Motivated Memory in Dictator Games

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Abstract

The memory people have of their past actions is one of the main sources of information about themselves. To study whether people retrieve their memory self-servingly, we designed an experiment in which participants have first to play binary dictator games and, second, recall the amounts allocated to the receiver. We investigate whether dictators (i) exhibit poorer recalls, (ii) over-estimate more often and (iii) to a larger extent the receiver's amount when they have chosen the selfish option. We find that introducing monetary incentives for memory accuracy increases the dictators' percentage of correct recalls only when they have chosen the altruistic option. The percentage of correct recalls of the dictators is lower when they have chosen the selfish option, showing that amnesia is more likely to affect selfish than altruistic dictators. However, dictators do not bias strategically the direction and magnitude of their recalls.

Keywords: Motivated memory, selective recalls, self-image, dictator game, experiment.

JEL Codes: C91, D91, D63, D64

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1 Introduction

The desire to see oneself in a positive light is a fundamental feature of humans (*e.g.*, Bénabou and Tirole, 2002). People like to think of themselves as good persons. Yet, this demand for positive self-image can be challenged by the fact that most people sometimes behave in ways that they would like to think they did not. This discrepancy between what we do and how we would like to see ourselves may create intra-personal conflicts (Conen et al., 1957; Bazerman et al., 1998; O'Connor et al., 2002). One way to restore consistency between positive self-image and past actions that threaten this image is through motivated memory. Time gives individuals a wiggle room to forget or distort the memory of actions they would rather not recall (*e.g.*, Moore, 2016). By forgetting or arranging versions of past behavior, motivated memory allows individuals to reconcile the present "want" (or "hot") self with the ex-post "should" (or "cold") self, when these two are in conflict (*e.g.*, Bazerman et al., 1998; Bénabou and Tirole, 2002).[1] Motivated memory can be identified when individuals experience a different rate of recall or awareness in response to desirable or to undesirable information (Carrillo and Mariotti, 2000; Bénabou and Tirole, 2002; Mullainathan, 2002; Bernheim and Thomadsen, 2005; Gottlieb, 2014; Wilson, 2014). It can play in various directions, including amnesia but also positive delusion or confabulation (Chew et al., 2013).

While memory is at the source of any belief formation and updating process,[2] little is known about how individuals use it strategically to sustain their demand for positive self-image. Exploring memory biases is important since they may lead to inaccurate statements about oneself, such as overconfidence (*e.g.*, Bénabou and Tirole, 2002), with major implications on the quality of choices. They may also indirectly favor behaviors that are potentially costly for the society: for example, if individuals have the capacity to forget −at least partially− past unethical behavior, they do not have to entirely bear its moral costs and they can sustain a positive self-image without providing the corresponding effort.

Our study aims at understanding how and to what extent individuals manipulate their memory to sustain their demand for pro-social self-image. This question relies on two assumptions. First, the demand for positive self-image is linked with the desire to appear pro-social, not only in the eyes of others (Bénabou and Tirole, 2006; Battigalli and Dufwenberg, 2007) but also in one's own eyes (Ariely et al., 2009; Grossman and Van Der Weele, 2017). Second, individuals have the ability to distort their memory. They can influence the way they store and recollect information and, if needed, *ex-post* revise their memories.[3]

Most of the economic literature on this topic is theoretical. Identifying empirically whether individuals use their memory self-servingly is difficult with observational data. Laboratory experiments appear as a powerful tool to this purpose. A crucial methodological aspect of our

[1] In psychology, Tenbrunsel et al., 2010 have explored the biased perceptions that people hold of their own ethicality. They argue that the temporal trichotomy of prediction, action and recollection is central to these misperceptions: people predict that they will behave more ethically than they actually do, and when evaluating past (un)ethical behavior, they believe they behaved more ethically than they actually did.

[2] In particular, memory manipulations may distort the ability to recall events and thus impair probability assessments (*e.g.*, Hammond et al., 2006).

[3] See the literature on *memory revisionism*, a process according to which individuals selectively and self-servingly revise the memory of their past behavior to maintain a coherent self-identity (Epstein, 1973; Greenwald, 1980; Markus and Wurf, 1987).

experiment is that we can observe the memory retrieval of outcomes induced in the lab. Observing both the action and the recollection phases not only allows us to measure the accuracy of memory, but also the direction and magnitude of memory errors. In this respect, we differ from most experiments in psychology that rely on self-reported and/or on autobiographical memory.[4] Second, using lab experiments to investigate recalls of lab-induced outcomes minimizes the effects of rehearsal and associativeness.[5] These two effects, that strongly impact the individuals' ability to store and recollect information, are minimized in a controlled environment. In the lab, we also control for the time between the action and the recollection phases. Implementing the same time span for the entire pool of participants avoids potential confounds between the effect of time and the effect of motivation on memory retrieval. A last advantage is that we are able to control for individual differences in memory capacity that are hardly observable in real settings.

To investigate whether individuals use their memory as a self-impression management strategy, we designed an experiment where participants were asked, first, to play a series of binary dictator games and, second, to recall the amounts allocated to the receiver, regardless of their role in the games. *Unbiased memory* would predict similar percentages of correct recalls and symmetric memory errors for both selfish and altruistic dictators. In contrast, *biased memory* predicts that dictators exhibit a different degree of memory accuracy about the amounts they have given to the receivers, depending on whether they have chosen the option that favors them (the selfish option) or the option that favors the receiver (the altruistic option). Our intuition is that dictators exhibit no biased memory when they have chosen the altruistic option since it is not self-image threatening for them to recall the amount actually transferred to the receiver. But when they have chosen the selfish option, we conjecture that, on average, dictators i) exhibit a lower memory accuracy, ii) are more likely to over-estimate and iii) to a larger extent the amount given to the receiver, compared to when they have chosen the altruistic option. Indeed, dictators who value pro-social self-image may suffer from a higher discrepancy between their self-interested decisions in the binary games and their desire to see themselves as pro-social when recalling. Memory manipulations may be used to reconcile these two selves. On the contrary, we do not expect to observe memory differences for the receivers. They did not take any decision and thus, have no reason to experience any intra-personal conflict related to a decision.

Our contribution to the nascent economic literature on memory is twofold. First, our experimental design allows us to investigate the existence of motivated memory in an economic framework. Dictator games involve moral behavior (Konow, 2000; Cappelen et al., 2007), a domain susceptible to motivated memory (Moore, 2016). Contrary to ultimatum or trust games where the responsibility for the final outcome is shared by two players, in dictator games only one player (the dictator) bears the entire responsibility for both players' outcomes. This set-

[4]Self-reported or autobiographical memory does not permit to disentangle false memory (when a person recalls something that actually never happened) from motivated memory (when a person experiences a differential percentage of recall or awareness in response to desirable or to undesirable events). In addition, with autobiographical memory the experimenter cannot check the veracity of the recalled event, which prevents the study of motivated memory at an individual level.

[5]Rehearsal corresponds to the fact that the higher frequency to which an event is remembered makes it easier to remember again. Associativeness corresponds to the fact that the similarity of a past event to a current event makes this latter event easier to recall.

ting does not enable a dilution of responsibility that may substitute to memory manipulations. Our calibration of the dictator games allows us to identify whether memory biases are more susceptible to emerge under advantageous or disadvantageous payoff inequality between the dictator and the receiver. Our second contribution is estimating the magnitude of memory manipulations. While previous papers (Chew et al., 2013; Li, 2013) only offer binary measures −forgetting or recalling−, we can measure the extent to which individuals distort their memory.

In our experiment, participants play a series of 12 binary dictator games. In each game, the dictator has to choose between two options for sharing an amount between himself and a receiver. One option always favors the dictator, while the other always favors the receiver. In each game, the dictator has thus to choose between a selfish and an altruistic option. The difference between games is that we vary both the inequality of payoffs in the two options and whether the dictator or the receiver is in an advantageous position with both options. After having performed a distraction task intending to exhaust instant memory, both dictators and receivers are asked to recall the amounts allocated to the receiver. Participants were not informed of the memory task when playing the dictator games. To help them, we remind them the two amounts in the non-chosen option and the dictator's amount in the chosen option. The receiver's amount in the chosen option is replaced by a question mark. This design allows us to investigate whether the percentage of correct recalls, the direction, and the magnitude of participants' memory errors differ depending on the option chosen by the dictator.

We introduce two treatments in a between-subjects design. In the Incentive - Receiver's Amount treatment, correct recalls increase payoffs, whereas in the No-Incentive - Receiver's Amount treatment, they do no impact payoffs. In the second treatment, memory manipulation has no cost. Our conjecture is that the percentage of correct recalls of dictators is higher when memory accuracy is incentivized. We also conjecture that motivated memory decreases their probability to recall the receiver's amount after they chose the selfish option rather than the altruistic option. However, we cannot exclude that selfish dictators are more concerned by their own amount when choosing an option and thus may pay less attention to the receiver's amount. Therefore, we added the Incentive - Dictator's Amount treatment as a control treatment in which subjects have to recall the amounts allocated to the dictator. Our conjecture is that if dictators manipulate their memory, they should exhibit a lower percentage of correct recalls for the selfish option than for the altruistic option not only when they have to recall the receiver's amount, but also when they have to recall their own amount.

Our results are mixed. We find that incentivizing correct recalls increases the dictators' percentage of correct recalls when they chose the altruistic option but not when chose the selfish option. This suggests that when participants are given a monetary incentive to provide a memory effort, they allocate this effort to retrieve the memory of desirable rather than undesirable information. We also find that dictators make more memory errors after choosing the selfish option than after choosing the altruistic option. While dictators' accuracy depends on their actions, receivers' accuracy depends on the payoffs hierarchy: they recall better when they suffer from disadvantageous inequality regardless of the option chosen by the dictator.

We also find that dictators are more likely to over-estimate the amount given to the receiver after choosing the selfish option than after choosing the altruistic one. However, it is unlikely the result of a motivated manipulation of memory since the same asymmetry is found for the receivers. The magnitude of memory errors is also similar between dictators and receivers, regardless of the option chosen by the dictator. Finally, our control treatment indicates that players are less likely to remember the dictator's payoff after choosing the selfish than the altruistic option. This again goes in the direction of motivated memory but we reject this interpretation since receivers exhibit the same pattern.

Overall, we show that selfish dictators are more likely to suffer from amnesia than altruistic dictators. However, there is no robust evidence that they manipulate strategically the direction or the magnitude of their recalls to enhance their pro-social self-image. The likelihood of over-estimating rather than under-estimating the receiver's amount and the magnitude of the memory errors are the same for dictators and receivers. Selfish players are more likely to forget, but not to bias their memory self-servingly.

The remainder of the paper is organized as follows. Section 2 briefly reviews the related literature. Section 3 presents the experimental design and procedures. Section 4 outlines our behavioral conjectures. Section 5 reports our results. Section 6 provides robustness tests. Section 7 highlights the challenge that represents the study of motivated memory in economic experiments, suggests several extensions, and concludes.

