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Motivated memory in dictator games

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The memory people have of their past behavior is one of the main sources of information about themselves. To study whether people retrieve their memory self-servingly in social encounters, we designed an experiment in which participants play binary dictator games and then have to recall the amounts allocated to the receivers. We find evidence of motivated memory through selective recalls: dictators remember more their altruistic than their selfish choices. A causal effect of the responsibility of decisions is identified, as the recall asymmetry disappears when options are selected randomly by the computer program. Incentivizing memory accuracy increases the percentage of dictators' correct recalls only when they behaved altruistically. In contrast, there is no clear evidence of motivated memory through biased memory errors, i.e., overly optimistic recalls: dictators recall selectively but do not bias the direction and magnitude of these recalls in a self-serving way.

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. The discrepancy between what people do and how they would like to see themselves 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 image-threatening actions 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" self with the ex-post "should" self when these two are in conflict (e.g., Bazerman et al., 1998; Bénabou and Tirole, 2002).[1] Motivated memory can develop through two channels. *Selective recalls* correspond to asymmetric probabilities of recalling desirable *vs.* undesirable events (Carrillo and Mariotti, 2000; Bénabou and Tirole, 2002; Mullainathan, 2002; Bernheim and Thomadsen, 2005; Gottlieb, 2014; Wilson, 2014) and lead to uncertainty about past self-image threatening actions. *Biased memory errors* refer to the direction and magnitude of errors; they correspond

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[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.

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to overly optimistic recalls of past behavior.[2] Motivated memory can thus play in various directions, including selective amnesia but also positive delusion or confabulation (Chew et al., 2018).

While memory is at the source of any belief formation and updating process,[3] little is known about how individuals use it strategically to sustain their demand for positive self-image, especially in social encounters. 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: if individuals are able to forget —at least partially— past unethical behavior, they do not have to entirely bear its moral costs. Using a laboratory experiment, our study aims at understanding whether and to what extent individuals manipulate their memory to sustain their demand for pro-social self-image. This relies on two assumptions. First, the demand for positive self-image is linked to 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, people are able to distort their memory. They can influence the way they encode and recollect information and, if needed, *ex-post* revise their recalls.[4]

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 enable to observe the memory retrieval of outcomes induced in the laboratory. Observing both the action and the recollection phases permits not only to identify selective recalls but also to measure the direction and magnitude of memory errors. In this respect, the rare economic experiments on motivated memory differ from most experiments in psychology that rely on self-reported and/or on autobiographical memory.[5] Moreover, using a controlled environment minimizes the effects of rehearsal and associativeness that strongly impact the individuals' ability to store and recollect information.[6] This permits also to control for the time between the action and the recollection phases, avoiding potential confounds between the effect of time and the effect of motivation on memory retrieval. A last advantage is the control for individual differences in memory capacity that are hardly observable in natural 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. By introducing social interactions, we differ from the previous economic experiments that mainly investigated how people manipulate their memory about their performance in intelligence tests (Li, 2017; Chew et al., 2018; Zimmermann, 2019), with the exception of Li (2013) who considered trust games and the recent study of Carlson et al. (2018) on sharing decisions. In our experiment, non selective memory would predict similar percentages of correct recalls and symmetric memory errors for both selfish and altruistic decisions. In contrast, motivated memory predicts that dictators exhibit a different degree of memory accuracy about the amounts 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 the choice of the altruistic option leads to a higher memory accuracy and to less biased recalls than the choice of the selfish option because its memory is not self-image threatening. When they have chosen the selfish option, we conjecture that dictators i) exhibit a lower memory accuracy (selective recalls), ii) are more likely to over-estimate and iii) to a larger extent the amount given to the receiver (biased memory errors), 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 and their desire to see themselves as pro-social when recalling. Memory manipulations may be used self-servingly to reconcile these two selves.

Our contribution to the nascent experimental economic literature on memory is threefold. First, our design allows us to investigate the existence of motivated memory in social interactions in an economic framework. Dictator games engage moral behavior (Konow, 2000; Cappelen et al., 2007), a domain susceptible to motivated memory (Moore, 2016). Moreover,

[2] Selective memory corresponds to a different likelihood of recalling or not an event depending on the desirability of this event. Selective memory predicts that the more self-image enhancing is the event, the higher will be the likelihood of recalling it instead of forgetting it. This can be illustrated by the following example. An individual often passes by a homeless person on his way home from work. Sometimes he does not give him money ($0), sometimes he gives a low amount ($1), and sometimes he gives a high amount ($10), equiprobably. Since he likes to think of himself as a generous person, he may better recall the times he gave a positive amount than when he gave nothing. If he underestimates the number of times he gave nothing, he exhibits selective memory. Biased memory is different and refers to the size and the direction of the memory errors. Keeping the same illustration, given inaccurate recalls, if the individual is more likely to recall having given $5 when he actually gave $1 than to recall having given $8 when he actually gave $10, memory errors are biased. In other words, selective memory expresses the idea that given that the individual recalls the given amounts correctly, the likelihood of recalling the times he gave $0 is lower than the likelihood of recalling the times he gave either $1 or $10. Biased memory errors express the idea that when the person **does not** recall the given amount correctly, the likelihood of overestimating this amount is higher than the likelihood or underestimating it.

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

[4] *Memory revisionism* is 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).

[5] 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 can hardly check the veracity of the recalled event, which prevents the study of motivated memory at an individual level.

[6] 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 (Kahana, 2012).

our calibration of the games allows us to identify whether motivated memory is more susceptible to emerge under advantageous or disadvantageous payoff inequality between the dictator and the receiver. Our second contribution is establishing causality between the responsibility of the decisions and motivated memory, by manipulating the dictator's responsibility for the receiver's amount. Contrary to ultimatum or trust games where the responsibility for the final outcome is shared by two players, in dictator games one player bears the entire responsibility for both players' outcomes. This setting does not enable a dilution of responsibility that may substitute to memory manipulations. Our third contribution is estimating selective recalls and biased memory errors (the direction and magnitude of memory manipulation) separately. While most previous experiments (Li, 2013; Chew et al., 2018) offer binary measures −forgetting or recalling−, we can measure the extent to which individuals distort their memory. Also, by manipulating incentives we can, like Zimmermann (2019), disentangle between forgetting and suppression or selective retrieval of past decisions: if past decisions are actually forgotten, incentives should not change the recall accuracy.

In our experiment, participants play 12 binary dictator games. In each game, the dictator has to choose between a selfish and an altruistic option for sharing an amount between himself and a receiver. Across games, 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. Then, after performing a distraction task, players are asked to recall the amounts allocated to the receiver. Participants are not informed of the memory task when playing the dictator games. This design allows us to investigate whether the percentage of correct recalls, the direction, and the magnitude of memory errors differ depending on the option chosen by the dictator.

We introduce four treatments in a between-subjects design. In the Incentive - Receiver's Amount treatment (IRA hereafter), dictators are responsible for the amount allocated to the receiver and correct recalls of the receiver's amount are incentivized. We conjecture that motivated memory increases the dictators' probability to recall after they chose the altruistic rather than the selfish option. The Incentive - Receiver's Amount - Computer treatment (IRAC hereafter) is similar to IRA except that the option is randomly selected by the computer program. Since in this treatment the dictator is not responsible for the amount allocated to the receiver, we conjecture no difference in recalls between selfish and altruistic options. The No-Incentive - Receiver's Amount treatment (NIRA hereafter) is similar to the IRA treatment, except that correct recalls are not incentivized. If individuals forget past decisions, introducing or removing incentives should not affect the accuracy of recalls; in contrast, if accuracy depends on incentives, it suggests that people either selectively suppress the past decisions they are not so proud of, or make a greater effort to retrieve past image-enhancing decisions. Finally, if selfish dictators make more memory errors, it might be because of motivated memory or because they paid less attention to the receiver's amount when making decisions. We ran an Incentive - Dictator's Amount treatment (IDA hereafter) that is similar to the IRA treatment, except that participants have to recall the amount allocated to the dictator. We conjecture that biased dictators should exhibit a different percentage of correct recalls and a different magnitude of memory errors depending on their chosen option not only when they have to recall the receiver's amount, but also when they have to recall their own amount.

Our results show evidence of selectively accurate *vs.* inaccurate recalls driven by the responsibility of actions. First, when dictators are responsible for the amount allocated to the receivers, their percentage of correct recalls is higher after they chose the altruistic rather than the selfish option. This is not the case when the receiver's amount is selected randomly. Second, 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 people do not forget their past decisions but when given a monetary incentive to provide a memory effort, they allocate this effort to retrieve the memory of desirable rather than undesirable information. Finally, in the IDA treatment dictators are also less likely to remember their own amount after choosing the selfish than the altruistic option. In contrast, we do not find clear evidence of biased memory errors. Dictators are more likely to over-estimate than under-estimate the amount allocated to the receiver after choosing the selfish rather than the altruistic option. However, the same asymmetry is found when the amount allocated to the receiver is randomly selected by the program. Also, the magnitude of dictators' memory errors is similar regardless of the pro-sociality of decisions and of whether dictators are responsible or not for the amount allocated.

Overall, these findings identify a causal effect of the responsibility of pro-social decisions on selective recalls but not on biased memory errors. Individuals have a less accurate memory of past behavior when they have been selfish but they do not exhibit overly optimistic recalls of their past behavior. These selective recalls in social interactions are consistent with theoretical and empirical studies establishing an asymmetric recall of feedback depending on whether people receive good news or bad news about their relative performance (Bénabou and Tirole, 2002; Li, 2017; Chew et al., 2018; Zimmermann, 2019). These findings show that memory errors can result from cognitive impairment but also from motivated biases.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the experimental design and procedures. Section 4 outlines the behavioral conjectures. Section 5 reports the results and section 6 provides robustness tests. Section 7 discusses these findings 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 involving 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. Also, people have less clear memory of their own unethical experiences than of their ethical experiences, while they recall others' ethical and unethical actions similarly (Kouchaki and Gino, 2016).

