at which participants reported misinformation is roughly in line with average rates of misinformation acceptance in the literature; these vary widely depending on the paradigm used, but are typically in the range of 20-50% of participants in a given experiment (Loftus, 2005; Scoboria et al., 2017). While a relatively high proportion of participants therefore appeared to form a false memory of having read a statement

from the other player about their intentions, only a subset of these participants reported this misinformation as a reason for their behaviour. Examination of the reasons selected by participants across all five experiments (available in supplemental materials) reveals a wide range of motivations for behaviour, including general morality ("Because I believe in looking after other people") or strategic evaluation ("Because I thought it was the best long-term strategy"), as well as situation-specific reasons relating to the game at hand or the other player's characteristics. A substantial proportion of defectors across all experiments mentioned Player 2's fondness for Donald Trump as a reason for their decision; for example, one participant wrote, "He mentioned liking Donald Trump's book, that made me think that he'd look out for himself by testifying against me". Thus, we note that when evaluating memory distortions, measurement is important. It is already established that false memories are detected at different rates when evaluated using forced choice recognition vs. cued or free recall of misinformation (Zaragoza et al., 2007). Moreover, even outside misinformation paradigms, people are often highly inconsistent in reporting reasons for their own past behaviour (Murphy et al., 2020). In the present study, a focus simply on participants' selection of misinformation as a reason for their behaviour would have underestimated the rate of memory distortion and false memory formation in the sample.

Despite the overall lower rate of selection of misinformation in Experiments 4 and 5, examination of these data reveals interesting patterns. A subset of both co-operators and defectors selected misinformation as a reason for their decision, however while "losers" tended only to select the misinformation that Player 2 also stated an intention to remain silent, "winners" were equally likely to select either form of misinformation. This suggests two possible uses of misinformation as justification for defecting in the Prisoner's Dilemma: participants who 'remembered' that Player 2 said they would defect too could convince themselves that they were acting in agreement with Player 2, and had not actually betrayed their partner at all. In contrast, participants who 'remembered' that Player 2 said they intended to co-operate could rationalise their choice as an obvious strategic

decision, which would certainly result in a win for the participant. Either of these justifications may result in the construction of a corresponding false memory for the misinformation.

The scenario employed in these experiments presents a highly simplified version of a real-world situation in which two people's memories of a single event are at odds. Our original goal was to consider susceptibility to misinformation in the context of "he said/she said" sexual assault trials, whereby the "winners" and "losers" can be considered analogous to "wrongdoers" and "victims", respectively. Copious evidence from the eyewitness memory literature suggest that memory experts provide a valuable service in the justice system. In the context of sexual assault trials (whether criminal or civil), expert knowledge on this topic is typically leveraged on behalf of the accused, with the implication that the complainant's memory of the event may be impaired while the accused's memory is intact. There have been previous calls for expert witnesses to explain the nature of memory in support of complainants – e.g. to note that minor inconsistencies in a victim's account do not signal dishonesty (Ellison, 2005). Data from the present study may suggest that, at least in principle, the memory of the accused could be just as likely to be faulty as the memory of the complainant. We therefore suggest that prosecutors would do well to hire memory experts in cases that hinge on memory evidence.

It is however important to recognise that the analogy here is very distant; the Prisoner's Dilemma presents an artificial situation, in which participants have no previous knowledge of the other player and are aware that they are playing a game with limited real-life consequences. Moreover, there are a range of other factors which might influence the memory of the complainant or the accused in a sexual assault case; these include, but are not limited to, the time that has passed since the event (Frost, 2000; Paterson et al., 2009; Paz-Alonso et al., 2013), the emotional state of either party at the time in question (Christianson, 1992; Greenstein & Franklin, 2020; Marr et al., 2021; Paz-Alonso & Goodman, 2008) and the consumption of alcohol or other intoxicants (Flowe et al., 2019; van Oorsouw

et al., 2019). Any conclusions regarding the memory functions of participants in real-world trials are therefore tentative and require further investigation.

Human memory is malleable, and a variety of factors can undermine the reliability of a memory for a given event. In this paper, we manipulated the outcome of a co-operation game to produce an adversarial situation and presented participants with misinformation about what the other party had said. Our results demonstrate that both the “winner” and the “loser” in this scenario are susceptible to memory distortion, and report the misinformation at similar rates.

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