2 Related Literature

Psychologists have intensively investigated the individuals' tendency to selectively forget self-threatening information. They have shown that people are more likely to recall their successes than their failures (Korner, 1950; Mischel et al., 1976), they have self-serving recollections of their past performance (Crary, 1966), they exhibit poorer recall of negative *vs.* positive self-relevant information (Green and Sedikides, 2004; Sedikides and Green, 2009), and they recall more accurately favorable than unfavorable feedback (Story, 1998). In the context of social interactions, people sometimes engage in actions that harm others, which contradicts their demand for pro-social image and may even be inconsistent with their own preferences (Banaji and Bhaskar, 2000; Banaji et al., 2004; Chugh et al., 2005; Tenbrunsel et al., 2010). Since people are threatened by information that has undesirable implications for their self-image, poor recall of this information may help think of past behavior under a positive light (Moore, 2016). For example, Stanley et al. (2017) have shown that recalled actions that involve emotional harm are perceived as more morally wrong when participants are put in the shoes of the actor than when put in the shoes of an observer. For Kouchaki and Gino (2016), people have less clear memory of their own unethical experiences than of their ethical experiences, while they recall others' ethical and unethical actions similarly.

While the economic literature using imperfect memory frameworks is substantial (Dow, 1991; Piccione and Rubinstein, 1997; Mullainathan, 2002; Bénabou and Tirole, 2004, 2006; Wilson, 2014), very few papers investigate the use of memory as a self-deceptive mechanism. In a model where individuals can vary the probability of recalling a given piece of data, Bénabou and Tirole (2002) show that individuals have an incentive to forget signals that undermine long-term goals (for motivational reasons) or lower self-esteem (for affective reasons).

In a multiple-self model, Gottlieb (2014) shows that after observing a negative signal, the decision-maker faces a conflict between forgetting the signal and having a better self-image, or recalling it and making a better decision. When there is no ex-post decision to make, the self-image factor takes over and the decision-maker always recalls a negative (positive, respectively) signal with probability below (above, respectively) the actual percentage. Our experimental study takes root in these theoretical models. It particularly relies on the case where signals have a purely hedonic or affective value. The decision-maker does not make any *ex-post* decision and the only reason for memory manipulation is the improvement of his self-view.

Economists have recognized the role played by memory in the maintenance of one's self-image in theoretical models, but they have provided limited empirical evidence. As far as we are aware of, the only empirical studies on motivated memory in economics are Chew et al. (2013); Li (2013); Dessi et al. (2016) and Li (2017). Chew et al. (2013) showed that, after a delay of several months, individuals exhibit asymmetric recalls of their past performance in an IQ test. Individuals tend to forget more their incorrect answers than their correct ones. Before having to recall whether their answer was correct or incorrect, participants were shown the correct answer. Therefore, individuals may have distorted their recalls but they may also have tried to deceive themselves to self-signal a higher ability without using their memory, especially since the time between the action and the recollection was from months to a year (see, *e.g.*, Mijović-Prelec and Prelec (2010) for a model of self-deception as self-signalling). In our experiment, people do not receive any feedback between the decision and the recollection phases that both take place within the same session. Thus, participants have a bigger chance to recall the amounts given to the receivers, which should limit direct self-signalling deception.

More directly connected to our research is the study of Li (2013) that investigates players' recollection of decisions in a trust game after different delays. He found that betrayed trustors have a lower recall accuracy, while those who benefit from kind acts remember perfectly. In contrast, the probability of trustees to recall their past decisions is the same, regardless of whether they reciprocated or betrayed the trustor. In our experiment, we asked the dictators to recall not the option they have chosen, but the amount allocated to the receiver in the selected option, for three reasons. First, the time span between the decision and the recollection may be too short to observe participants actually forgetting their action when reminded the two options. In Li (2013), less than 5% of the players forgot their choice when the decision and the recollection were on the same day. Having to recall the amount left to the other player is harder and leaves room for forgetting. The second reason for not asking participants to recall their option is that if a participant does not recall it, he may simply play the game again. If preferences are stable over time, he should be able to find the option he had chosen without recruiting any memory effort. The third reason is that asking the receiver's amount allows us to measure both the direction and the magnitude of memory manipulations, if any. Indeed, the key point is to investigate not only whether participants are able or not to recall, but also whether recalls are systematically biased in one direction and whether the magnitude of the bias depends on the chosen option.

Recently, Li (2017) has tested whether individuals exhibit biased memory in recalling their performance in a five-round word-entry task. Forty days after performing the task, subjects were asked to recall their number of mistakes and their performance rank. A within-subject design manipulated whether subjects had to make forecasts about their absolute and relative performances, and whether they received feedback. Li (2017) found that having to forecast performance and receiving feedback eliminate biased recalls. While this study highlights the importance of attention and awareness in memory biases about one's performance, we are interested in how and to what extent individuals manipulate their memory to sustain their demand for pro-social self-image. Finally, Dessi et al. (2016) study the ability to recall information about friendship networks, but not in the perspective of exploring memory as a self-view management mode.

3 Experimental Design and Procedures

We first describe the design of the experiment, and then we detail the procedures.

3.1 Experimental Design

Our experiment consists in four parts. In part 1, participants play dictator games. This task generates outcomes to be recalled in part 3. In part 2, participants perform a distraction task used to wipe out their instant memory of part 1. In part 3, participants are asked to recall the amount allocated to the receiver in each game played in part 1. In part 4 we measure the participants' general memory capacity. Instructions are included in Appendix 1. We now describe each part in detail.

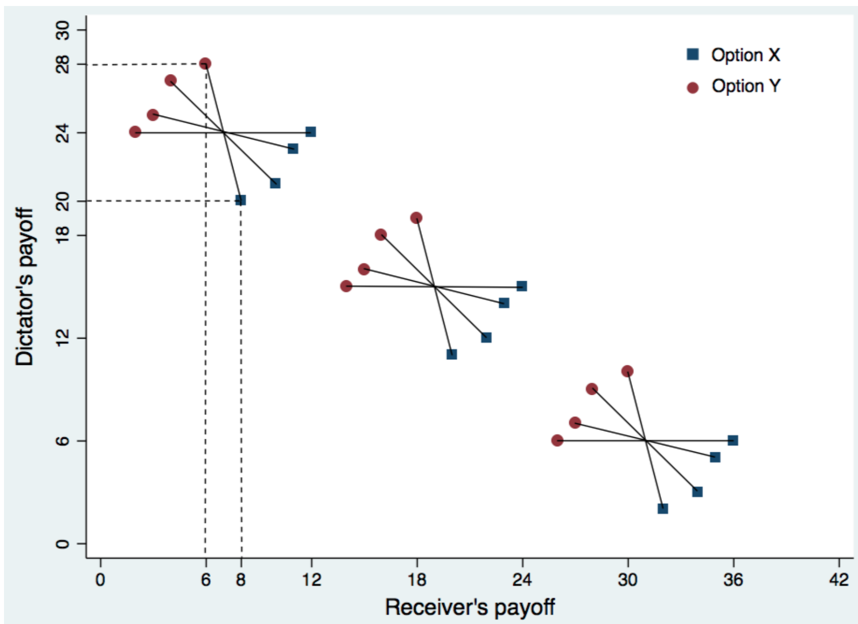
Part 1: Dictator Games

In part 1, participants play twelve binary dictator games, as described in Table 1. Half of the participants are dictators (players A), the other half are receivers (players B). Roles are randomly assigned at the beginning of the part. Participants keep the same role for the twelve games.[6] Dictators and receivers are randomly re-matched after each game. In each game, the dictator has to choose one of two options: option X or option Y. Option X pays X_a to the dictator and X_b to the receiver. Option Y pays Y_a to the dictator and Y_b to the receiver. The receiver is passive. At the end of the session, one game is randomly selected for payment. Participants are not informed that they will be asked to recall the receiver's amounts in part 3. To avoid any possible confound, the dictator games have been built such that each game is unique and each receiver's amount (X_b or Y_b) appears only once.

Figure 1 illustrates the twelve dictator games (see also Table 1). The calibration is inspired by Bruhin et al. (2018). Each of the three circles represents a set of four dictator games in

[6] We decided not to play under the veil of ignorance for two reasons. First, deciding under uncertainty about one's actual role could have led to a more empathetic behavior and thus, could have affected the measurement of other-regarding preferences (Casari and Cason, 2009; Iriberri and Rey-Biel, 2011). Second, choices under role uncertainty are less self-image threatening, both before and after role assignment. Before, because the player does not know whether his decision is going to be implemented and he may thus distantiate himself from the responsibility of both players' outcomes. After, because once roles have been assigned, the dictator can persuade himself that the other players have done the same selfish choices, which may reduce guilt and the need to bias memory.

different payoff spaces. In the first payoff space (top-left), dictators are always in an advantageous position. This means that their amount is always higher than the receiver's amount, regardless of the chosen option. In the second payoff space (middle), the position depends on the chosen option. In option X dictators are in a disadvantageous position while they switch to an advantageous position in option Y. In the third payoff space (bottom-right), dictators are always in a disadvantageous position, regardless of the chosen option. Hereafter, option X is called the "altruistic" option and option Y the "selfish" option. In the altruistic option, the dictator's (receiver's, respectively) amount is always lower (higher, respectively) than in the selfish option.



Notes: Each game is represented by a line that connects options X and Y. The slope of the line represents the cost for the dictator of increasing the receiver's amount. The steeper the slope, the more costly it is for the dictator to increase the receiver's amount. Each of the three stars represents a set of four games in different payoff spaces. In the top-left space, dictators are always in an advantageous position. In the middle space, the position depends on the chosen option. In the bottom-right space, dictators are always in a disadvantageous position. *Example (short-dashed lines)*: option X yields 20 ECU to the dictator and 8 ECU to the receiver.

Figure 1: Dictator games

A crucial aspect of our design is that participants must pay sufficient attention to the games to be able to recall the amounts in part 3. To be sure that they actually pay attention to these amounts in part 1, we implemented some rules. First, the screens that display the two options are frozen during five seconds before dictators can enter their decision. Second, dictators have not only to select an option but also to type in the dictator's and the receiver's amounts in the chosen option. After being informed of the option chosen by the dictator, this choice remains visible on the screen for five seconds and receivers have also to type in the two selected amounts on their computer. Typing the amounts increases the probability to recall these amounts.[7]

[7]It has been shown that writing down a statement helps memorize it (see, *e.g.*, Naka and Naoi (1995) and

Table 1: The binary dictator games

Games	Option X Altruistic	Option Y Selfish	Relative position of the dictator
1	(2, 32)	(10, 30)	Disadvantageous
2	(3, 34)	(9, 28)	Disadvantageous
3	(5, 35)	(7, 27)	Disadvantageous
4	(6, 36)	(6, 26)	Disadvantageous
5	(11, 20)	(19, 18)	Mixed
6	(12, 22)	(18, 16)	Mixed
7	(14, 23)	(16, 15)	Mixed
8	(15, 24)	(15, 14)	Mixed
9	(20, 8)	(28, 6)	Advantageous
10	(21, 10)	(27, 4)	Advantageous
11	(23, 11)	(25, 3)	Advantageous
12	(24, 12)	(24, 2)	Advantageous

Notes: The first numbers in parentheses display the dictator's amounts, the second numbers the receiver's amounts. The receiver's amount is always higher with option X than with option Y. The dictator's amount is always higher (or equal) with option Y than with option X. The two options were randomly ordered across games.