While the economic literature modelling cognitive limitations in recalls and their impact on belief formation and decision-making is substantial (Dow, 1991; Piccione and Rubinstein, 1997; Mullainathan, 2002; Bénabou and Tirole, 2004; Brunnermeier and Parker, 2005; Bénabou and Tirole, 2006; Wilson, 2014; Bordalo et al., 2017), very few papers have investigated 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 recalls a negative (positive, respectively) signal with probability below (above, respectively) the actual percentage. Our study takes root in these models, focusing 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 recognize the role played by memory in the maintenance of 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 Li (2013); Dessi et al. (2016); Li (2017); Chew et al. (2018); Zimmermann (2019), and Carlson et al. (2018). Chew et al. (2018) show that after a delay of several months, individuals exhibit asymmetric recalls of past performance in an IQ test. They forget more their incorrect answers than their correct ones. However, before having to recall whether their answer was correct or not they were shown the correct answer. Thus, they may distort their recalls but also 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, they have a higher chance to recall the amounts given to the receivers, which should limit direct self-signalling deception. Also, we can explore the magnitude of memory errors.

Zimmermann (2019) investigates the underlying mechanism of motivated beliefs and provides evidence of asymmetry in the recall of feedback on past relative performance in an IQ test. Different treatments manipulate the incentives for correct recalls and the time between feedback and the second elicitation of beliefs about one's rank in a group. People adjust their posterior beliefs just after receiving feedback on their performance, but when these beliefs are elicited one month later rather than immediately, people who received positive feedback keep high beliefs whereas those who received negative feedback return to their prior beliefs. By varying incentives, Zimmermann (2019) finds that people manage to suppress feedback that threatens their desire to view themselves as intelligent persons. Li (2017) also tests whether individuals exhibit biased memory in recalling their performance but using a word-entry task instead of an IQ test. Forty days after performing the task, participants are asked to recall their number of mistakes and their performance rank. The design manipulates whether they forecast their absolute or relative performances, and whether they receive or not feedback. Both having to forecast performance and receiving feedback eliminate biased recalls.

Like these studies, we aim at identifying motivated memory and we investigate the selectivity of recalls. We also manipulate the existence of incentives for accurate recalls to test for forgetting or suppression of past decisions. In contrast to these studies, we manipulate exogenously the dictators' responsibility of decisions and therefore we are able to identify a causal effect of decisions on selective memory. We also focus on the memory of other-impacting decisions and we explore another side of individuals' desired self-view: the demand for pro-social self-image. Motivated memory on pro-sociality has been almost unexplored. An exception is Li (2013) who investigates the recollection of decisions in a trust game after various delays.[7] 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. We differ from this study in several respects. We use dictator games instead of trust games because the dictator bears the full responsibility of the receiver's payoff, which we assume has a key role in triggering selective memory and allows us to identify a causal effect on selective memory. Also, we do not manipulate the time between decisions and recalls but we explore both selective recalls and biased memory errors, which highlights the underlying mechanism of motivated memory. A key point is indeed to investigate not only whether participants recall or not, but also whether recalls are systematically biased self-servingly in one direction and whether the magnitude of the bias depends on the pro-sociality of the decision. Finally, we have been aware of a recent study by Carlson et al. (2018) that, like us, investigate motivated memory in dictator games. The two studies developed independently. The authors found that misremembering in dictator

[7] 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.

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. The dictator's amount is always higher (or equal) with option Y.

games is more likely when participants made decisions that fall short of their personal view of fairness. By contrast, we focus on the role of personal responsibility in decision-making on motivated memory, and we compare whether memory errors differ when participants have to recall the amount given to another person and the amount kept for themselves.

3. Experimental design and procedures

We describe the design of the experiment before detailing the procedures.

3.1. Design

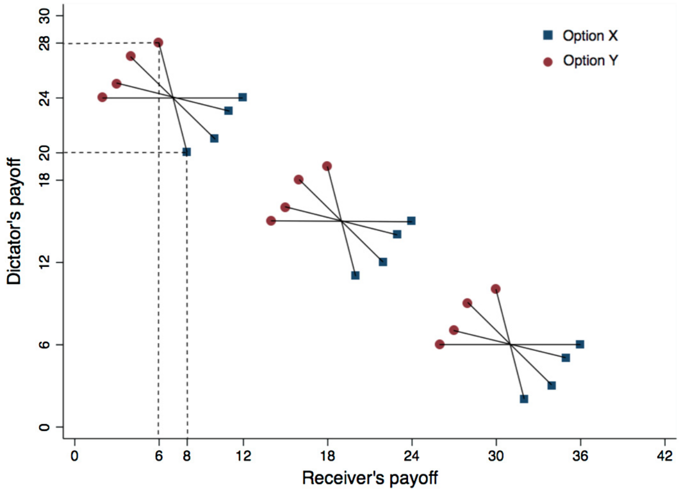
Our experiment consists in four parts. In part 1, participants play dictator games. In part 2, they perform a distraction task used to wipe out the instant memory of part 1. In part 3, in most treatments they are asked to recall the amount allocated to the receiver in each game played in part 1. In part 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 and kept constant for the twelve games.[8] Dictators and receivers are randomly re-matched after each game. In each game, the dictator has to choose one of two options. 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, each game is unique and each receiver's amount (X_b or Y_b) appears only once. Fig. 1 illustrates the games. The calibration is inspired by Bruhin et al. (2018). Each star represents a set of four dictator games in different payoff spaces. In the top-left payoff space, dictators are always in an advantageous position: their amount is always higher than the receiver's amount, regardless of the chosen option. In the middle payoff space, 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 bottom-right payoff space, 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 amount is always lower than in the selfish option.

A crucial aspect of the design is that participants must pay sufficient attention to the games to encode and to be able to recall the amounts in part 3. To that aim, 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 to type in the dictator's and the receiver's amounts in the chosen option. Then, the option chosen by the dictator remains visible on the receiver's screen for five seconds. For symmetry receivers have also to type in the same amounts. Typing the amounts increases the probability

[8] We decided not to play under the veil of ignorance for two reasons. First, deciding under uncertainty about one's role 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 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 outcomes. After, because once roles have been assigned, the dictator can persuade himself that the others have made the same selfish choices, which may reduce guilt and the need to bias memory.



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. 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 (dashed lines)*: option X yields 20 ECU to the dictator and 8 ECU to the receiver.

Fig. 1. The dictator games.

to recall these amounts, as writing down a statement helps memorize it (see, e.g., Naka and Naoi (1995) and Skinner et al. (1997)).

Part 2: Filler task

Part 2 introduces a filler task (solving mazes during eight minutes - see Appendix 1) that requires attention and concentration and which purpose is to distract participants from the previous task and allow some forgetting. Drawing the participants' attention away from the previous dictator decisions may open a wiggle room for memory manipulation. Each maze solved pays €0.25.

Part 3: Memory task

Part 3 introduces the memory task. For each dictator game played in part 1, participants, regardless of their role, are asked to recall and report the amount allocated to the receiver in the selected option.[9] 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 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. This task allows us to measure both selective recalls and biased memory errors.[10] Games are displayed in a random order independent from their order in part 1. Two recalls are selected randomly. Each correct recall pays two Euros, a correct recall plus or minus one unit pays one Euro, and otherwise participants neither earn nor lose anything.

Dictators are asked to recall the amount allocated to the receiver in the selected option and not the chosen option for three reasons. First, the time span between the decision and the recollection may be too short to observe forgetting. 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. Second, if a participant does not recall his decision, 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. Third, asking the receiver's amount allows us to measure both the direction and the magnitude of memory errors, if any, and not only the existence of selective recalls.[11]

[9] Participants were not informed about the memory task before part 3 because it might have impacted not only their recall accuracy but also their choice of option. Indeed, if they anticipate negative utility due to self-image threatening decisions, they may make less selfish choices strategically and thus, they have no incentives to bias their recalls. In addition, knowing that they will be paid for correct recalls, they could act strategically by choosing not the option they prefer but the option whose amounts are easier to recall.

[10] Note that over-estimating the amount given to the receiver, if any, could be driven by motivated memory but also possibly by social image concerns *vis-a-vis* the experimenter. Eliciting recalls a month later instead of within the same session would help investigate whether memory selectively fades over time; however, it could also reinforce social image concerns. When recalls are elicited in the same session, incentives might still be salient and the trade-off between a better social image and a higher payoff might be pronounced. In contrast, a month later incentives have been received, probably spent, and might thus appear less salient; thus, the relative importance of social image might increase over time.

[11] Our memory task is cognitively demanding. We could have used instead a standard one-shot dictator game and increased the time span between decisions and recalls. However, in Li (2013) even after 43 days, more that 85% of the participants recalled their choice in a trust game. Using a repeated

Part 4: Elicitation of memory capacity

The capacity to memorize may be heterogeneous across individuals. Thus, in the last part we elicit participants' memory capacity in an individual environment. To avoid any confound with the memory task in part 3, the new task does not involve numbers but tests verbal memory. It is adapted from one of the three paradigms used to study memory performance (Bordalo et al., 2017): the free recall test (see e.g., Murdock (1962); Tulving et al. (1972)). This part is made of three rounds. In each round, participants have to read and memorize a sequence of 15 random words. Each word is displayed one by one on the screen for two seconds. Then, participants are asked to recall as many words as possible. They receive no feedback on their performance until the end of the session. They are paid according to their performance in a round selected at the end of the session. Each correct recall pays €0.25. Finally, participants have to fill out a standard demographic questionnaire.

We acknowledge that this measure is imperfect since it tests verbal memory whereas our main task is about memorizing numbers, and it was administered at the end of the experiment when subjects were possibly tired. But administering the test at the beginning of the session could have primed the subjects about the nature of the main task. Despite its limitations, this measure remains informative since 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).

Treatments

Our four between-subjects treatments are summarized in Table 2. The Incentive - Receiver's Amount treatment (IRA) is the baseline. Dictators choose the amount allocated to the receiver, have to recall this amount, and are paid for accurate recalls. The Incentive - Receiver's Amount - Computer treatment (IRAC) is similar to IRA, except that the option in the dictator games is always selected randomly by the computer program instead of being chosen by the dictator. Dictators in this treatment bear no responsibility for the receiver's outcome. The comparison between the IRA and IRAC treatments indicates whether the responsibility for decisions triggers motivated memory, if any.

