# What are you calling intuitive?
## *Subject heterogeneity as a driver of response times in an impunity game*[*]

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**Abstract**

We study choices and reaction times of respondents in an impunity game with unfair offers. The non-private impunity game features two roles, proposer and respondent, who are both aware whether the pie size is small or large. Proposers decide among three more or less unfair offers; respondents can accept or reject the offer, in which case it is lost for them. Whatever the responder decides is communicated to the proposer.

240 proposers took part in a traditional laboratory; 24 respondents were in an fMRI setup where they confronted all 240 proposals elicited from proposers. Responses were sent via email to proposers.

Proposers revealed little concern for respondents. Respondents overwhelmingly rejected small offers, especially from a large pie. Surprisingly and in contrast with most of the literature and the Social Heuristic Hypothesis, we find that on average acceptances took longer than rejections. This result is driven by individual heterogeneity. The rich response data allow us to distinguish different respondent types, finding a remarkable consistency: subjects mainly accepting (rejecting) take more time to reject (accept). We attribute this finding to heterogeneity in self-priming. Our results suggest a primary role for individual heterogeneity in experiments testing the intuitive or deliberate status of cooperation and altruism.

*JEL classification:* C72; C78; C91; D87.

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# 1 Introduction

The widespread recognition of the existence of dual decision processes in economic and social choice (Kahneman, 2011) has led to a debate around which social decisions are intuitive and which are deliberate. According to the Social Heuristic Hypothesis (Rand et al., 2014), the drive for cooperation would be intuitive, while the pursual of selfish objectives would require a deliberate decision process. The SHH has been supported by studies in the realm of cooperation (Rand, 2016, 2019), honesty (Capraro, 2017), and reciprocity (Hallsson et al., 2018). However, the SHH has been challenged by other studies and meta-analyses which do not support the intuitive nature of cooperation (Alos-Ferrer and Garagnani, 2020; Tinghög et al., 2013; Bouwmeester et al., 2017)

In most of these studies, the identification of 'intuitive' replies is obtained via time constraints, cognitive load, ego depletion, or procedural priming (for a thorough review, see Capraro, 2019). A time-constrained (cognitive loaded, depleted, appropriately primed) individual is assumed to rely more on intuitive, System I than on deliberate, System II cognitive strategies. While largely adopted, these experimental designs are not guaranteed to yield the expected identification for two main reasons.

First, most studies rely on exogenously fixed limits or tasks that do not take into account subjects' heterogeneity. The same, say, time limit can be enough for some subjects to make a System II response while simultaneously being extremely constraining for others. This heterogeneity has been recently shown to be an important moderator in interpreting results from these experiments (Alos-Ferrer and Garagnani, 2020).

Second, subjects' self priming can incapacitate the constraints. By self priming we mean that subjects can devise a rule to navigate the experimental task during the usually unconstrained instruction phase, and then apply it during the constrained experiment, irrespective of the constraints imposed. This rule can be the result of intuitive or more deliberate mechanisms; but in general, such self-priming has the potential to invalidate most largely employed designs. A way to partially overcome this limit is to use neuro-imaging to look into brain activation patterns in different social dilemmas, and look for neural correlates of intuitive *vs.* deliberate thinking as a way to identify the subjects' decision mode (see, for instance, Takagishi et al., 2009).

In this paper we contribute to the debate on the intuitive *vs.* deliberate cognitive status of actions in social dilemmas, focusing on the role of heterogeneity and self-priming. We employ a non-private impunity game (Bolton and Zwick, 1995) with unfair offers. In this game, proposers split a pie between themselves and a respondent with all possible splits favoring the proposer. Respondents can burn what is offered to them to send a message of disapproval to the proposer, but cannot sanction proposers otherwise. Thus they have choice and voice, but no punishment power. In this setting, the game-theoretic profit maximising response choice is to always accept. Behaviorally, the game limits the possible motives by ruling out any material punishment, but leaving the door open for immaterial punishment motives via communicating one's disgust.

We argue that in our setting the emotional response would be to reject offers, while

accepting requires sidestepping one's emotions over the unfair split and making monetary reason prevail over venting one's anger. This is in line with existing evidence from the related ultimatum and dictator games, where across several experiments and different designs (in particular, using time pressure or time delay) rejecting offers is deemed as more 'intuitive' than accepting them (Sutter et al., 2003; Cappelletti et al., 2011; Grimm and Mengel, 2011; Wang et al., 2011; Neo et al., 2013; Ferguson et al., 2014).

In order to account for individual heterogeneity and to analyze in depth the strategies of respondents while avoiding deception, our study employs two different laboratories. We first collected 240 offers from proposers in a traditional experimental economics laboratory. Proposers could offer unequal splits (1, 3, or 5€) from a small (11€) or a large (19€) pie. When deciding, proposers knew that respondents in another lab would decide on the offers at a later time and that they would learn their matched respondent's reaction by email. We then collected replies to *each* of the 240 proposals from 24 subjects in an fMRI laboratory. The fMRI setting allowed to track decision times to the millisecond, and to explore the dynamics of choice and decision times as subjects reply to each offer, while learning across time more and more about the distribution of offers. In line with the intuition at the core of the SHH, we interpret shorter response times as a proxy (more) for "intuitive" behavior, and interpret longer response times as being correlated with System II cognitive modes (for a detailed survey on the use of response times in experimental economics, see Spiliopoulos and Ortmann, 2018).