Part 2: Filler Task

In part 2, we introduce a filler task that requires attention and concentration and which purpose is to distract participants from the previous task. Indeed, in part 3 players will be asked to recall the amounts allocated to the receivers in the dictator games. Thus, it is important to enable some forgetting between parts 1 and 3, not only by introducing a time span but also by removing instant memory. Moreover, drawing the participants' attention away from the previous dictator decisions may open a wiggle room for memory manipulation. Participants are asked to solve computerized mazes during eight minutes (see an example of maze in Appendix 1). Each maze solved pays 0.25 Euro. Therefore, the higher the number of mazes solved, the higher the payoff.

Part 3: Memory Task

Part 3 introduces the memory task. For each of the twelve binary dictator games played in part 1, participants, regardless of their role, are asked to recall and report the amount allocated to the receiver. For each game the screen displays the two options, but for the option actually chosen by the dictator in part 1, the receiver's amount is replaced by a question mark. All the amounts to be recalled are between 2 and 36. However, to give to each amount a chance to be over and under-estimated, we allowed the recalls to lie in the interval 0 to 38, inclusive. Participants are informed that the amounts to recall are within this range.

Skinner et al. (1997)).

In two treatments played between subjects we manipulate the monetary incentives for accurate memory. In the No-Incentive - Receiver's Amount treatment (NIRA, hereafter), the recall task is not incentivized. In the Incentive - Receiver's Amount treatment (IRA, hereafter), it is incentivized based on accuracy. Two recalls among the twelve are selected at random. Each correct recall pays two Euros. A correct recall plus or minus one unit pays one Euro. In the other cases, the participant neither earns nor loses anything. The underlying hypothesis is that memory is likely to be less biased when it is costly to manipulate it.

We cannot exclude that other-regarding preferences may condition the attention paid by the dictators to the receiver's amount in the dictator games, and this may affect the quality of recalls. To disentangle self-image motives from attention effects, we ran a control treatment, the Incentive - Dictator's Amount treatment (IDA, hereafter), in which participants have to recall the dictator's amount instead of the receiver's amount. Recalls are incentivized like in the IRA treatment. If memory accuracy is affected by self-image concerns, dictators should still exhibit a lower percentage of correct recalls when they have chosen the selfish option than when they have chosen the altruistic option. If the difference of memory accuracy across the chosen options is mainly driven by different levels of attention paid to the receiver's amount, the percentage of correct recalls should not be significantly different between the selfish and the altruistic chosen options when dictators have to recall their own amount.

Part 4: Elicitation of Memory Capacity

The capacity to memorize may be heterogeneous across individuals. In the last part, we elicit the participants' memory capacity in a neutral and individual environment. To avoid any confound with the memory task in part 3, the task used in this part does not involve numbers. We chose a verbal memory task because cognitive psychologists have shown that verbal empan (the highest number of words that an individual is able to recall) and digit empan (the highest number of digits that an individual is able to recall) are significantly correlated within individuals (Hilton, 2006). This part is made of three rounds. In each round, participants are instructed to read and memorize a sequence of 15 random words. Each word is displayed one by one on the screen for two seconds. After having seen the 15 words, participants are asked to recall and report on their computer as many words as possible. They do not receive any feedback on their performance until the end of the session. At the end of the session, one round is randomly chosen and participants are paid according to their performance in this round. Each word correctly recalled pays 0.25 Euro. Finally, at the end of the session participants have to fill out a standard demographic questionnaire and they receive a detailed feedback on their earnings.

3.2 Procedures

The experiment was programmed using Java language. It was conducted at GATE-LAB, Lyon, France. A total of 466 participants were recruited from our subject-pool, using the H-ROOT online recruitment software (Bock et al., 2014). 146 participated in the NIRA treatment, 158 in the IRA treatment and 162 in the IDA treatment. Table A1 in Appendix 2 summarizes the participants' characteristics in each treatment.

At the beginning of the experiment, each participant was randomly allocated to a terminal. Instructions for each part were self-contained and displayed on the participants' screen at the end of the previous part. No feedback on performance or earnings was given until after all parts were completed. Participants were informed that the use of paper, pen or mobile phone was prohibited and would lead to the exclusion of the session without receiving any payment. Sessions lasted on average fifty-five minutes. At the end of the session, participants received their earnings individually and confidentially in cash in a separate room. They earned on average €14.97 (S.D. 2.80), including a €5 show-up fee.

4 Behavioral Conjectures

The following section formulates four behavioral conjectures regarding the percentage of correct recalls across treatments and options, the direction of memory errors and the magnitude of memory errors.

In the IRA treatment, the memory task is incentivized. Therefore, there is a monetary opportunity cost of not being accurate, contrary to the NIRA treatment. If dictators want to appear more pro-social to themselves than they actually are, they face a trade-off when asked to recall their decisions. On the one hand, they can recall accurately and receive the monetary incentive associated to a correct recall, but this recall may threaten their self-image because it reminds them their selfish decision. On the other hand, they can twist their memory and report they gave a higher amount to the other participant. This memory distortion satisfies their demand for positive self-image but makes them lose the incentive for a correct recall. In the NIRA treatment, such a trade-off does not exist. Therefore, introducing monetary incentives for correct recalls should tip the scale in favor of more accurate recalls. Another potential reason for this prediction is that monetary incentives may increase the effort provided by participants to correctly recall the amounts. This leads to the first conjecture:

Conjecture 1 (Memory and Monetary Incentives) *The percentage of correct recalls is higher in the IRA treatment than in the NIRA treatment.*

At the time of the decision, dictators may prefer the option that maximizes their own payoff. But at the time of the recollection, they may prefer to recall that the chosen option was more generous to the receiver than it was actually.[8] When dictators have chosen the altruistic option, recalling correctly how much they gave to the receiver has no undesirable implications in terms of self-image. In contrast, when dictators have chosen the option that benefits themselves at the receiver's expense, recalling accurately the amount given to the receiver may conflict with the desire to see themselves as pro-social. In this case, dictators have more intrinsic motivation not to be accurate and exhibit poorer recall of the amount actually allocated to the receiver. In contrast, since they did not take any decision, the receivers have no reason to experience a self-image conflict between what they have done and what they ex-post would like to think they have done. We hypothesize that they exhibit the

[8]Tenbrunsel et al. (2010) use the "want/should" theoretical framework to explain the bounded ethicality that arises from temporal inconsistencies. They posit that the "should" self, −characterized by intentions and beliefs on how one ought to behave−, dominates during the prediction and recollection phases, but that the "want" self, −characterized by a relative disregard for ethical considerations−, dominates during the action phase.

same percentage of correct recalls for the altruistic and the selfish options. We state our second conjecture as follows:

Conjecture 2 (Percentage of Correct Recalls) *The percentage of correct recalls of the dictators is higher when they chose the altruistic option than when they chose the selfish option, while the percentage of correct recalls of the receivers is the same regardless of the option chosen by the dictator.*

Psychologists have shown that individuals not only tend to forget self-image threatening information but also sometimes arrange past events or even create false memories (Gonsalves and Paller, 2002; Gonsalves et al., 2004; Chrobak and Zaragoza, 2008). Biasing one's memory allows the individual to reconcile his actual action with the action he, ex-post, would have preferred to think he made. Our design allows us to investigate not only whether participants recall correctly the amounts allocated to the receivers, but also the direction and the magnitude of their memory errors. When participants do not recall the exact amount, they can either over-estimate or under-estimate it. The difference between the recalled and the actual amounts across decisions allows us to disentangle simple errors from memory biases. Simple errors should give similar percentages of over and under-estimation across decisions, between options and between roles. In contrast, if dictators manipulate their memory to appear pro-social to themselves, they are expected to over-estimate more often the receiver's amount when they chose the selfish option than when they chose the altruistic option. On the other hand, receivers are expected to make errors in the same proportion above and below the actual amounts.[9] This leads to our third conjecture:

Conjecture 3 (Direction of Memory Errors)

- ***3a*** *Conditional on incorrect recalls, dictators over-estimate more often than they under-estimate the amount given to the receiver, while the percentages of over- and under-estimated recalls of the receivers do not differ.*
- ***3b*** *The percentage of over-estimated dictator's recalls is higher when they chose the selfish option than when they chose the altruistic option, while the percentage of over-estimated receiver's recalls is the same for both options.*

Moreover, the magnitude of the dictators' memory errors informs us on the underlying mechanism of memory manipulation. If poor recalls are only errors, we should not observe any difference in the average magnitude of errors between dictators and receivers. In contrast, if dictators manipulate their memory to satisfy their demand for pro-social self-image, we should observe larger over-estimations of the amounts given to the receivers when they chose the selfish option than when they chose the altruistic one. This lead to our final conjecture:

Conjecture 4 (Magnitude of Memory Errors) *Dictators' recalls over-estimate the amount given to the receiver to a larger extent when they chose the selfish option than when they chose the altruistic option, while the magnitude of the receivers' memory errors does not vary with the option chosen by the dictator.*

[9] Note that we cannot exclude that some receivers may suffer from being powerless in the dictator games and this may lead them to under-estimate their recalled amounts; but if this is the case, they should under-estimate their amounts regardless of the option chosen.

5 Experimental Results

Before we introduce our main results, Table 2 displays the relative frequency of the selfish choice in each game, by treatment.[10] It shows that this frequency is relatively high but also that it varies across games, which gives opportunities to image-concerned dictators to bias their memory.

Table 2: Summary statistics on decisions in the dictator games

Games	Option X	Option Y	Percentage of dictators choosing Y			
	Altruistic	Selfish	All	IRA	NIRA	IDA
1	(2, 32)	(10, 30)	98.71 %	97.47 %	98.63 %	100.00 %
2	(3, 34)	(9, 28)	98.28 %	98.73 %	95.89 %	100.00 %
3	(5, 35)	(7, 27)	80.26 %	75.955 %	82.19 %	82.72 %
4	(6, 36)	(6, 26)	20.60 %	21.52 %	26.03 %	14.81 %
5	(11, 20)	(19, 18)	99.14 %	98.73 %	98.63 %	100.00 %
6	(12, 22)	(18, 16)	98.71 %	98.73 %	98.63 %	98.77 %
7	(14, 23)	(16, 15)	82.40 %	83.54 %	84.93 %	79.01 %
8	(15, 24)	(15, 14)	22.75 %	24.05 %	27.30 %	17.28 %
9	(20, 8)	(28, 6)	91.85 %	91.14 %	91.78 %	92.59 %
10	(21, 10)	(27, 4)	74.25 %	77.22 %	72.6 %	72.84 %
11	(23, 11)	(25, 3)	50.64 %	45.57 %	47.95 %	54.32 %
12	(24, 12)	(24, 2)	9.01 %	10.13 %	8.22 %	8.64 %
Total			68.88 %	69.30 %	69.75 %	67.70 %

Notes: The first numbers in parentheses display the dictator's amounts, the second numbers the receiver's amounts. The percentages of dictators choosing option Y are significantly different neither between IRA and IDA, nor between IRA and NIRA except for games two (Mann-Whitney test, p=0.066) and four (M-W, p=0.084).