The No-Incentive - Receiver's Amount treatment (NIRA) is similar to IRA, except that recalls are not incentivized. The comparison between the NIRA and IRA treatments allows us to test whether individuals erase definitely some decisions from their memory, or whether they either suppress or retrieve them selectively. We expect that recalls are less selective and biased when manipulation is costly. If individuals actually forget, incentives should not affect the accuracy of recalls regardless of the option (see Zimmermann, 2019). If selfish choices are recalled less when incentives are absent rather than present, this indicates that individuals suppressed them; if altruistic choices are recalled more when incentives are present than when they are absent, this indicates that individuals allocate their memory effort selectively.

Finally, in the Incentive - Dictator's Amount treatment (IDA) participants have to recall the amount allocated to the dictator instead of the amount allocated to the receiver. Recalls are incentivized like in IRA and IRAC. This treatment should control for the fact that social preferences may condition the attention paid to the receiver's amount, and thus the memory of it. If any difference in memory accuracy across the chosen options in IRA is driven by differential attention, the percentage of correct recalls should not differ between the selfish and the altruistic options when dictators have to recall their own amount. If memory accuracy depends on self-image concerns, the difference in accuracy between the recalls of selfish *vs.* altruistic decisions should be similar in this treatment and in IRA.

Table 2
Summary of treatments.

Treatment	IRA	IRAC	NIRA	IDA
Active dictator	Yes	No	Yes	Yes
Incentives for accurate recalls	Yes	Yes	No	Yes
Recall of the receiver's amount	Yes	Yes	Yes	No

Notes: IRA: Incentives - Receiver's Amount. IRAC: Incentives - Receiver's Amount - Computer. NIRA: No-Incentives -Receiver's Amount. IDA: Incentives - Dictator's Amount.

3.2. Procedures

The experiment was programmed using Java language. It was conducted at GATE-Lab, Lyon, France. A total of 620 participants were recruited from our subject-pool, mainly from local engineering and business schools, using hroot (Bock et al., 2014). 158 participated in the IRA treatment, 154 in the IRAC treatment, 146 in the NIRA treatment and 162 in the IDA treatment. Table A.2 in Appendix 2 summarizes the participants' characteristics in each treatment.

Upon arrival, 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 provided

game increases the space for forgetting. Moreover, at the time of recollection, participants could have played the game another time instead of trying to remember their decision. Thus, any difference between recalls and decisions could be attributed to motivated memory but also to a variation of preferences over time.

until after all parts were completed. The use of paper, pen or mobile phone was prohibited. Sessions lasted on average 55 mins. At the end of the session, participants were paid individually in cash in a separate room. They earned on average 15.01 Euros (S.D. 2.80), including a 5-Euro show-up fee.

4. Behavioral conjectures

The following section formulates four behavioral conjectures regarding the asymmetry of dictators' recalls conditional on the selected option (selective recalls), the direction and the magnitude of memory errors (biased memory errors).

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.[12] 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 selfish option, recalling accurately the amount given to the receiver may conflict with the desire to see themselves as pro-social. In this case, dictators have some motivation to exhibit poorer recall of the amount actually allocated to the receiver. This is consistent with Bénabou and Tirole (2002) where individuals are motivated to forget signals that undermine their long-term goals (motivational reason) or lower their self-esteem (affective reason). Here, motivated memory can only respond to affective reasons when the individual sends a signal to himself about his nature when he chose his options in the dictator games.

In contrast to IRA, in IRAC the receiver's amount is selected randomly by the program. Since the dictator is not responsible for the amount allocated to the receiver, the selection of the selfish option is not self-image threatening. We conjecture that the responsibility for the receiver's amount in IRA leads to selective recalls, i.e. a difference in the probability of an accurate recall after the choice of the selfish option *vs.* the altruistic option. In contrast, we do not expect any difference in this probability when the option has been selected by the program in IRAC. We state our first conjecture as follows:

Conjecture 1 *(Selective Recalls). Because people prefer receiving good rather than bad signals about their own nature, the percentage of accurate recalls is higher when the dictators chose the altruistic option than when they chose the selfish option, whereas these percentages are the same when dictators bear no responsibility in the choice of option.*

If individuals actually forget their past decisions, the accuracy of recalls should not vary according to the presence (IRA) or absence (NIRA) of monetary incentives. If they do not forget, monetary incentives are expected to increase the accuracy of recalls. There may be two effects. First, incentives may increase the individuals' effort to retrieve the memory of decisions that give them a positive self-image more than the memory of those that threaten their self-image. As a result, introducing incentives should increase the accuracy of recalls when the altruistic option has been chosen. Second, incentives may discourage people from suppressing the memory of decisions they are not so proud of because of the opportunity cost for not being accurate. Indeed, as modeled in Bénabou and Tirole (2002), incentives introduce a trade-off between the affective benefits from biasing beliefs in a self-serving way and the monetary incentives for accurate beliefs: on the one hand, a correct recall increases payoff but may threaten self-image, on the other hand, forgetting satisfies the demand for positive self-image but leads to give up the bonus for correct recalls. As a result, introducing incentives may increase the accuracy of recalls when the selfish option has been chosen.

This leads to our second conjecture about selective recalls:

Conjecture 2 *(Incentives and Selective Recalls). The percentage of dictators' correct recalls is higher when correct recalls are incentivized than when they are not incentivized, regardless of the option.*

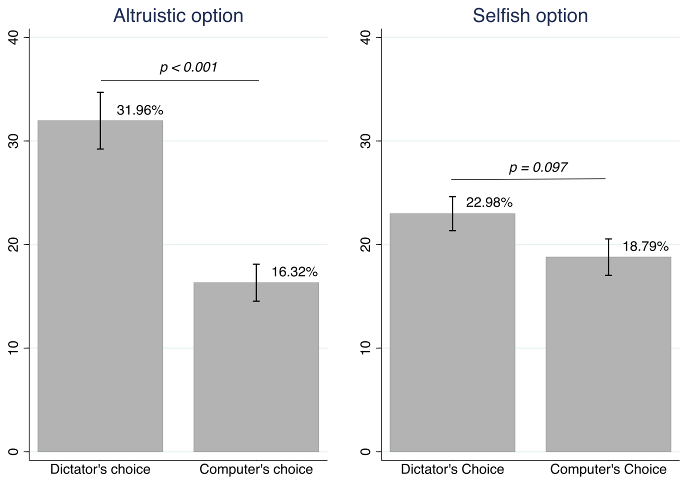
The following two conjectures are related to biased memory errors. Psychologists have shown that individuals not only tend to forget self-image threatening information but also sometimes arrange past events or even create false memories (Gonsalves and Paller, 2002; Gonsalves et al., 2004; Chrobak and Zaragoza, 2008). Biasing one's memory self-servingly allows individuals to reconcile their actual action with the action they, ex-post, would have preferred to think they 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 memory errors. When participants do not recall the exact amount, they can either over-estimate or under-estimate it, and to a greater or a lesser extent. The difference between the recalled and the actual amounts across decisions allows us to disentangle simple errors from biased memory errors. Simple errors should give similar percentages of over- and under-estimation and a similar magnitude of memory errors across options and across treatments. 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, and to a larger extent.

This leads to our third and fourth conjectures:

[12] Tenbrunsel et al. (2010) use the "want/should" 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, whereas the "want" self, −characterized by a relative disregard for ethical considerations−, dominates during the action phase.

Conjecture 3 *(Direction of Memory Errors). The percentage of over-estimated recalls is higher when dictators chose the selfish option than when they chose the altruistic option, while no difference is expected when dictators bear no responsibility in the choice of option.*

Conjecture 4 *(Magnitude of Memory Errors). Dictators' recalls over-estimate the amount given to the receiver to a larger extent when they preferred the selfish option to the altruistic option, while no difference is expected when dictators bear no responsibility in the choice of option.*



Notes: The Figure displays the percentages of dictators' correct recalls depending on the option (altruistic or selfish) chosen by the dictator in IRA or by the program in IRAC. p-values are from Mann-Whitney tests.

Fig. 2. Average Percentage of Dictator's Correct Recalls in IRA and IRAC, by Option.

5. Results

We present four results that correspond to the four conjectures. The first result analyzes the impact of dictators' responsibility on selective recalls. The second result presents the impact of monetary incentives on selective recalls. Results three and four investigate biased memory errors by exploring the direction and the magnitude of these errors, respectively. In this analysis, a recall is defined as correct if the recalled amount is equal to the actual amount plus or minus one unit.[13,14] When a recall is incorrect, a memory error is defined as the difference between the recalled amount and the amount actually transferred by the dictator.

We introduce our first result:

Result 1 *(Selective Recalls). The percentage of dictators' correct recalls is higher when they chose the altruistic option than when they chose the selfish option; this is not the case when dictators bear no responsibility in the choice of option.*

To support Result 1, we provide three types of analyzes. Two of the three analyzes support Conjecture 1.

Support for Result 1: We start with the most conservative non-parametric tests. Fig. 2 displays the average percentage of dictator's correct recalls in the IRA and IRAC treatments, by option, and Table 3 summarizes descriptive statistics on recalls (the raw individual decisions and recalls are displayed in Fig. A.1 in Appendix 3).[15] In IRA, dictators recall accurately the 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. These percentages go in the direction of Conjecture 1; however, a Wilcoxon

[13] We replicated our analysis using both a stricter definition (a recall is defined as correct if it matches exactly the actual amount) and a less strict definition (it is defined as correct if it deviates from the actual amount by up to two units). All specifications qualitatively confirm the main results (see Appendix 4).

[14] We restrict our analysis to the dictators' recalls although we also elicited the receivers' recalls of dictators' choices. Comparing dictators' and receivers' recalls cannot provide a clean identification of dictators' motivated memory because receivers may also motivate their memory, albeit for different reasons. For example, they may remember better the altruistic decisions because they may want to believe that they are surrounded by altruistic people, because they made them happier, or because they try to experience the positive anticipated utility from expected higher future payoffs. Interested readers can find an analysis of the receivers' recalls in Appendix 5.

[15] Table A.1 in Appendix 2 presents the relative frequency of the selfish choice in each game, by treatment. This frequency is 69.30% in IRA, 53.57% in IRAC, 69.75% in NIRA, and 67.70% in IDA and it varies across games, which gives opportunities for memory manipulation. Table A.3 in Appendix 2 summarizes statistics on behavior in the four parts of the experiment and in the final questionnaire, by treatment.

Table 3
Summary statistics - dictators' recalls.

	IRA (1)	IRAC (2)	NIRA (3)	IDA (4)
Percentage of correct recalls, by chosen option				
Alt. option	31.96% (291)	16.31%***(429)	25.28%** (265)	42.36%* (314)
Self. option	22.98% (657)	18.79%* (495)	24.06% (611)	28.27% (658)
p-values	*0.517*	*0.088*	*0.320*	*0.010*
Percentage of over-estimated recalls, by chosen option				
Alt. option	31.82% (198)	23.96% (359)	30.30% (198)	52.49%*** (181)
Self. option	54.74% (506)	62.44%*** (402)	54.96% (464)	38.98%*** (472)
p-values	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Magnitude of absolute memory errors, by chosen option				
Alt. option	5.06 (291)	7.27*** (429)	6.08 (265)	3.10*** (314)
Self. option	5.75 (657)	7.02*** (495)	5.58 (611)	4.11*** (658)
p-values	*0.665*	*0.566*	*0.355*	*0.035*

Notes: In the non-parametric tests, each individual gives one independent observation. Numbers in parentheses indicate the number of individual observations. The p-values in lines compare recalls when the altruistic *vs.* selfish options have been chosen, using W tests. The stars in columns come from pairwise treatment comparisons with IRA taken as the reference category, using M-W tests. $^{*}p$<0.10, $^{**}p$<0.05, $^{***}p$<0.01.

signed-rank test (W test, hereafter) with one observation per subject per type of decision, shows that the difference is not significant (p=0.517).[16] In the IRAC treatment in which the option is selected by the program, dictators recall accurately the amount allocated to the receiver 16.31% of the time when the altruistic option has been selected, and 18.79% of the time when the selfish option has been selected. This difference is marginally significant (p=0.088) and goes in the opposite direction of what is observed in IRA. Comparing IRA and IRAC reveals that the percentage of correct recalls for the altruistic option is significantly higher in IRA (Mann-Whitney tests —M-W hereafter—, p<0.001); this is also the case for the selfish option but to a much lower extent (p=0.097).

Our second test of Conjecture 1 examines whether the accuracy of recalls varies across various types of dictators. In each treatment, we split the sample of dictators based on the median frequency of selfish choices.[17,18] In IRA, 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%). The difference is highly significant (M-W test, p=0.006). This is not the case when dictators are not responsible for the amounts allocated to the receivers. Indeed, in IRAC the percentage of correct recalls is 17.34% for dictators with a number of selfish choices above or equal to six (N=37) and 17.92% for those with a number of selfish choices below six (N=40). These percentages are not significantly different (M-W, p=0.810). This analysis supports Result 1: dictators exhibit selective recalls when they are responsible for the amount given to the receivers. The difference in recall accuracy between the more selfish and the less selfish active dictators cannot be explained by differences in memory capacity. Indeed, more selfish dictators (N=41) do not differ from less selfish ones (N=38) in terms of memory capacity in the verbal memory task. On average more selfish dictators remember 24.66 words correctly out of 45 and less selfish dictators remember 25.29 words correctly (M-W test, p=0.640).

Our third test of Conjecture 1 is based on a regression analysis that controls for the characteristics of the games and of the individuals. Table 4 reports the marginal effects from Logit regressions in which the dependent variable is equal to one if the recall is correct and zero otherwise. Robust standard errors are clustered at the individual level. In model (1) the independent variables include the four treatments (with IRA as the reference category) and the option chosen by the dictator (selfish *vs.* altruistic) in order to test the presence of selective recalls. They also include the three sets of games 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 (with the advantageous category taken as the reference). This allows us to test whether the demand for motivated memory is lower when the dictator is always in a disadvantageous position in a game because it might be easier to justify a selfish choice in this setting. The independent variables also include the time spent to enter the recall and the game orders in part 1 (dictator games) and in part 3 (recalls) because they may impact memory accuracy, as attention may have decreased over time. Finally, we control for the performance of the participant in the verbal memory task performed in part 4 and for various demographic variables (age, male and educational attainment, as measured by the number of years of study after high school). Models (2) to (5) replicate model (1) for each treatment separately.

[16] 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.

[17] In IRA, the median frequency of selfish choices is 8. It is 6 in IRAC since the options were selected at random.

[18] The design of the twelve games allows us to identify more than two types of dictators, i.e., spiteful, altruistic, inequality averse individuals and social welfare maximizers. However, we did not use these categories in our analysis of motivated memory for several reasons. In particular, there are no obvious mechanisms that would justify conjectures on dictators' recalls depending on their type. For example, between social-welfare maximizers and inequality-averse individuals, it is not clear who should be more susceptible to exhibit motivated memory. Moreover, such a classification requires that players exhibit a consistent pattern of decisions across the twelve games, which is not systematically observed.

Table 4
Determinants of dictators' correct recalls.

Dependent variable	*Dictator's correct recall*				
	All (1)	IRA (2)	IRAC (3)	NIRA (4)	IDA (5)
IRA treatment	Ref. -	-			
IRAC treatment	-0.099*** (0.023)		-		
NIRA treatment	-0.015 (0.026)			-	
IDA treatment	0.073*** (0.025)				-
Selfish option	-0.057*** (0.017)	-0.083** (0.034)	0.025 (0.025)	-0.014 (0.034)	-0.146*** (0.035)
Dict. in disadv. position	Ref. -	Ref. -	Ref. -	Ref. -	Ref. -
Dict. in mixed position	-0.007 (0.017)	0.017 (0.034)	-0.039 (0.035)	0.009 (0.035)	-0.016 (0.036)
Dict. in adv. position	-0.028 (0.018)	0.014 (0.034)	-0.025 (0.029)	-0.035 (0.044)	-0.077* (0.039)
Performance verbal memory	0.004** (0.001)	0.0001 (0.003)	0.005** (0.002)	0.002 (0.003)	0.006** (0.003)
Time to recall	-0.003*** (0.001)	-0.003 (0.002)	-0.001 (0.001)	-0.003 (0.002)	-0.005** (0.002)
Game order, part 1	0.002 (0.002)	0.006 (0.004)	0.002 (0.004)	-0.003 (0.004)	0.002 (0.004)
Game order, part 3	-0.005*** (0.002)	-0.012*** (0.004)	-0.004 (0.004)	-0.002 (0.005)	-0.005 (0.004)
Age	-0.00004 (0.001)	-0.005** (0.003)	0.010 (0.007)	0.001 (0.001)	0.001 (0.005)
Male	0.025 (0.017)	0.052 (0.033)	0.029 (0.034)	-0.048 (0.036)	0.061* (0.034)
Educational attainment	0.007 (0.005)	-0.009 (0.011)	-0.006 (0.011)	0.010 (0.010)	0.021** (0.010)
N	3720	948	924	876	972
Clusters	310	79	77	73	81
Pseudo R^2	0.025	0.026	0.016	0.011	0.035
Log pseudolikelihood	-2050.25	-526.65	-423.81	-481.70	-593.62
Wald chi2	93.01	33.73	15.67	9.80	41.26
prob > Chi2	<0.0001	0.0002	0.1096	0.4584	<0.0001

Notes: This Table reports marginal effects from Logit regressions. Robust standard errors clustered at the individual level are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 4 supports Result 1 on the existence of selective recalls. Having to recall the amount given to the receiver when the selfish option has been chosen in IRA decreases significantly (at the 5% level) the likelihood of a correct recall (model (2)).[19] This is not the case in IRAC: there is no difference in the likelihood of recalling accurately when the program has selected the selfish or the altruistic option (model (3)). The relative position of the dictators in the game does not affect memory, as the various sets of games have no significant effect. This confirms descriptive statistics: the average percentage of correct recalls is 26.61% when dictators are in a disadvantageous position, 25.24% when they are in a mixed position, and 23.95% when they are in a disadvantageous position, with no significant differences in pairwise comparisons (W tests, p>0.10). The conclusion remains if the analysis is restricted to the cases in which dictators select the selfish option: when in an advantageous position, they do not exhibit less memory accuracy than in any other position (see Table A.4 in Appendix 2). This may result from the fact that the games were presented in random order, which probably makes the identification of the three categories of games impossible.

These models provide additional insights for our understanding of memory mechanisms. First, the participants' performance in the verbal memory task is positively correlated with the likelihood of making a correct recall in part 3 (model (1)). This confirms the significant correlation between the percentage of correct recalls of the dictators in the dictator games and their performance in the verbal memory task (pairwise Pearson's correlation coefficient=0.12, p=0.039, N=310). This effect is, however, mainly driven by the IRAC treatment (model (3)), whereas it is not observed in IRA and NIRA (models (2) and (4), respectively). In IRAC, the Pearson coefficient between the average number of correct recalls and the performance

[19] Throughout the analysis, we define an option as "selfish" when it maximizes the payoff of the decision-maker. We acknowledge that in some games, choosing the "selfish" option is consistent with other types of preferences. For example, a subject who chooses the selfish option in games 1, 5 and 9 may be maximizing social welfare. We confirm that our results are robust to the exclusion of these games in regressions similar to those presented in Table 4. These regressions are available upon request.

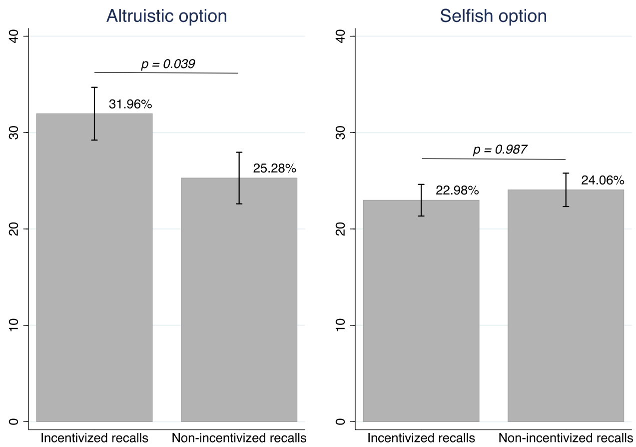


Fig. 3. Average Percentage of Dictator's Correct Recalls in IRA and NIRA, by Option.

at the verbal memory task is equal to 0.21 (p=0.073). In the other treatments, it is not significant (p=0.515, p=0.246 and p=0.220 for IRA, NIRA and IDA). This gives a valuable indication that individuals actually did a memory effort to recall the amounts, but less so when they had to remember the consequences of their choices on the receiver. Second, Table 4 shows that spending more time to recall a given amount is negatively correlated with the likelihood of a correct recall. 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). This may be due to tiredness or weariness.