In this section, we present four results that correspond to our four conjectures. The first result analyzes the impact of monetary incentives on memory accuracy. The second result presents the percentage of correct recalls according to the option chosen and to the participant's role. Results three and four investigate the direction and the magnitude of memory errors. Hereafter, we define a memory error as the difference between the recalled amount and the amount actually transferred by the dictator to the receiver. A recall is defined as correct if the recalled amount is exactly equal to the actual amount or is equal at plus or minus one unit.[11]

We introduce our first result:

Result 1 (Incentives and Memory) *Incentivizing recalls increases the percentage of dictators' correct recalls, but only when they chose the altruistic option.*

Result 1 partially supports Conjecture 1.

[10] Table A2 in Appendix 2 summarizes statistics on behavior in the four parts of the experiment and in the final questionnaire, by treatment.

[11] We also run all the tests and regressions using a stricter definition in which a recall is correct if it exactly equals the actual amount. Results do not change when using this strictest definition of a correct recall.

Table 3: Summary statistics on individual recalls

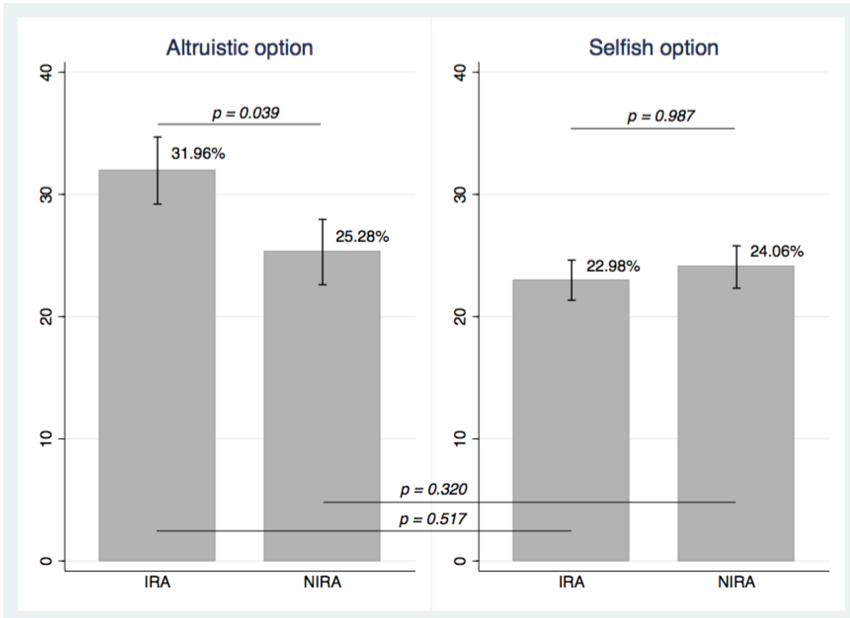
	IRA (1)	NIRA (2)	Pooled (3)	*p-values* (1)-(2)
Percentage of correct recalls, by role and option				
Dictators				
Altruistic option	31.96% (291)	25.28% (265)	28.77% (556)	*0.039*
Selfish option	22.98% (657)	24.06% (611)	23.50% (1268)	*0.987*
	0.517	*0.320*	*0.824*	-
Receivers				
Altruistic option	25.43% (291)	21.51% (265)	23.56% (556)	*0.181*
Selfish option	22.07% (657)	24.22% (611)	23.11% (1268)	*0.588*
	0.383	*0.170*	*0.828*	-
Percentage of over-estimation, by role and option				
Dictators				
Altruistic option	31.82% (198)	30.30% (198)	31.06% (396)	*0.898*
Selfish option	54.74% (506)	54.96% (464)	54.85% (970)	*0.417*
	0.001	*0.001*	*0.001*	-
Receivers				
Altruistic option	27.65 (217)	30.77% (208)	29.18% (425)	*0.675*
Selfish option	53.52 (512)	57.24% (463)	55.28% (975)	*0.207*
	0.001	*0.001*	*0.001*	-
Magnitude of absolute memory errors, by role and option				
Dictators				
Altruistic option	5.06 (291)	6.08 (265)	5.54 (556)	*0.329*
Selfish option	5.75 (657)	5.58 (611)	5.67 (1268)	*0.861*
	0.665	*0.355*	*0.733*	-
Receivers				
Altruistic option	5.80 (291)	6.12 (265)	5.95 (556)	*0.521*
Selfish option	5.38 (657)	5.75 (611)	5.56 (1268)	*0.456*
	0.588	*0.214*	*0.217*	-

Notes: The p-values in lines and in columns are from M-W tests and Wilcoxon signed-rank tests (altruistic *vs.* selfish option). The average percentage of accurate recalls of each individual gives one independent observation. Numbers in parentheses display the number of individual observations.

Support for Result 1: Each participant had to recall twelve amounts, which gives 3648 (304*12) recalls in total. Overall, 24.18% of the recalls are correct, with a total of 25.11% for the dictators and 23.25% for the receivers (Mann-Whitney test, M-W hereafter, p=0.260). The percentage of correct recalls is 23.92% in the NIRA treatment (dictators: 24.43%, receivers: 23.40%, p=0.479) and 24.42% in the IRA treatment (dictators: 25.74%, receivers: 23.10%, p=0.392). These percentages are not significantly different (M-W, p=0.474).[12] Raw individual data of the participants' recalls compared with the actual decisions are displayed in Figure A1 in Appendix 3, with the correct recalls displayed on the diagonal. Table 3 details the

[12]In all non-parametric tests reported in this paper, the average recall of each individual gives one independent observation, and all tests are two-sided.

percentage of correct recalls across treatments, roles and options.



Notes: The Figure displays the percentages of correct recalls depending on the option chosen by the dictators, by treatment. p-values comparing the treatments are from Mann-Whitney tests. p-values comparing the options are from Wilcoxon paired-signed-rank tests.

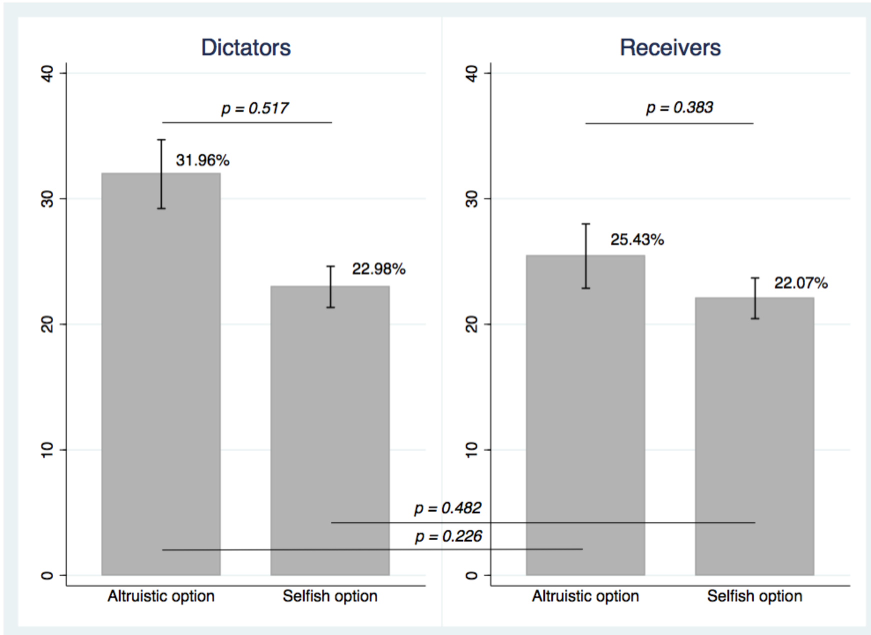
Figure 2: Average percentage of dictator's correct recalls, by option and treatment

However, the percentages of dictators' correct recalls differ significantly between the NIRA and the IRA treatments when they chose the altruistic option (M-W test, p=0.039). This is not the case when they chose the selfish option (M-W test, p=0.987) (and this is not the case for the receivers either). Figure 2 displays the mean percentages of dictators' correct recalls by option and treatment.[13] The percentage of correct recalls of the chosen altruistic option in IRA (31.96%) is significantly higher than in NIRA (25.28%) (M-W test, p=0.039). Our interpretation is that when dictators are given a monetary incentive to provide a memory effort, they allocate this effort to access memory of desirable rather than undesirable decisions.

We now introduce our second result:

Result 2 (Accuracy of Recalls) *The percentage of correct recalls of the dictators is lower when they chose the selfish option than when they chose the altruistic option. No such difference is observed for the receivers.*

[13]When dictators have chosen the altruistic option, the effect size is 0.32 and the statistical power is 0.61. With the same α error probability (p=0.039), 38 additional dictators per group would have been needed to observe a statistical power equal to 0.80. When dictators have chosen the selfish option, the effect size is 0.03. With an α error probability equal to 0.05, we would need 13453 observations per group to observe a statistical power of 0.80.



Notes: The Figure displays the percentages of correct recalls by role in the IRA treatment. p-values comparing the options are from Wilcoxon signed-rank tests. p-values comparing roles are from Mann-Whitney tests.

Figure 3: Average percentage of correct recalls, by role and by option

To support Result 2, we provide three types of analyses. Two of the three analyses support Conjecture 2.

Support for Result 2: We start with the most conservative non-parametric tests. In the IRA treatment, dictators recall accurately the actual amount allocated to the receiver 31.96% of the time when they have chosen the altruistic option, and 22.98% of the time when they have chosen the selfish option (see Figure 3 and Table 3). These percentages of correct recalls go in the direction of our conjecture; however, using a Wilcoxon signed-rank test (W test, hereafter) with one observation per subject per type of decision, we find that the two values are not statistically significant (p=0.517). The percentage of correct recalls of the receivers is 25.43% when the dictator has chosen the altruistic option and 22.07% when he has chosen the selfish option. As predicted, the difference is not significant (p=0.383). The percentages of correct recalls of the dictators and of the receivers differ neither when the altruistic option has been selected (M-W test, p=0.226), nor when the selfish option has been selected (M-W test, p=0.482).[14] We also find no significant differences between the percentages of correct recalls when the dictator chose the altruistic *vs.* the selfish option in the NIRA treatment (see Table A.3 and Figure A.3 in Appendix 2).

[14]When the altruistic option has been chosen, the effect size between the dictators' and the receivers' percentages of correct recalls is 0.18. With this effect size, we would need a minimum sample of 328 dictators and 328 receivers to have a significant difference at the 5% level and a statistical power equal to 0.80. When the selfish option has been chosen, the effect size between the dictators' and the receivers' percentages of correct recalls is 0.16. With this effect size, we would need a minimum sample of 390 dictators and 390 receivers to have a significant difference at the 5% level and a statistical power equal to 0.80.