Are dictators conscious of their selective recalls? At the end of the experiment participants had to report their belief about the accuracy of their recalls on a 10-point scale, with 0 if they believe that they had no correct recall and 10 if they believe that all their recalls were correct. Pooling all the treatments, the correlation between the percentage of correct recalls and the belief about memory accuracy is highly significant (Pearson's correlation coefficient=0.17, p=0.002), indicating a good perception of performance in the recall task. This correlation is highly significant for the less selfish dictators (correlation coefficient=0.21, p=0.005) but not for the more selfish ones (0.11, p=0.205). Moreover, there are differences across treatments. The correlation is stronger when dictators are responsible for the receiver's amount (IRA, p=0.021) than when they are passive (IRAC, p=0.092). An interpretation is that in IRAC participants provided a lower memory effort and were thus more uncertain of their performance.[20]

We now introduce our second result:

Result 2 *(Incentives and Selective Recalls). Incentivizing recalls increases the percentage of dictators' correct recalls only when they chose the altruistic option.*

Result 2 supports only partially Conjecture 2.

Support for Result 2: Each dictator was asked to recall 12 amounts, which gives 3720 (310*12) recalls in total for all treatments. 25.27% of these recalls are correct. The percentage of dictators' correct recalls is 24.43% in NIRA and 25.74% in IRA. These percentages are not significantly different (M-W, p=0.583). The picture changes when we consider the selected options separately. Fig. 3 displays the average percentages of dictators' correct recalls in IRA and NIRA, depending on the selected option. When dictators chose the altruistic option the percentages of correct recalls is significantly higher in IRA (31.96%) than in NIRA (25.28%, M-W test, p=0.039). This is not the case when they chose the selfish option (22.98% in NIRA and 24.06% in IRA; M-W test, p=0.987). This finding shows that since dictators somewhat react to incentives, they have not completely forgotten their decisions. With incentives, dictators do not remember more their choices when they were selfish but they remember them more when these choices were altruistic. We take this as evidence that with incentives dictators provide a higher effort to recall, but they allocate this effort to retrieve selectively the memory of desirable rather than undesirable decisions.

We now turn to biased memory errors and introduce our third result:

Result 3 *(Direction of Memory Errors). Dictators are significantly more likely to over-estimate their recalls when they chose the selfish option than when chose the altruistic option. This is also the case when they bear no responsibility in the choice of option.*

[20] This interpretation is supported by an additional questionnaire on the intensity of memory effort reported on a 10-point scale. On average, the self-reported memory effort is 7.02 in IRA and 5.84 in IRAC (M-W, p<0.001). Table A.3 in Appendix 2 displays the average reported beliefs on memory accuracy and the average reported memory effort across treatments.

Result 3 does not support Conjecture 3.

Support for Result 3: If dictators bias their memory self-servingly for self-image reasons, they should more frequently over- than under-estimate the amount given to the receiver when they make memory errors. In IRA, when dictators make an error they over-estimate the receiver's amount 48.30% of the time, regardless of their actual choices. This percentage is not significantly different from 50% (one-sample test of proportion, p=0.366). Conditioning the percentage of over-estimated recalls on decisions 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 significant (W test, p<0.001). However, these percentages are similar in IRAC: dictators over-estimate the receiver's amount 23.96% of the time when the program selected the altruistic option and 62.44% of the time when it selected the selfish option. The difference is also significant (W test, p<0.001) and it can hardly be motivated by the willingness to bias recalls for self-image reasons since it is common knowledge that dictators are passive.

Table A.5 in Appendix 2 reports 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.[21] Model (1) pools all the treatments together while models (2) to (5) consider each treatment separately. The independent variables are the same as in Table 4. Robust standards errors are clustered at the individual level. Model (1) confirms that the probability to over-estimate rather than under-estimate the receiver's amount is significantly higher when the selfish option has been selected (p<0.001). However, this is independent from the responsibility of the action itself since this is found not only in IRA (model (2)) but also in IRAC (model (3)). Had the dictators motivated their memory to appear more pro-social to themselves, the difference in the percentage of over-estimated recalls between the selfish and the altruistic options should have been higher in IRA than in IRAC. These findings suggest that the difference between the percentages of over-estimated amounts in the altruistic and selfish options in both treatments results more from the structure of the games (i.e., lower amounts are structurally more likely to be over-estimated) than from behavioral determinants.[22]

We introduce our last result about biased memory errors based on the analysis of the magnitude of these errors, defined by their absolute value:

Result 4 *(Magnitude of Memory Errors). The magnitude of over-estimated recalls is not significantly different between altruistic and selfish choices. This is observed regardless of the dictator's responsibility for the receiver's amount.*

Result 4 rejects Conjecture 4.

Support for Result 4: Table 3 displays the average absolute value of memory errors across options, conditional on making an error.[23] In IRA, 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. The difference is not significant (W test, p=0.665). In IRAC, the average magnitude of memory errors is 7.27 and 7.02, respectively, and the difference is not significant either (W test, p=0.566). Further support is provided by Table A.6 in Appendix 2 that reports the marginal effects from Tobit regressions in which 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 regression Tables. Tobit models are justified since data are censored on the left. Robust standard errors are clustered at the individual level. With the exception of model (4) for NIRA, models (1) to (5) show that having to recall the outcome of the selfish option has no significant impact on the magnitude of memory errors compared to when the altruistic option has been selected. Thus, when they do not recall the amount given to the receiver, dictators do not inflate their recalls self-servingly. Model (1) also indicates that the magnitude of memory errors is significantly higher when the set of available options puts the dictator in a disadvantageous position, and that a higher performance at the verbal memory task decreases the magnitude of memory errors.

6. Robustness tests

This section presents three checks. We first examine whether memory errors differ from pure noise. Then, we test whether selective recalls are driven by a higher attention paid to the receiver's amount by other-regarding dictators. We finally investigate the role of guilt.

[21] 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 memory 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.

[22] Incidentally, the fact that in IRAC dictators are also more likely to over-estimate the receiver's amount when the program has selected the selfish option indicates that selective recalls are not driven by a concern for social-image independent from memory biases. This over-estimation cannot be explained by the willingness to appear more generous in the experimenter's eyes since in IRAC it is common knowledge that the receivers' amounts are randomly selected by the program without any intervention of the dictators.

[23] Considering the average memory error in non-absolute instead of absolute values does not qualitatively change the results.

6.1. Memory errors or noise?

The recollection task was hard for the players because of the number of values to recall (12). Could the higher (lower, respectively) probability to over-estimate the receivers' outcome when the selfish (altruistic, resp.) option has been chosen derive from the fact that dictators simply recall the average outcome of the two options? To investigate whether recalls differ from pure noise, we simulated three distributions of recalls and tested whether our results differ from these simulated distributions. The first two simulated sets of recalls follow a normal distribution centered at 18 (the mean actual receiver's amount) with a standard deviation of 4 or 2 (to simulate players that almost always reported the average receiver's amount). The third simulated set follows a uniform distribution over the range of possible recalls from 0 to 38.

This exercise reported in Table A.7 in Appendix 2 shows that the percentage of correct recalls is significantly higher in the experimental data than in any simulated distribution (W tests, $p<0.001$). Thus, participants used their memory actively. A test of normality shows that participants did not simply report the average receiver's amount (skewness/kurtosis test for normality, $p<0.001$). Moreover, the magnitude of memory errors is significantly lower in the experimental data than in any simulated distribution (W tests, $p<0.001$). In contrast, the probability to over-estimate the receiver's amount is not significantly different between actual and simulated data (except in the second simulation). Thus, Result 3 would have been obtained for normal or uniform distributions of recalls, confirming that the difference between the probability to over-estimate a selfish *vs.* an altruistic option does not result from motivated memory, but probably from the structure of the amounts themselves.

6.2. Memory and attention

In the treatments in which players had to recall the receiver's amounts, the higher percentage of dictators' correct recalls 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. In contrast, when they made their decisions selfish dictators may have simply compared their own amount in the two options and ignored the receiver's amounts, leading to more memory errors. Analyzing behavior in the IDA treatment where players have to recall the amount kept by the dictator is informative because both other-regarding *and* selfish dictators are likely to have paid attention to their own amount. If the difference in recalls observed in the main treatment is driven by differential attention, we should observe no difference in recalls in IDA. In fact, in IDA also the percentage of correct recalls differs significantly between the altruistic and the selfish options (42.36% and 28.27%, respectively; W test, $p=0.010$, see Table 3). It would not be the case if recalls were only driven by differing attention according to the chosen option. Moreover, model (5) in Table 4 shows that having to recall the choice of the selfish option decreases significantly (at the 1% level) the likelihood of a correct recall of one's amount by the dictators. These findings support the interpretation of behavior in terms of motivated memory rather than in terms of differences in attention in our main treatments.

6.3. Memory and guilt

Impression management may depend not only on the chosen option but also on the very nature of the individual. A selfish dictator who accepts his egotist nature may feel no need to recall selectively. Motivated memory may be needed only by individuals who suffer from a dissonance between their actions and their self-image, in particular those who suffer from guilt. In the post-experimental questionnaire dictators were asked to report on a 10-point scale their feelings toward the receivers, from 0 for very guilty to 10 for perfectly serene (mean=7.21, S.D=2.46, see Table A.3 in Appendix 2). Table A.8 in Appendix 2 displays the average percentage of dictators' correct recalls depending on their reported feeling toward the receiver. It shows that dictators who report a feeling below or equal to the median (7) on the serenity scale exhibit a lower percentage of correct recalls than dictators who report a serenity level above the median (M-W test, $p=0.028$, all treatments pooled). Considering only treatments in which dictators bear responsibility in the choice of options (IRA, NIRA and IDA), more guilty dictators have also a significantly lower percentage of correct recalls than more serene dictators (M-W test, $p=0.005$). This is not the case when dictators bear no responsibility in the choice of options (IRAC, $p=0.717$). Overall, this suggests that dictators who experienced more discomfort *vis-à-vis* the receivers retrieve more selectively their recalls when they are responsible for the receiver's payoff.

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 selective recalls and bias their memory errors self-servingly (over-estimating more often and to a larger extent the receivers' amounts), after making selfish rather than altruistic decisions.

We found evidence of *selective memory*. Individuals remember better the amount allocated to the receiver when they made altruistic rather than selfish decisions. We interpret these asymmetric recalls as a self-deception strategy motivated by self-image concerns. This finding is consistent with previous theoretical and empirical studies on motivated memory revealing an asymmetric recall of feedback depending on whether individuals receive good or bad news about their relative performance (Bénabou and Tirole, 2002; Gottlieb, 2014; Li, 2017; Chew et al., 2018; Zimmermann, 2019). More generally, it contributes to the literature showing that individuals have motivated cognitive limitations even in the absence of risk and uncertainty (Exley and Kessler, 2018), selective memory being one of these self-serving biases. We complement the previous studies on motivated memory by showing that individuals also use selective memory in social interactions and by revealing the crucial role of personal responsibility in this process. Indeed, the asymmetric recalls that we identified are no longer observed when decisions are made at random by a robot. Moreover, our study shows that 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 retrieve the memory of desirable rather than undesirable information in terms of image. Like Zimmermann (2019), we interpret the fact that incentives generate more accurate recalls as evidence against complete forgetting. Individuals selectively suppress bad news (in the case of Zimmermann, 2019) or selectively retrieve good news (in our case).

In contrast, we found no clear evidence of *biased memory errors*. Dictators are more likely to over-estimate than under-estimate the amount transferred to the receiver after choosing the selfish rather than the altruistic option. But this does not prove the existence of motivated memory since this also applies when dictators are not responsible for the amount transferred to the receiver. Moreover, the magnitude of memory errors is not significantly different across options. Thus, individuals recall selectively but they do not manipulate their memory self-servingly to appear altruistic when they were selfish. There are several possible explanations for the absence of biased memory errors. First, dictators may not bias their memory because it is common knowledge that the experimenter knows the information dictators are asked to recall. In a different domain, it has been shown that the propensity of individuals to lie differs depending on whether the experimenter can or cannot observe the truth (Gneezy et al., 2018). The same might apply to our setting: forgetting is unverifiable but inflating one's recalls systematically is detectable. An extension of our study could be to design games in which participants know that the experimenter cannot observe memory errors at the individual level. Second, the limited bias of memory errors may also result from the short span of time between 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. But it is possible that a larger span of time is needed to bias recalls self-servingly. A natural extension would be to vary the length between the decision and the recollection phases to test how it affects biased memory errors.

Other possible extensions can be thought of to study biases in memory errors. Even if a majority of individuals 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 is available and maintaining a positive self-image may not be strong enough to generate a major internal conflict. Introducing decisions that threaten self-image more deeply, by revealing to participants a more precise and valuable information about their intrinsic nature, could generate a stronger need for biased memory. Finally, in our design individuals could manipulate their memory only for hedonic reasons. Another interesting extension would be to introduce strategic reasons to use selective memory and to bias recalls asymmetrically. Testing how memory can be manipulated self-servingly for motivational purposes is left for further investigation.

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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.

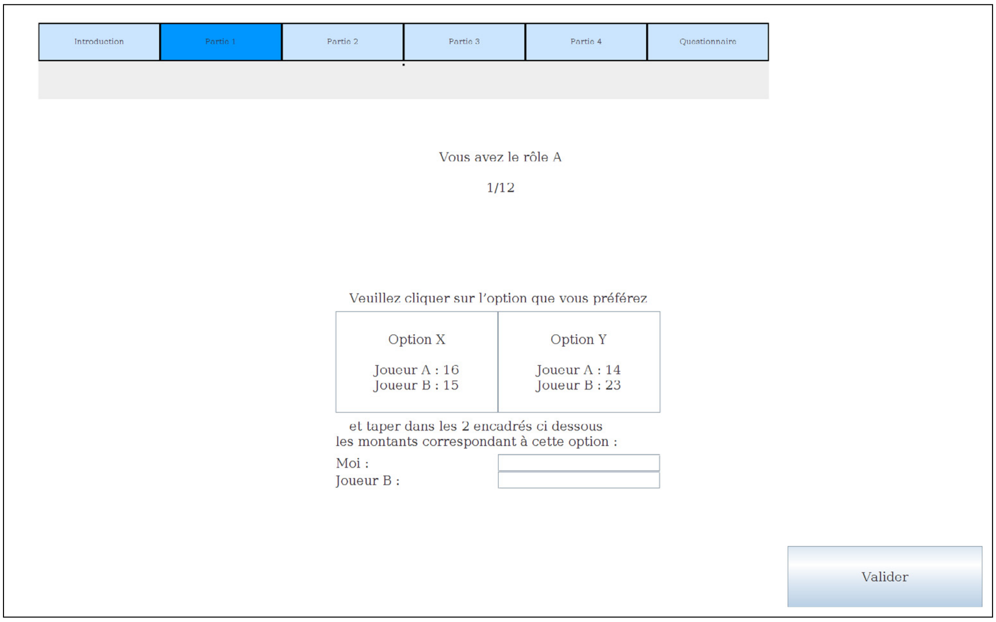
The decision of participant A consists in choosing the preferred option between two options: option X and option Y. Each option is composed of two amounts: the first amount corresponds to the payoff of participant A, the second amount corresponds to the payoff of participant B.

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. Participant 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.



Translation: "You have role A. Please click on the option you prefer and type in the amounts corresponding to this option in the two boxes below. Me. Player B."

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.

Example of a maze in Part 2. (*Translation:* "Next maze")

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

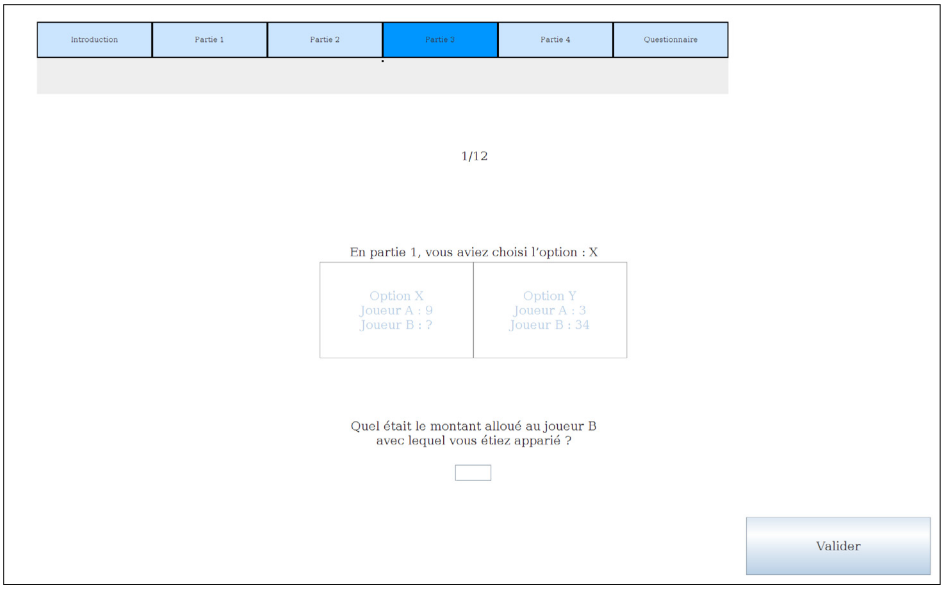
In each of the 12 periods in Part 1, you (player A, respectively) had to choose the option you (he, resp.) preferred among two. Each option contained two amounts: the first amount corresponded to your (player A's, resp.) payoff and the second amount corresponded to the payoff of player B (your payoff, resp.). The amounts between you (player A, resp.) and player B (A, resp.) 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 (player A, resp.) have (has) chosen, the amount received by player B (you, resp.) 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 (player A, resp.) have (has) chosen option X that gave you (player A, resp.) 20 ECU, you have to recall the amount replaced by the question mark. This amount corresponds to player B's (your, resp.) payoff in the option you (player A, resp.) 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 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.



Translation: "In part 1, you have chosen option X. What was the amount allocated to the Player B you were matched with?"
Example of a screen in Part 3, player A

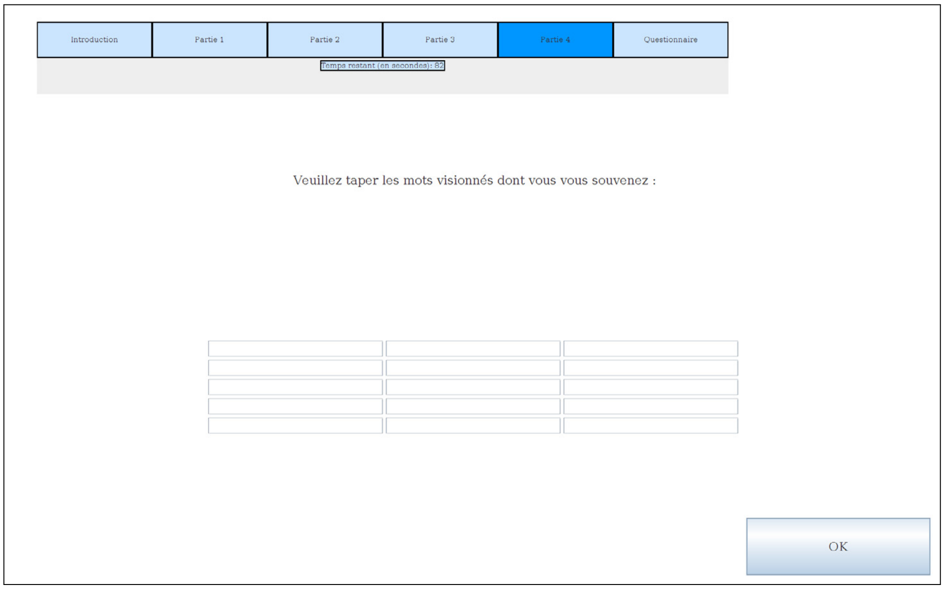
Instructions for part 4 (displayed on the subjects' screen after completing part 3)

This part consists in 3 independent periods. In each period, 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 recall as many words as possible and type them 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 period out of the three will be randomly selected. For each word correctly recalled in that period, 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.