We also test Conjecture 2 by examining whether the accuracy of recalls differs between types of dictators. We split the sample of dictators based on the median frequency of selfish choices. In the IRA treatment, the more selfish dictators (those who chose the selfish option in more than eight games, N=41) exhibit a lower average percentage of correct recalls (21.34%) than the less selfish dictators (N=38; 30.48%), and the difference is highly significant (M-W test, p=0.006). In the NIRA treatment, the percentages are 23.65% for the more selfish dictators (N=37) and 25.23% for the less selfish ones (N=36), and they are not significantly different (p=0.394). We find no significant difference in the rate of correct recalls between the receivers who have been more frequently exposed to selfish dictators and the other receivers, in either treatment.[15]

However, these tests do not control for the characteristics of the games and of the individuals. Therefore, we report a regression analysis in Table 4, pooling the data from the IRA and NIRA treatments. Models (1) to (3) display the marginal effects from Logit regressions in which the dependent variable is a binary variable equal to one if the recall is correct, and zero otherwise. Model (1) pools the data from the dictators and the receivers, model (2) only includes the data relative to the dictators, and model (3) only those relative to the receivers. Robust standards errors are clustered at the individual level. The independent variables include the incentivization of recalls (with NIRA as the reference category), the role of the participant (only in model (1)), the option chosen by the dictator (selfish *vs.* altruistic), and the three sets of options indicating whether the dictator was in an advantageous or a disadvantageous position regardless of his choice, or in a mixed situation depending on his choice (the latter category being taken as the reference). The independent variables also include the time spent to enter the recall and the game order in part 1 (dictator games) and in part 3 (recalls); indeed, they may have an impact on memory accuracy, as attention may have decreased over time. Finally, we control for the performance of the participant at the verbal memory task performed in part 4 and for various demographic variables (age, male and educational attainment).

Table 4 supports Result 2. Model (2) shows that having to recall the choice of the selfish option decreases significantly (at the 5% level) the likelihood of a correct recall by the dictators. In contrast, the nature of the option chosen by the dictator has no impact on the receivers' recall accuracy (model (3)). Receivers are significantly more likely to make a correct recall when the two options available to the dictator leave him in an advantageous rather than in a disadvantageous position. An interpretation is that they paid more attention to the amounts because they suffered from a large disadvantageous payoff inequality in this set, regardless of the dictator's choice, and the negative distance to their reference point was more salient. In other words, dictators' recall accuracy depends on their actions, whereas receiver's accuracy depend on the set of options available.

[15]In IRA, the receivers who have been exposed to selfish dictators more than 8 times out of 12 (N=37) exhibit the same average percentage of correct recalls (22.30%) than those who have been less exposed (N=42; 23.80%), and the difference is not significant (M-W test, p=0.522). In NIRA, the respective percentages (and numbers) are 23.50% (N=39) and 23.28% (N=34), and they are not significantly different either (p=0.973).

Table 4: Determinants of individual recalls

Dependent variables	*Correct recall*			*Over-estimated recall*			*Magnitude of memory error*		
	All	Dict.	Receiver	All	Dict.	Receiver	All	Dict.	Receiver
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IRA treatment	-0.002	0.014	-0.022	-0.015	0.008	-0.038	-0.186	-0.054	-0.323
	(0.018)	(0.026)	(0.024)	(0.018)	(0.028)	(0.024)	(0.283)	(0.394)	(0.408)
Dictator	0.023	-	-	-0.007	-	-	-0.151	-	-
	(0.017)			(0.019)			(0.282)		
Selfish option	-0.022	-0.051**	0.008	0.344***	0.335***	0.357***	-0.556**	-0.344	-0.801**
	(0.018)	(0.024)	(0.023)	(0.022)	(0.031)	(0.031)	(0.262)	(0.398)	(0.347)
Dict. in disadvantageous pos.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Dict. in mixed position	0.016	0.017	0.015	0.222***	0.222***	0.222***	-0.857***	-0.793*	-0.882**
	(0.016)	(0.024)	(0.020)	(0.019)	(0.028)	(0.026)	(0.308)	(0.438)	(0.431)
Dict. in advantageous pos.	0.028	-0.003	0.061**	0.526***	0.528***	0.524***	-1.553***	-1.504***	-1.571***
	(0.018)	(0.027)	(0.024)	(0.020)	(0.028)	(0.028)	(0.339)	(0.498)	(0.462)
Verbal memory score	0.005***	0.002	0.006***	0.001	0.002	0.0002	-0.049*	-0.091**	-0.023
	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)	(0.025)	(0.037)	(0.032)
Time to recall	-0.003***	-0.003*	-0.003*	0.001	0.001	0.001	-0.010	-0.020	-0.0004
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.014)	(0.019)	(0.020)
Game order, Part 1	-0.003	-0.004	-0.003	-0.0003	0.001	-0.002	-0.033	-0.058	-0.008
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)	(0.032)	(0.044)	(0.046)
Game order, Part 3	-0.009***	-0.007**	-0.011***	0.004	0.001	0.006*	-0.087**	-0.142***	-0.037
	(0.002)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.035)	(0.050)	(0.050)
Age	-0.002	-0.0004	-0.005***	0.002**	0.002*	0.002	0.069***	0.049**	0.092***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.022)	(0.024)	(0.036)
Male	0.017	0.001	0.030	-0.037*	-0.033	-0.036	-0.952***	-0.900**	-0.978**
	(0.017)	(0.026)	(0.023)	(0.019)	(0.029)	(0.024)	(0.278)	(0.391)	(0.385)
Educational attainment	0.0004	0.002	0.002	-0.0002	-0.008	0.008	0.054	0.124	-0.013
	(0.006)	(0.008)	(0.008)	(0.006)	(0.009)	(0.007)	(0.081)	(0.113)	(0.111)
N	3648	1824	1824	2766	1366	1400	3071	1534	1537
Clusters	304	152	152	304	152	152	304	152	152
Pseudo R^2	0.015	0.0096	0.0297	0.1995	0.1939	0.2081	0.0062	0.0069	0.0067
Log pseudolikelihood	-1987.539	-1018.040	-959.646	-1532.372	-762.328	-766.911	-9223.013	-4582.040	-4635.475
F	52.24	19.96	57.39	566.60	264.82	316.91	5.85	4.62	2.79
$p > F$	0.0000	0.0459	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013

Notes: IRA and NIRA treatments included; marginal effects reported; robust standard errors clustered at the individual level in parentheses; * $p<0.10$, ** $p<0.05$, *** $p<0.01$. Models (1), (2), (3): Dependent variable: probability of making a correct recall; Logit models. Models (4), (5), (6): Dependent variable: probability to over-estimate the receiver's amount, conditional on making an incorrect recall; marginal effects; Logit model. Models (7), (8), (9): Dependent variable: magnitude of memory errors in absolute value, conditional on making an incorrect recall, Tobit models. (7): 305 left-censored observations. (8): 168 left-censored observations. (9): 137 left-censored observations. No right-censored observations.

These models provide additional insights for our understanding of memory mechanisms. First, the participants' performance in the verbal memory task conducted in part 4 is positively correlated with their likelihood of making a correct recall in part 3 (model (1)). This effect is driven by the receivers sub-sample (see model (3)). The Pearson coefficient between the average number of correct recalls and the performance at the verbal memory task is 0.32 for the receivers (p<0.001) and 0.11 for the dictators (p=0.178). This gives a valuable indication that individuals actually did a memory effort to recall the amounts in the dictator games, especially those who could not influence choices actively. Second, spending more time to recall a given amount is negatively correlated with the likelihood of a correct recall: either individuals recall the correct amount quickly, or they do not recall it correctly. The extra time spent to recall does not increase accuracy. Finally, the probability of a correct recall is negatively correlated with the order in which participants had to recall this amount (p<0.001). The later the amount appears in the sequence of recollection, the lower is the likelihood of recalling it correctly. This may be due to tiredness or weariness, as the task is cognitively demanding.

We now introduce our third result:

Result 3 (Direction of Memory Errors)

- **3a** *Conditional on making an incorrect recall, dictators are not significantly more likely to over-estimate than to under-estimate their recalls. Receivers are more likely to under-estimate than to over-estimate their recalls.*
- **3b** *Dictators are significantly more likely to over-estimate their recalls when they chose the selfish option than when chose the altruistic option. But this is also the case for the receivers.*

Result 3 rejects Conjecture 3 for both dictators and receivers.

Support for Result 3: In IRA, when they make an error, regardless of their actual choices, dictators under-estimate the receiver's amount 51.70% of the time and they over-estimate the amount 48.30% of the time. This difference is not significant (W test, p=0.503). If dictators had manipulated their memory for self-image reasons, they would have more frequently over- than under-estimated recalls. Similarly, when they make an error, receivers under-estimate their amount 54.18% of the time and they over-estimate it 45.82% of the time. But here, this difference is significant (W test, p=0.009).

Conditioning the percentage of over-estimated recalls on the dictator's actual decision reveals interesting differences. On average, when they make an error dictators over-estimate the receiver's amount 31.82% of the time when they chose the altruistic option and 54.74% of the time when they chose the selfish option. The difference is highly significant (W test, p<0.001).[16] However, and surprisingly, these percentages are similar for the receivers: they over-estimate their amount 27.65% of the time when the dictator chose the altruistic option

[16]Alternatively, splitting the dictators in two groups based on the median of selfish choices in the IRA treatment shows that the group of more selfish dictators over-estimates 52.45% of the time the receiver's amount while the group of less selfish dictators over-estimates this amount 43.22% of the time. The difference between the two groups is significant (M-W test, p=0.058).

and 53.52% of the time when he chose the selfish option (p<0.001). The percentages of over-estimated recalls are not significantly different between dictators and receivers, neither for the altruistic option (p=0.434), nor for the selfish option (p=0.892).

Models (4) to (6) in Table 4 display the marginal effects from Logit regressions in which the dependent variable is the likelihood of observing an over-estimated recall rather than an under-estimated recall, conditional on making an incorrect recall. The independent variables are the same as in models (1) to (3). Model (4) pools the data from the dictators and the receivers, model (5) includes only the data relative to the dictators and model (6) only those relative to the receivers. Robust standards errors are clustered at the individual level.

These models confirm that the probability to over-estimate the receiver's amount is higher when the selfish option has been preferred by the dictator to the altruistic option (p<0.001). However, this is independent from the action itself (and its responsibility) since both dictators and receivers have the same likelihood to over-estimate the receiver's amount after a selfish choice by the dictator (p=0.892).[17] Had the dictators motivated their memory to appear more pro-social to themselves, the difference in the percentage of over-estimated recalls between the chosen selfish and the altruistic options should have been higher than for the receivers. We also find evidence that, regardless of the role in the game, over-estimation is significantly less likely when the two options leave the dictator in a disadvantageous position (with a maximum payoff of 10), probably because in that cases the receivers' payoffs are much higher (with a minimum of 26) and there is less room to over-estimate them.