Translation: "Please type in the words that you recall."
Example of a screen in Part 4

Appendix 2. Tables

Table A.1
Summary Statistics - Decisions in the Dictator Games.

Games	Option X Altruistic	Option Y Selfish	Percentage of dictators choosing option Y All	IRA	IRAC	NIRA	IDA
1	(2, 32)	(10, 30)	86.77	97.47	50.65	98.63	100.00
2	(3, 34)	(9, 28)	87.42	98.73	54.55	95.89	100.00
3	(5, 35)	(7, 27)	75.81	75.96	62.34	82.19	82.72
4	(6, 36)	(6, 26)	28.06	21.52	50.65	26.03	14.81
5	(11, 20)	(19, 18)	88.06	98.73	54.55	98.63	100.00
6	(12, 22)	(18, 16)	89.35	98.73	61.03	98.63	98.77
7	(14, 23)	(16, 15)	73.87	83.54	48.05	84.93	79.01
8	(15, 24)	(15, 14)	31.61	24.05	58.44	27.30	17.28
9	(20, 8)	(28, 6)	81.94	91.14	51.95	91.78	92.59
10	(21, 10)	(27, 4)	69.03	77.22	53.25	72.60	72.84
11	(23, 11)	(25, 3)	49.35	54.43	45.45	52.05	45.68
12	(24, 12)	(24, 2)	19.68	10.13	51.95	8.22	8.64
Total			65.08	69.30	53.57	69.75	67.70

Notes: The first numbers in parentheses in columns 2 and 3 indicate the dictator's amounts and the second numbers indicate the receiver's amounts. The percentages of dictators choosing option Y are significantly different neither between IRA and IDA, nor between IRA and NIRA. The percentages of option Y selected randomly by the program (IRAC treatment) are always significantly different from the percentages of dictators choosing option Y (treatment IRA) at 5% level, except for games 3 (Mann-Whitney tests, p=0.066) and 11 (p=0.264).

Table A.2
Summary Statistics - Participants, by Treatment.

Treatments	All	IRA	IRAC	NIRA	IDA
Male	47.58%	43.67%	50.00%	45.20%	51.23%
Age	22.50	22.84	21.06***	24.64	21.62**
Number of participants	620	158	154	146	162
Number of sessions	26	7	6	6	7
Ave. num. of part. per session	23.85	22.57	25.67	24.33	23.14

Notes: This Table reports the results of two-tailed M-W tests in which each individual is taken as an individual observation. NIRA, IDA and IRAC are compared to IRA.

Table A.3
Summary Statistics on Each Part, by Treatment.

Treatments		All	IRA	IRAC	NIRA	IDA
Part 1	Percentage of selfish choices (out of 12)	65.08	69.30	53.57***	69.75	67.70
Part 2	Num. of solved mazes	12.21	12.08	12.45**	11.64	12.64*
Part 3	Num. of correct recalls (out of 12)	3.01	2.93	2.30***	2.87	3.88***
Part 4	Num. of correct words (out of 45)	24.73	25.31	24.98	23.78**	24.78
Quest.	Reported belief on memory accuracy (0-10 scale)	4.16	4.44	3.54***	4.21	4.43
	Reported memory effort (0-10 scale)	6.50	7.02	5.84***	6.51	6.61*
	Reported feeling toward the other player:					
	Dictator (0: very guilty; 10: very serene)	7.21	7.14	7.45	6.89	7.32
	Receiver (0: very angry; 10: very serene)	6.45	6.61	5.91**	6.41	6.85

Notes: This Table reports the results of two-tailed M-W tests in which each individual is taken as an individual observation. IRAC, NIRA, and IDA treatments are compared to IRA.

Table A.4
Percentage of Dictators' Correct Recalls, by Option and by Position (IRA).

	Position			*p-values*	
	Disadvantageous	Mixed	Advantageous		
	(1)	(2)	(3)	(1)-(2)	(1)-(3)
Altruistic	35.71%	28.00%	31.82%	*0.165*	*0.873*
Selfish	21.12%	25.31%	22.28%	*0.226*	*0.872*

Notes: The *p*-values are from two-tailed W tests in which each individual gives one independent observation.

Table A.5
Determinants of Dictators' Over-Estimated Recalls.

Dependent variable	*Dictator's Overestimated Recall*				
	All	IRA	IRAC	NIRA	IDA
	(1)	(2)	(3)	(4)	(5)
IRA treatment	ref.	-			
	-				
IRAC treatment	0.024		-		
	(0.025)				
NIRA treatment	-0.007			-	
	(0.028)				
IDA treatment	-0.054				-
	(0.034)				
Selfish option	0.247***	0.312***	0.362***	0.360***	-0.164***
	(0.023)	(0.048)	(0.026)	(0.039)	(0.045)
Dict. in disadv. position	ref.	ref.	ref.	ref.	ref.
	-	-	-	-	-
Dict. in mixed position	0.139***	0.271***	0.228***	0.150***	-0.115***
	(0.022)	(0.035)	(0.035)	(0.040)	(0.039)
Dict. in disadv. position	0.352***	0.532***	0.460***	0.477***	-0.183***
	(0.028)	(0.027)	(0.034)	(0.045)	(0.046)
Performance verbal memory	0.002	-0.0002	0.006**	0.003	-0.002
	(0.002)	(0.004)	(0.002)	(0.003)	(0.005)
Time to recall	0.002**	0.001	-0.002	-0.0003	0.006***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Game order, Part 1	0.0004	-0.001	0.001	0.001	-0.001
	(0.002)	(0.004)	(0.004)	(0.005)	(0.005)
Game order, Part 3	0.010***	0.004	0.0001	0.0002	0.014***
	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)
Age	0.004**	0.003	-0.001	0.002	0.014***
	(0.002)	(0.003)	(0.010)	(0.002)	(0.004)
Male	-0.036*	-0.007	-0.047*	-0.052	-0.039
	(0.021)	(0.043)	(0.028)	(0.041)	(0.053)
Educational attainment	-0.010*	-0.011	-0.012	-0.009	-0.015
	(0.006)	(0.016)	(0.014)	(0.010)	(0.010)
N	2780	704	761	662	653
Clusters	310	79	77	73	81
Pseudo R^2	0.1083	0.2181	0.2753	0.1780	0.0672
Log pseudolikelihood	-1709.08	-381.22	-378.65	-376.76	-415.74
Wald chi2	244.32	167.24	235.53	121.73	48.42
Prob > chi2	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Notes: Marginal effects from Logit models are reported, with robust standard errors clustered at the individual level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A.6
Determinants of Dictators' Magnitude of Memory Errors.

Dependent variable	*Dictator's Magnitude of Memory Error*				
	All (1)	IRA (2)	IRAC (3)	NIRA (4)	IDA (5)
IRA treatment	ref.	-			
	-				
IRAC treatment	1.414***		-		
	(0.380)				
NIRA treatment	0.010			-	
	(0.369)				
IDA treatment	-1.637***				-
	(0.338)				
Selfish	-0.278	-0.126	-0.078	-0.927*	0.258
	(0.245)	(0.514)	(0.429)	(0.541)	(0.389)
Dict. in disadv. position	ref.	ref.	ref.	ref.	ref.
	-	-	-	-	-
Dict. in mixed position	-1.186***	-0.862	-1.368**	-1.740***	-0.705
	(0.286)	(0.547)	(0.598)	(0.639)	(0.483)
Dict. in adv. position	-1.269***	-1.449**	-1.861***	-1.649**	0.231
	(0.318)	(0.574)	(0.618)	(0.790)	(0.548)
Performance verbal memory	-0.062**	-0.088**	-0.019	-0.107*	-0.041
	(0.026)	(0.044)	(0.051)	(0.064)	(0.042)
Time to recall	0.0001	-0.044**	0.014	0.009	0.029
	(0.012)	(0.019)	(0.023)	(0.035)	(0.019)
Game order, Part 1	-0.002	-0.066	0.016	-0.008	0.028
	(0.026)	(0.058)	(0.052)	(0.056)	(0.035)
Game order, Part 3	-0.096***	-0.068	-0.051	-0.188**	-0.032
	(0.030)	(0.061)	(0.065)	(0.076)	(0.038)
Age	0.063***	0.024	0.228	0.045	0.152**
	(0.022)	(0.045)	(0.153)	(0.027)	(0.071)
Male	-0.902***	-1.337***	-0.959*	-0.401	-0.941**
	(0.257)	(0.489)	(0.541)	(0.518)	(0.467)
Educational attainment	0.052	0.106	0.052	0.180	-0.206*
	(0.070)	(0.145)	(0.152)	(0.158)	(0.116)
N	2780	704	761	662	653
Clusters	310	79	77	73	81
Pseudo R^2	0.0128	0.0079	0.0053	0.0116	0.0170
Log pseudolikelihood	-8599.61	-2161.95	-2437.23	-2100.28	-1804.99
F	13.30	3.68	2.21	3.82	3.08
$p > F$	<0.0001	0.0001	0.0157	<0.0001	0.0008

Notes: Marginal effects from Tobit models are reported with robust standard errors clustered at the individual level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A.7
Participants' Recalls, Actual and Simulated Distributions.

	Data	Normal (s.d.=4)	Normal (s.d.=2)	Uniform
Percentage of correct recalls	22.49	3.48***	2.09***	3.88***
Percentage of over-estimated recalls	46.81	47.15	50.15***	47.92
Magnitude of memory errors	6.09	9.16***	8.76***	12.31***
Clusters	458	458	458	458

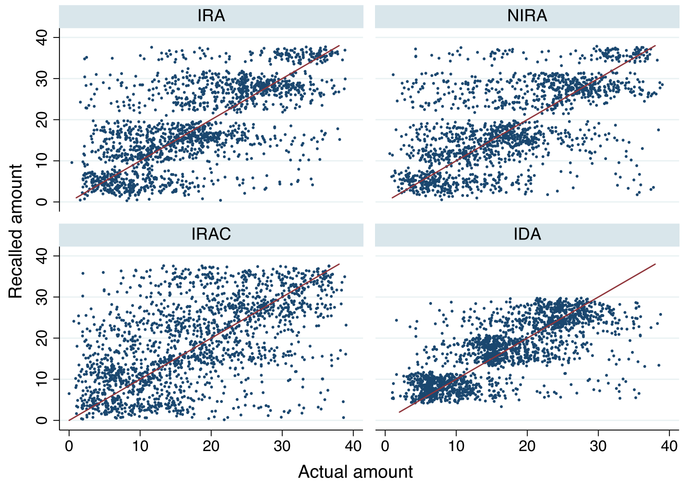
Notes: The first simulated set of recalls follows a normal distribution centered at 18 (the mean actual receiver's amount) with a standard deviation of 4. The second simulated set of recalls follows a normal distribution centered at 18 but with a standard deviation of 2 to simulate players that may have almost always reported the average receiver's amount. The third simulated set of recalls follows a uniform distribution over the range of possible recalls from 0 to 38. For each distribution, three variables have been computed: a binary variable equal to 1 if the recall is correct and 0 otherwise, a binary variable equal to 1 if the recall is overestimated and 0 otherwise, and a variable that indicates the magnitude of errors and is equal to the difference between the simulated recall and the actual amount. p-values from W tests indicate whether each simulated distribution differs from the actual results. Each individual gives one independent observation. *** p<0.01.

Table A.8
Average Percentage of Dictators' Correct Recalls Depending on Their Reported Feeling Toward the Receiver.

	Reported Feeling		
	More Serene	More Guilty	*p-value*
All	26.44% (214)	22.66% (96)	0.028
Dictators responsible for the decision	29.63% (162)	23.59% (71)	0.005
Dictators **not** responsible for the decision	16.51% (52)	20.00% (25)	0.717

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 lower or equal to 7 (the median of reported feeling); the reported serene group includes dictators reporting a value higher than 7. *p*-values from M-W tests are in italics. The average number of correct recalls of each individual gives one independent observation.

Appendix 3. Figure



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.

Fig. A.1. Recalled and Actual Amounts in the Dictator Games, by Treatment.

Appendix 4. Alternative definitions of correct recalls

In Table A.9 a recall is defined as correct if the recalled amount is exactly equal to the actual amount. In Table A.10 a recall is defined as correct if the recalled amount is equal to the actual amount plus or minus two units.

Appendix 5. Analysis of the receivers' recalls

In our experiment, participants play 12 binary dictator games. Then, after performing a distraction task, they are asked to recall the amounts allocated to the receivers. While the Results section only reports the dictators' recalls (comparing dictators' and receivers' recalls cannot provide a clean identification of dictators' motivated memory because receivers may also motivate their memory, albeit for different reasons), this section presents a brief analysis of the receivers' recalls.

First, receivers do not exhibit selective recalls. Their percentage of correct recalls is 25.43% when the dictator has chosen the altruistic option and 22.07% when he has chosen the selfish option. The difference is not significant (p=0.383, M-W, IRA treatment). We also find no significant differences between the percentages of correct recalls when the dictator chose the altruistic *vs.* the selfish option in the IRAC and NIRA treatments (see Table A.11). In the IDA treatment in which receivers have to recall the dictator's amount, they exhibit a higher percentage of correct recall when the dictator chose the altruistic

Table A.9
Determinants of Dictators' Correct Recalls (+/- 0 units).

Dependent variable	*Dictator's Correct Recall*				
	All	IRA	IRAC	NIRA	IDA
	(1)	(2)	(3)	(4)	(5)
IRA treatment	ref.	-			
	-				
IRAC treatment	-0.068***		-		
	(0.0198)				
NIRA treatment	-0.012			-	
	(0.022)				
IDA treatment	0.080***				-
	(0.022)				
Selfish option	-0.075***	-0.060*	-0.010	-0.016	-0.198***
	(0.015)	(0.032)	(0.022)	(0.028)	(0.029)
Dict. in disadv. position	ref.	ref.	ref.	ref.	ref.
	-	-	-	-	-
Dict. in mixed position	0.030**	0.053*	-0.035	0.051**	0.043
	(0.014)	(0.029)	(0.028)	(0.024)	(0.030)
Dict. in adv. position	-0.036**	-0.003	-0.023	-0.030	-0.090**
	(0.014)	(0.031)	(0.025)	(0.033)	(0.036)
Performance verbal memory	0.004***	0.003	0.005**	0.001	0.005**
	(0.001)	(0.003)	(0.002)	(0.002)	(0.003)
Time to recall	-0.003***	-0.002	-0.0001	-0.004**	-0.005**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Game order, part 1	0.001	0.006**	-0.002	-0.0004	-0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)
Game order, part 3	-0.008***	-0.011***	-0.007**	-0.008**	-0.008**
	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Age	0.0004	-0.002	0.004	0.001	0.0002
	(0.001)	(0.002)	(0.006)	(0.001)	(0.004)
Male	0.011	0.037	0.005	-0.056*	0.043
	(0.015)	(0.030)	(0.031)	(0.032)	(0.032)
Educational attainment	0.006	-0.004	0.003	0.007	0.016*
	(0.005)	(0.010)	(0.011)	(0.009)	(0.009)
N	3720	948	924	876	972
Clusters	310	79	77	73	81
Pseudo R^2	0.0427	0.0352	0.0279	0.0332	0.0729
Log pseudolikelihood	-1612.24	-407.41	-318.03	-363.97	-493.07
Wald chi2	120.56	32.93	20.17	29.51	79.65
Prob > chi2	<0.0001	0.0003	0.0277	0.0010	<0.0001

Notes: Marginal effects from Logit models are reported, with robust standard errors clustered at the individual level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

option (39.81%) than when he chose the selfish option (28.11%, p=0.013, M-W). 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.[24]

Second, there is no statistical difference in the percentage of correct recalls between the IRA and IRAC treatments, neither when the altruistic option was selected (p=0.174, M-W), nor when the selfish option was selected (p=0.972, M-W). We also find no evidence of statistical differences between the IRA and NIRA treatments, neither conditional on the altruistic option (p=0.181) nor conditional on the selfish option (p=0.588).

Third, receivers are significantly more likely to over-estimate their recalls when dictators chose the selfish option than when they chose the altruistic option (see Table A.11). This could suggest that receivers bias their memory to derive positive anticipated utility from high-expected future payoffs. However, the opposite is observed in the IDA treatment in which receivers have to recall the dictator's amount. This result suggests that the likelihood of overestimating the amount is more driven by the amount itself than by the nature of the option. Indeed, when the amount is low (selfish option in IRA, IRAC and NIRA and altruistic option in IDA), it has by construction a higher likelihood of being over-estimated. We also find no evidence of a different magnitude of memory errors between the altruistic and the selfish options (see Table A.11).

[24] 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 IRAC, the respective percentages (and numbers) are 21.63% (N=37) and 19.79% (N=40), and they are not significantly different either (p=0.409).

Table A.10
Determinants of Dictators' Correct Recalls (+/- 2 units).

Dependent variable	*Dictator's Correct Recall*				
	All	IRA	IRAC	NIRA	IDA
	(1)	(2)	(3)	(4)	(5)
IRA treatment	ref.	-			
	-				
IRAC treatment	-0.075***		-		
	(0.025)				
NIRA treatment	0.014			-	
	(0.027)				
IDA treatment	0.105***				-
	(0.027)				
Selfish option	-0.060***	-0.098***	0.001	-0.014	-0.136***
	(0.018)	(0.036)	(0.0300)	(0.040)	(0.039)
Dict. in disadv. position	ref.	ref.	ref.	ref.	ref.
	-	-	-	-	-
Dict. in mixed. position	-0.017	0.009	-0.030	-0.002	-0.040
	(0.019)	(0.039)	(0.042)	(0.036)	(0.035)
Dict. in adv. position	-0.005	0.048	0.052	-0.003	-0.115***
	(0.020)	(0.035)	(0.036)	(0.049)	(0.041)
Performance verbal memory	0.005***	-0.001	0.008***	0.003	0.009**
	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)
Time to recall	-0.003**	-0.002	-0.001	-0.003	-0.005**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Game order, part 1	-0.0004	0.007	-0.004	-0.004	-0.001
	(0.002)	(0.005)	(0.004)	(0.005)	(0.005)
Game order, part 3	-0.003	-0.008**	-0.004	-0.003	-0.002
	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
Age	-0.0002	-0.002	0.0004	0.0003	0.0002
	(0.001)	(0.002)	(0.007)	(0.002)	(0.003)
Male	0.030	0.068**	0.056	-0.075**	0.073*
	(0.019)	(0.034)	(0.036)	(0.040)	(0.040)
Educational attainment	0.006	-0.007	-0.009	0.008	0.026**
	(0.005)	(0.010)	(0.011)	(0.011)	(0.010)
N	3720	948	924	876	972
Clusters	310	79	77	73	81
Pseudo R^2	0.0196	0.0182	0.0186	0.0101	0.0352
Log pseudolikelihood	-2393.48	-601.48	-549.56	-567.53	-645.62
Wald chi2	69.48	25.11	21.12	10.33	40.60
Prob > chi2	<0.0001	0.0051	0.0203	0.4116	<0.0001

Notes: Marginal effects from Logit models are reported, with robust standard errors clustered at the individual level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A.11
Summary Statistics - Receivers' Recalls.

Treatments	IRA	IRAC	NIRA	IDA
	(1)	(2)	(3)	(4)
Percentage of correct recalls, by option				
Alt. option	25.43% (291)	19.81% (429)	21.51% (265)	39.81%*** (314)
Self. option	22.07% (657)	21.41% (495)	24.22% (611)	28.11%*** (658)
p-values	*0.383*	*0.600*	*0.170*	*0.013*
Percentage of over-estimation, by option				
Alt. option	27.65% (217)	27.33% (344)	30.77% (208)	64.02%*** (189)
Self. option	53.52% (512)	61.44%*** (389)	57.24% (463)	38.90%*** (473)
p-values	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Magnitude of absolute memory errors, by option				
Alt. option	5.80 (291)	7.16** (429)	6.12 (265)	3.89*** (314)
Self. option	5.38 (657)	6.41** (495)	5.75 (611)	3.73*** (658)
p-values	*0.588*	*0.097*	*0.214*	*0.932*

Notes: The p-values in lines are from M-W tests and those in columns (altruistic *vs.* selfish option) are from W tests. Each individual gives one independent observation. Numbers in parentheses display the number of individual observations.

Appendix 6. Supplementary material

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.geb.2019.05.011.

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