We introduce our last result regarding the magnitude of memory errors, defined as the absolute value of memory errors:

Result 4 (Magnitude of Memory Errors) *The magnitude of over-estimated recalls is not significantly different between altruistic and selfish choices. This is observed for both dictators and receivers.*

Result 4 rejects Conjecture 4 according to which, compared to receivers, image-concerned dictators were expected to over-estimate to a larger extent the receiver's amount when they chose the selfish option.

Support for Result 4: Table 3 displays the average of the absolute value of memory errors across roles and chosen options, conditional on making an error. In the IRA treatment, the average magnitude of dictators' memory errors is 5.06 when they chose the altruistic option and 5.75 when they chose the selfish one (see column (1)). These magnitudes are not significantly different (W test, p=0.665). The average magnitudes of receivers' memory errors are 5.80 and 5.33, respectively (W test, p=0.588). There is also no difference in the magnitudes of memory errors in the NIRA treatment (see column (2)).

[17] We also considered two-step Heckman models, estimating first the likelihood of making an incorrect recall and then, the likelihood of over-estimating the amount given to the receiver, conditional on making a recall error. We used probit models to estimate both the selection and the outcome equations. Since the Inverse of the Mill's Ratio was significant in no model, showing that we do not need to correct for a possible selection bias, and since the results on the main variables were not affected, we omit reporting these regressions.

Models (7), (8), and (9) in Table 4 report marginal effects from Tobit regressions for, respectively, all players, dictators and receivers. The dependent variable is the absolute value of the magnitude of memory errors, conditional on making an error. The independent variables are the same as in the previous models. We use Tobit models since data are censored on the left when subjects make the smallest error. Robust standard errors are clustered at the individual level. These models show that being a dictator and having to recall one's selfish choice has no significant impact on the magnitude of memory errors compared to when the altruistic option has been selected (model (8)). Thus, when they do not recall exactly the amount given to the receiver, dictators do not inflate their recalls in a self-serving way. On the other hand, interestingly, we find that the magnitude of the receivers' errors is significantly smaller when they received the selfish option than when they benefited from the altruistic choice.

These models also reveal that for all players, regardless of their role, the magnitude of memory errors is significantly higher when the set of available options puts the dictator in a disadvantageous position compared to any other situation. They also show that, for the dictators, a higher performance at the verbal memory task decreases the magnitude of memory errors.

6 Robustness tests

This section presents two additional checks. We first report the results of the IDA treatment where participants had to recall the dictator's amount in the chosen option instead of the receiver's amount. We then investigate the participants' recalls depending on their reported feelings toward the other player.

6.1 Memory Errors in the IDA Treatment

In the treatments in which players had to recall the receiver's amounts, a higher percentage of correct recalls by the dictators when they chose the altruistic option could be explained not only by motivated memory, but also by a higher attention paid to the receiver's amount by other-regarding dictators. In contrast, when making their decisions, selfish dictators may have simply compared their own amount in the two options and ignored the receiver's amounts, leading to more recall errors. In the IDA treatment where players have to recall the amount kept by the dictator instead of that given to the receiver, both other-regarding *and* selfish dictators are likely to have paid attention to their own amount. Therefore, a higher percentage of correct recalls after choosing the altruistic option than the selfish option is less likely to be explained by different levels of attention than in the other treatments. If in the IRA treatment the explanation of the variations in memory accuracy depending on the selected option was purely based on different levels of attention paid to the receiver's amount, in the IDA treatment the percentage of correct recalls of the dictators should not differ between the chosen options. In contrast, if the explanation in the IRA treatment was in terms of motivated memory, dictators are likely to also exhibit a different rate of accurate recalls in the IDA treatment depending on the option they chose.

When dictators have to recall their own amount, their percentages of correct recalls are significantly different between the altruistic and the selfish options (42.36% and 28.27%, respectively; W test, p=0.009, see Figure A.4 in Appendix 3). It would not be the case if recalls where only driven by different levels of attention depending on the chosen option. A higher percentage of correct recalls when dictators chose the altruistic option in this treatment could support an explanation in terms of motivated memory. However, we observe that the percentages of correct recalls of the receivers are also significantly different between the altruistic and the selfish options (39.81% and 28.12%, respectively; W test, p=0.013). The percentage of correct recalls is similar for dictators and receivers, regardless of whether the altruistic (M-W test, p=0.665) or the selfish option has been chosen (M-W test, p=0.733). These findings confirm that selfish dictators suffer more from amnesia than altruistic dictators. For the receivers, further investigation should be conducted to understand why they remember better the dictator's payoff when he chose an option that was nicer to them.

6.2 Memory and Self-Reported Guilt Toward the Other Player

So far, the analysis mostly contrasted recalls associated to the choice of selfish *vs.* altruistic options. However, impression management may not depend only on the chosen options, but also on the very nature of the individual. A purely selfish dictator who accepts his intrinsic egotist nature may feel no need to bias his memory. Biasing one's memory may be needed only by individuals who suffer from a dissonance between their actions and their self-image. We started to explore this dimension by splitting the sample of dictators based on the number of times they acted selfishly. We found that more frequent selfish dictators suffer more from amnesia than the others. But this does not tell us whether frequent selfish dictators accept or not their type. We can explore this dimension thanks to our post-experimental questionnaire. Dictators were asked to report on a 10-level Likert-scale their feelings toward the receivers, from 0 for very guilty to 10 for perfectly serene. Their average reported feeling is 7.12 (S.D=2.48) (see Table A2 in Appendix 2). Motivated memory should be more likely for dictators with a higher reported guilt, while more serene dictators should experience less or no discomfort when recalling their decisions.

Table A3 in Appendix 2 reports the average percentages of correct recalls depending on the reported feelings toward the other player, by treatment. It shows that dictators who reported a feeling below or equal to 5 on the serenity scale exhibit a lower percentage of correct recalls than dictators who reported a feeling above 5 (M-W test, p=0.005, all treatments pooled). Considering only selfish decisions, the more guilty dictators have also a significantly lower percentage of correct recalls than more serene dictators (M-W test, p=0.028, all treatments pooled). Overall, this questionnaire suggests that dictators who experienced more discomfort *vis-à-vis* the receivers suffer more from amnesia. We acknowledge, however, that responses in the final questionnaire may have been biased by the actual behavior of the individual throughout the games.

7 Discussion and Conclusion

Individuals develop a variety of deceptive strategies to maintain their self-concept when behaving in ways that may threaten their self-image, including strategic ignorance of information or delegation of decisions. In this study, we explored whether individuals manipulate their memory to appear more pro-social to themselves than they actually are. In our experiment, participants played binary dictator games and then, had to recall the amounts allocated to the receivers. This design allowed us to investigate whether dictators exhibit poorer recalls, over-estimate more often and to a larger extent the receivers' amounts, after making a selfish rather than an altruistic decision.

Our results are mixed. On the one hand, we found evidence of *selective memory.* First, incentivizing correct recalls increases the percentage of dictators' correct recalls when they chose the altruistic option but has no effect when they chose the selfish option. This suggests that when dictators are given a monetary incentive to provide a memory effort, they allocate this effort to access memory of desirable rather than undesirable information in terms of image when they sacrificed a personal gain to benefit the receiver. Second, dictators' amnesia is more likely after making selfish decisions than altruistic ones. No such behavior is observed for receivers. Selective memory also characterizes the receivers, but for them it is driven by the set of options available (their rate of recalls is higher when the two options create disadvantageous inequality to their expense), while for the dictators selective memory is triggered by their actions.

On the other hand, we found no evidence of *biased memory.* While in their recalls receivers are in general more likely to under-estimate than over-estimate the amount received, dictators in general are not more likely to over-estimate than to under-estimate the amount given to the receiver. Dictators are more likely to over-estimate than under-estimate the receiver's amount after choosing the selfish rather than the altruistic option, though. But this is no evidence of motivated memory since the same effect was observed for receivers. The magnitude of memory errors is also not significantly different across options and roles.

How can we explain these findings? First, we can reject that participants did not provide any memory effort. The relatively high percentage of correct recalls, the positive correlation between the participants' memory in the dictator games and their performance at the verbal memory task, as well as the high levels of self-reported memory effort at the end of the experiment (see Figure A.2 in Appendix 3) reject that recalls are pure noise.

Second, the limited memory manipulation may result from the fact that the experimenter knows the information dictators are asked to recall. This makes the outcome to recall more tangible and may reduce the temptation to bias one's memory. In a different domain, it has been shown that the propensity of individuals to lie in an experiment differs depending on whether the experimenter knows or does not know the truth (Gneezy et al., 2018). The same could apply to our setting: being aware that the experimenter knows the true amount does not affect the propensity to forget a selfish action (it is unverifiable), but it may limit the willingness to inflate systematically the receiver's amount after a selfish action. An extension of our study could then be to design games in which participants know that the experimenter cannot observe memory errors at the individual level.

Third, our results may be driven by the limited span of time between the action and its recollection. We chose to hold the action and recollection phases in the same session to make it cognitively doable for the subjects to retrieve their memory. And indeed, we do observe selective memory retrieval in this setting. But it is possible that individuals need a larger span of time to bias their recalls in a self-serving direction. A natural extension of our study would be to increase the time span between the decision and the recollection phases to test how it affects biased memory.

Another explanation for not observing biased memory could be that decisions were not sufficiently self-image threatening. Even if a majority of individuals value positively pro-social self-image and would probably prefer to think of themselves as generous rather than egoist and unfair, the dissonance between making selfish decisions in dictator games when a pro-social alternative was available and keeping a positive self-image may not be strong enough to generate an internal conflict. A possible extension would be to consider decisions that threaten self-image more, by revealing to participants a valuable and threatening information about their nature, which could generate a stronger need for biased memory.

Finally, in our design individuals could manipulate their memory only for hedonic reasons. It would be interesting to explore whether individuals are more likely not only to use selective memory but also to bias their recalls asymmetrically for motivational purposes. We leave this for further investigation.

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Appendices

Appendix 1: Instructions (*translated from French*)

Introduction

We thank you for participating in this experiment on decision-making. Please switch off your cellphone and put it away. You are not allowed to communicate with the other participants. If you have any question during the session, you can press the red button on the side of your cubicle. An experimenter will come and answer to your questions in private. During the session, you will have to make several decisions. These decisions are anonymous and can earn you money. Regardless of these decisions, you will receive a five euros show-up fee. Your earnings will be expressed in Experimental Currency Units (ECU) and converted into Euros at the following rate: 4 ECU = €1. You will be paid in cash and in private, in a separate room. Other participants will not be informed of your earnings.

The session consists of 4 parts. At the end of each part, you will receive the instructions for the next part. All the instructions will be displayed on the screen.

Please read again these instructions. If you have any questions, please raise your hand or press the red button. When you are ready, press OK to see the instructions for Part 1.

Instructions Part 1

This part consists in 12 independent periods. At the beginning of the part, you will be assigned a role, either A or B. You will keep this role for the 12 periods.

At the beginning of each period, you are going to be randomly matched with another participant, to form a pair. In each pair, a participant has the role A and the other has the role B. If you have the role A, you are matched with a participant with role B and if you have the role B, you are matched with a participant with role A. Participant B has no decision to take.

The decision of participant A consists in choosing the preferred option between two options: option X and option Y. Each option is composed of two amounts: the first amount corresponds to the payoff of participant A, the second amount corresponds to the payoff of participant B.

To validate his choice, participant A has to click on the option he prefers and type the amounts corresponding to that option in the corresponding box. It is very important to look carefully at the two amounts of each option before choosing the preferred option. Once A has chosen his preferred option, B is informed of the option chosen by A. Player B has in turn to click on the option chosen by A and type the amounts corresponding to this option in a box. Then, a new pair is formed and a new period starts.

How is determined your payoff in this part?
At the end of the session, the program selects at random one period among the twelve. Par-

ticipant A receives the first amount corresponding to the option he has chosen in this period. Participant B receives the second amount corresponding to the option chosen by participant A in this period. For example, if the option chosen by A in the randomly selected period is (20, 12): A receives 20 ECU and B receives 12 ECU.

Please read again these instructions. If you have any questions, raise your hand or press the red button. Before starting this part, you have to answer to an understanding questionnaire. Press OK to answer to these questions.

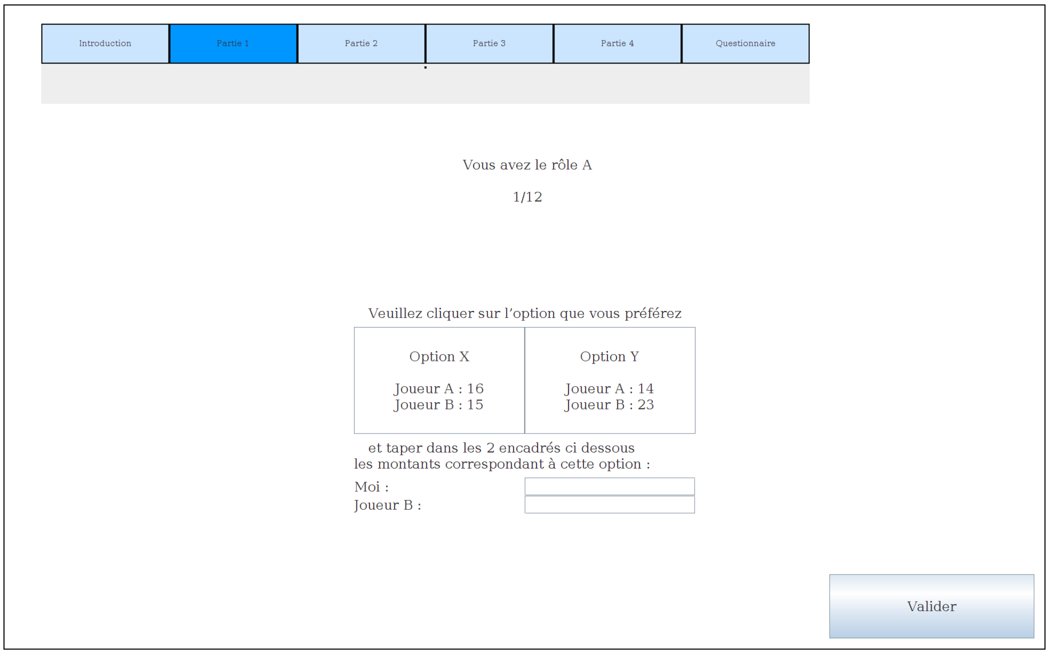


Figure 4: Example of a screen in Part 1, player A

Instructions for Part 2 (displayed on the subjects' screen after completing Part 1)

In this part, you have 8 minutes to solve mazes. There are 30 mazes in total with different levels of difficulty (10 easy, 10 intermediate, 10 difficult). You can skip a maze, but you cannot return to a previous maze. To solve a maze, you have to move a small character from the top left of the maze to the exit, at the bottom right of the maze. To move the character, use the left, right, top and down arrows of your keyboard. Before starting this 8-minute part, you will have the opportunity to practice on a maze. Solving this practice maze is not paid.

How is determined your payoff in this part?
You will earn 1 ECU for each maze solved.

Please read again these instructions. If you have any questions, raise your hand or press the red button. When you are ready, press OK to start Part 3.

Figure 5: Example of a maze in Part 2

Instructions for Part 3 (displayed on the subjects' screen after completing Part 2)

In each of the twelve games in Part 1, you (respectively, player A) had to choose the option you (respectively, he) preferred among two. Each option contained two amounts: the first amount corresponded to your (respectively, player A's) payoff and the second amount corresponded to the payoff of player B (respectively, your payoff). The amounts between you (respectively, player A) and player B (respectively, A) were different between the two options.

You are going to see again, successively and in a random order, the options that you have seen in each of the 12 periods of Part 1. However, in the option you (respectively, player A) have (has) chosen, the amount received by player B (respectively, you) will be hidden and replaced by a question mark, as in the example below. Your task consists in recalling this amount. In the above example, if you (respectively, player A) have (has) chosen option X that gave you (respectively, player A) 20 ECU, you have to recall the amount replaced by the question mark. This amount corresponds to player B's (respectively, your) payoff in the option you (respectively, player A) have chosen. Note that the amounts are bounded between 0 and 38. This means that no amount can be lower than 0 and higher than 38.

How is determined your payoff in this part?
At the end of the session, two recalls will be randomly selected. Your payoff depends on the accuracy of your recall in each of these two recalls. If your recall is correct, you will earn 8 ECU (€2). If your recall is correct plus or minus one unit, you will earn 4 ECU (€1). For example, if the amount to recall is 24 and that your recall is 24, you earn 8 ECU. If your recall is 23 or 25, you earn 4 ECU. If your recall is lower that 23 or higher than 25, you do not earn

anything. You will be informed of your total number of correct recalls at the end of the session.

Please read again these instructions. If you have any questions, raise your hand or press the red button. When you are ready, please press OK to start Part 3.

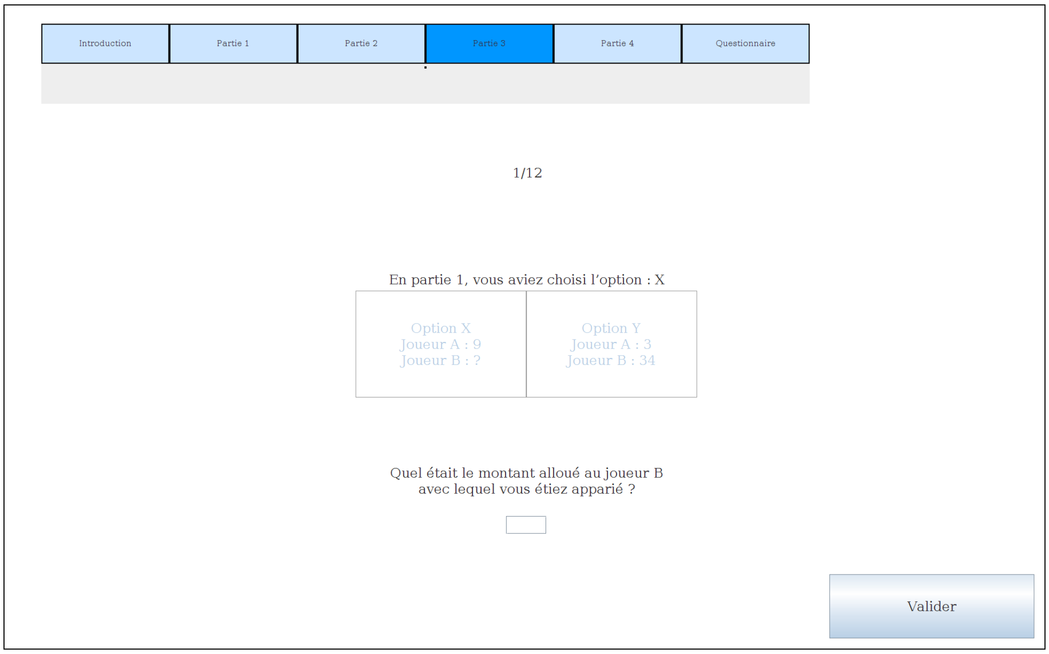


Figure 6: Example of a screen in Part 3, player A

Instructions for Part 4 (displayed on the subjects' screen after completing Part 3)

This part consists in 3 independent rounds. In each round, you will see a list of 15 words corresponding to singular nouns, without accent and written in lowercase. Each word will be displayed on your screen one by one during a few seconds. Your task consists in memorizing these words. Once you will have watched the 15 words, you will have to type the highest number of words that you recall from the list in a dedicated box. You will have 2 minutes to write the words you recall. The order in which you recall the words does not matter.

How is determined your payoff in this part?
At the end of the session, one round out of the three will be randomly selected. For each word correctly recalled in that round, you will earn 1 ECU.

Please read again these instructions. If you have any questions, raise your hand or press the red button. When you are ready, press OK to start Part 4.

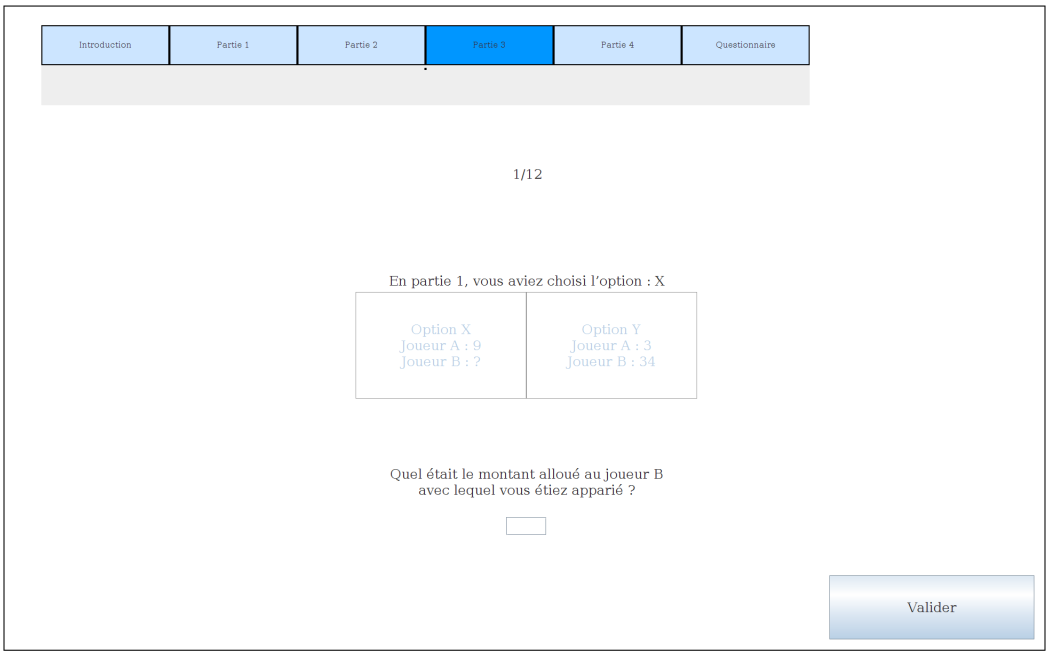


Figure 7: Example of a screen in Part 4, player A

Appendix 2: Tables

Table A.1: Summary statistics on participants

	All	NIRA	IRA	IDA
Male	46.78%	45.20%	43.67%	51.23%
Age	22.98	24.64	22.84	21.62**
Number of participants	466	146	158	162
Number of sessions	20	6	7	7
Num. of part. per session		18, 24, 26, 28, 20, 30	24, 18, 20, 22, 22, 26, 26	18, 24, 28, 22, 18, 28, 24

Notes: NIRA: No-Incentive - Receiver Amount treatment IRA: Incentive - Receiver Amount treatment IDA: Incentive - Dictator Amount treatment Mann-Whitney tests. NIRA and IDA are both compared to IRA. NIRA and IDA are never directly compared since there are more than one difference between the two treatments (the amount to recall and the presence of incentives).

Table A.2: Summary statistics on each part

Treatments		All	NIRA	IRA	IDA
Part 1	Percentage of altruistic choices (out of 12)	31.12%	30.25%	30.70%	32.30%
Part 2	Number of solved mazes	12.13	11.63	12.08	12.64*
Part 3	Number of correct recalls (out of 12 amounts)	3.24	2.87	2.93	3.88***
Part 4	Number of correct words (out of 45 words)	24.65	23.78**	25.31	24.78
Quest.	Estimated number of correct recalls (out of 12)	4.36	4.21	4.44	4.43
	Reported memory effort (0-10 scale)	6.71	6.51	7.02	6.61*
	Reported feeling toward the other player:				
	Dictators (0: very guilty; 10: very serene)	7.12	6.89	7.14	7.32
	Receivers (0: very angry; 10: very serene)	6.63	6.41	6.61	6.85

Notes: NIRA: No-Incentive - recall of the Receivers' Amount. IRA: Incentive - recall of the Receiver's Amount. IDA: Incentive - recall of the Dictator's Amount. The Table reports the results of two-tailed Mann-Whitney tests in which each individual is taken as an individual observation. The NIRA and IDA treatments are both compared to IRA. NIRA and IDA are never directly compared in the analysis since there are more than one difference between them (the amount to recall and the presence of incentives).

Table A.3: Average percentage of dictators' correct recalls depending on their reported feeling toward the other player

	All	NIRA	IRA	IDA
Reported guilty	23.07% (56)	20.42% (20)	22.67% (18)	26.39% (18)
Reported serene	29.28% (177)	25.94% (53)	26.64% (61)	34.66% (63)
p-value	*0.005*	*0.068*	*0.385*	*0.069*

Notes: Dictators had to report on a 10-level scale their feeling toward the receiver, from 0 (very guilty) to 10 (very serene), inclusive. The reported guilty group includes dictators reporting a value equal to or lower than 5; the reported serene group includes dictators reporting a value higher than 5.The *p*-values from M-W tests are in italics. The average number of correct recalls of each individual gives one independent observation.

Appendix 3: Figures

Notes: Each dot represents one recall. Each dot on the diagonal represents an amount recalled accurately. For a better view, we used the "jitter" option in Stata that differentiates dots located in the same position.

Figure A.1a: Recalled and actual amounts given to the receiver in the dictator games, by option and role, in the IRA treatment

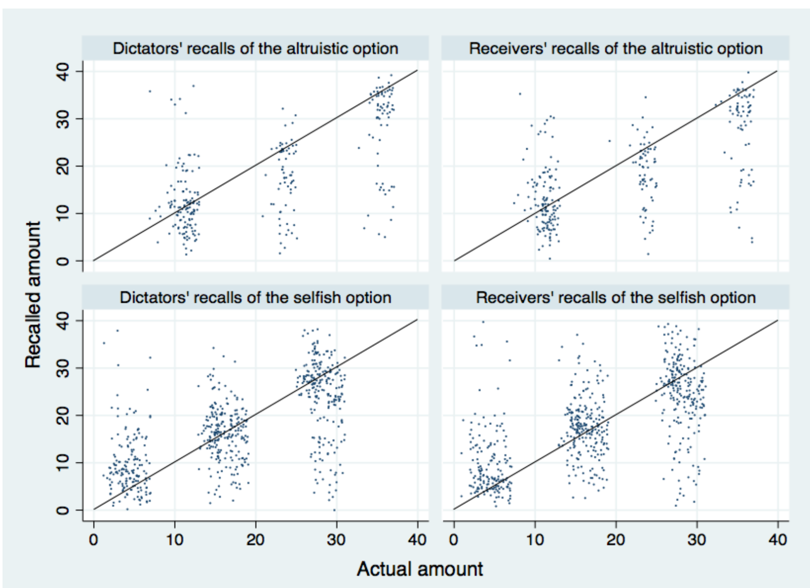
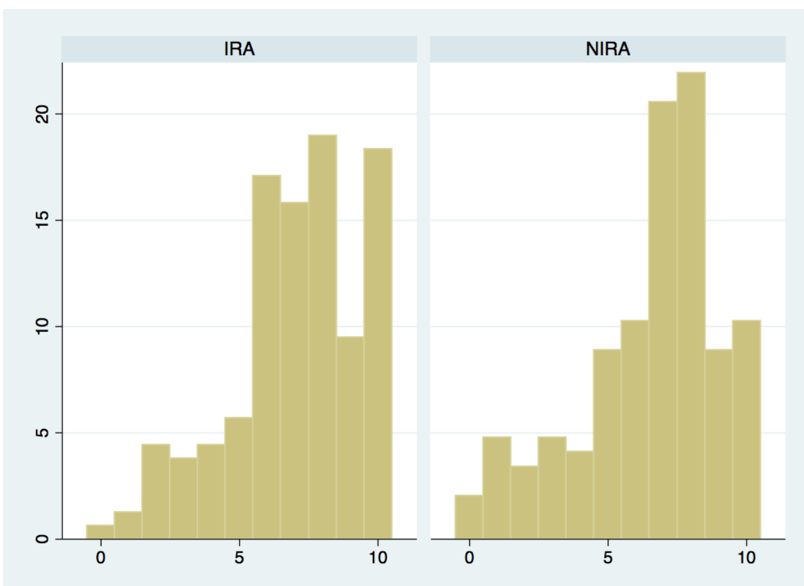


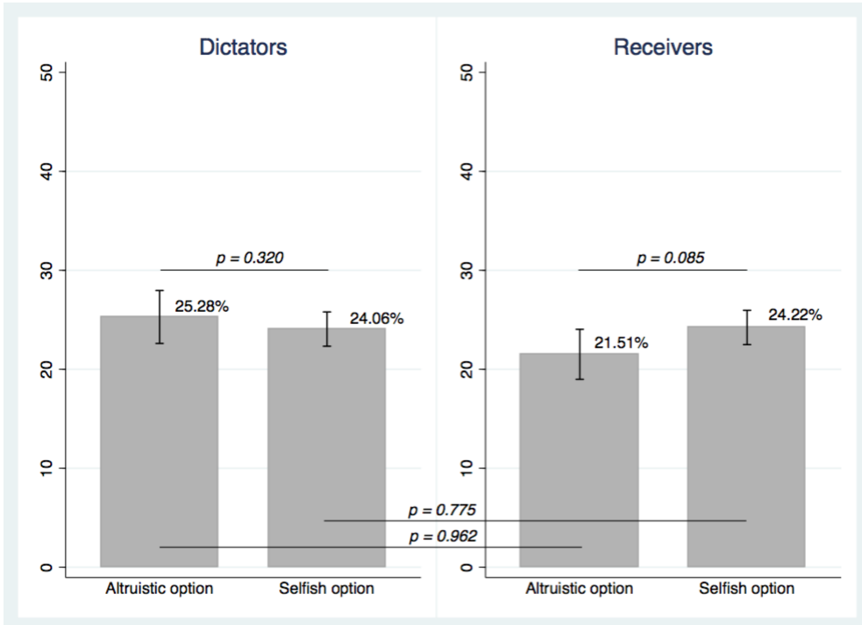
Figure A.1b: Recalled and actual amounts given to the receiver in the dictator games, by option and role, in the NIRA treatment

Figure A.1c: Recalled and actual amounts given to the receiver in the dictator games, by option and role, in the IDA treatment



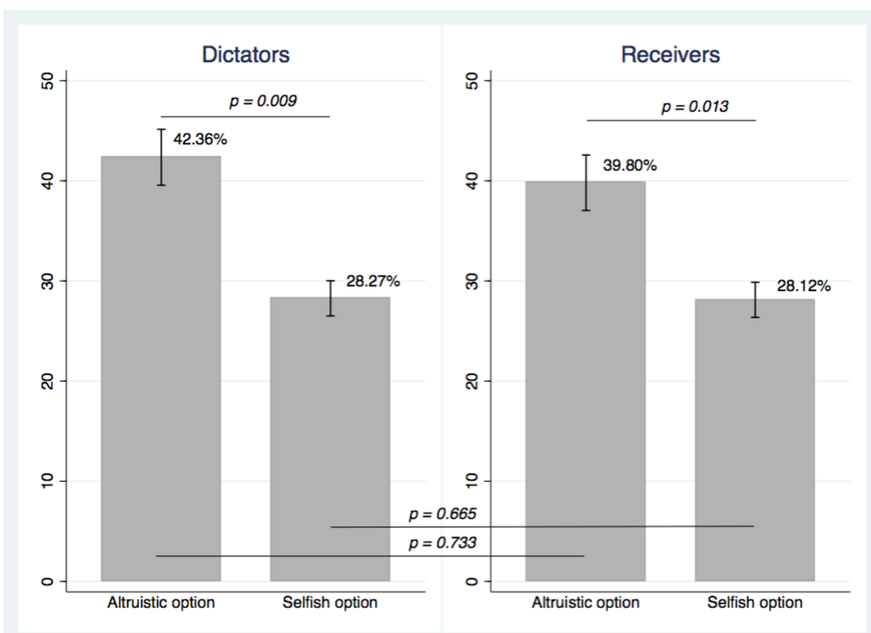
Notes: Participants had to report their memory effort on a 10-level scale, from 0 for the lowest effort to 10 for the highest possible effort, inclusive. The two distributions are not significantly different (Two-sample Kolmogorov-Smirnov test, p=0.618).

Figure A.2: Distribution of the reported levels of memory effort in the NIRA and IRA treatments, in percentage



Notes: The Figure displays the percentages of correct recalls depending on the option chosen by the dictators, by role.
p-values comparing the options are from Wilcoxon signed-rank tests.
p-values comparing the roles are from Mann-Whitney tests.

Figure A.3: Average percentage of correct recalls, by role and option, NIRA treatment



Notes: The Figure displays the percentages of correct recalls depending on the option chosen by the dictators, by role.
p-values comparing options are from Wilcoxon signed-rank tests.
p-values comparing roles are from Mann-Whitney tests.

Figure A.4: Average percentage of correct recalls, by role and option, IDA treatment