Compared to traditional game theoretic experiments, we collect hundreds of response choices without using the strategy method, and we obtain precise measures of response time with full attention and no confounds. As opposed to traditional fMRI experiments with social interaction, for example ultimatum experiments, we do not deceive respondents: each offer they see is real, and they know that their individual replies will be notified to ten matched proposers out of the 240, who learn about the response of their specific responder only. Overall, our design provides rich data on response behavior allowing us to measure the decision time closely, class respondents by type and track how behavior evolves during the course of the experiment.

Our findings strongly suggest that what is 'intuitive' for subjects depends on their type. Proposers tend to offer extremely unfair shares (majority of 1€ offers, irrespective of pie size) mostly in line with their ideosyncratic social preferences as measured by the Social Value Orientation Murphy et al. (2011) task. Faced with extremely unfair offers, respondents overwhelmingly reject while mostly accepting larger offers (3 or 5€).

Surprisingly, and in contrast with nearly every study of negative reciprocity in the ultimatum experiments (see the exhaustive review of Capraro, 2019) and impunity (Takagishi et al., 2009), in our data when looking at aggregate patterns acceptances take *longer* than rejections. But the average results are entirely driven by subject heterogeneity, in an extreme version of the findings of Alos-Ferrer and Garagnani (2020). Subjects can be distinguished in three clear types: Opportunistic subjects, who (nearly) always accept all offers; Fairness-minded subjects, who reject unfair 1€ offers irrespective of the pie size; and Monotonic subjects, who more likely reject unfair offers from the larger pie. Response times follow closely the behav-

ioral types. Subjects who (nearly) always accept take less time for accepting, while subjects who (nearly) always reject the (mostly very unfair €1) offers take less time for rejecting.

Our results cast doubt on the use of time constraints as a device to identify *average* 'intuitive' behavior, as largely done in the literature discussing the Social Heuristic Hypothesis. Echoing the conclusion of Alos-Ferrer and Garagnani (2020) but in an asymmetric bargaining setting, we document, by exploiting rich individual data, that a subject's type – or else, her self-prime, i.e. the strategy the subject has come to prefer while reading the instructions – consistently affect response times. Constraining response time works insofar as it constrains the subject to rely on a 'default' choice; but that default might depend on the subject type and her self-prime more than it has to do with a certain behavior – e.g., cooperation, or emotional inclination – as "intuitive" or "deliberate".

## 2 The impunity game

In order to study a particularly pure instance of negative reciprocity, we implement an asymmetric bargaining situation where the second-mover has no power, but a choice and a voice. To achieve this, we implement a special form of dictator game but with a right to a costly reply. This is known as an *impunity game* (see, for example, Bolton and Zwick, 1995; Forsythe et al., 1994). The particular interest of the non-private impunity game for our paper is that it does not have the strategic depth and behavioral nuances of ultimatum games (see Güth and Kocher (2014) for a recent review of ultimatum bargaining experiments) but it still allows to observe an intuitive or deliberate response to an otherwise dictator-like allocation choice.[1]

We implement some changes with respect to earlier impunity experiments (Forsythe et al., 1994; Bolton and Zwick, 1995), which feature a voiceless recipient, i.e., proposer participants receive no feedback information about response behavior. In our game, the respondent has no punishment power but is not choiceless and voiceless, as she can choose to burn own money to send a message to the proposer. We also vary the pie size by distinguishing a small and a much larger pie. Differently from, for instance, Mitzkewitz and Nagel (1993), the size of the pie is common rather than private knowledge. We do so to trigger different emotional responses. Learning that an offer comes from a larger pie can raise hopes of receiving a larger offer; moreover, the same monetary offer, for instance of €5, can be seen as relatively generous (unfair) when coming from a small (large) pie.

Formally, let $p > 0$ denote the joint endowment – the pie. The proposer distributes $p$ via determining $(p - y, y)$ with $y$ for the respondent and the residual $p - y$ for himself. Then the respondent, after learning about the offer $y$, can accept, $\delta(y) = 1$, or not, $\delta(y) = 0$. If the respondent accepts, then she receives $y$. If she rejects, then she does not receive any payoff. The proposer earns $p - y$ irrespective of $\delta y$. Finally, her decision is notified to the proposer via email. The monetary payoffs of such situations can be described as:

[1] granting choice and voice to respondents without sanctioning allows to explore other aspects, for example, mutual concession making of impunity proposers and responders (see Di Cagno et al., 2020).

$$\begin{cases} p - y & \text{for the proposer} \\ \delta(y) \cdot y & \text{for the respondent} \end{cases}$$

We exogenously fix a small ($\underline{p}$) and a larger ($\bar{p}$) positive pie. Proposers are randomly assigned a pie $p \in \underline{p}, \bar{p}$, and have to choose one of three possible offers $y \in y_{low}, y_{medium}, y_{high}$, with $y_{high} < \frac{1}{2}p, \ \forall p$ to be made to respondents. Respondents learn the size of the pie and the offer, and decide between accepting, $\delta(y) = 1$, or rejecting $\delta(y) = 0$ the offer $y$. The resulting payoffs are $p - y$ for proposers and $\delta(y) \cdot y$ for respondents.

An opportunistic proposer interested only in her own payoff, will offer the smallest possible positive amount. An equally opportunistic respondent would accept all positive offers. Behaviorally, however, one would expect embarrassingly low offers to be sometimes rejected (see Cooper and Kagel (2015) who review studies showing that social preferences, e.g. payoff-based inequity aversion, induce such reactions). This might additionally motivate truly opportunistic proposers to offer the lowest amount to respondents, as rejected offers remain with the experimenter as cash and can be used in further experiments.

We chose to stick to absolute amounts because, given our focus on respondent behavior, we were interested in how respondents would react to identical offers from different pies. We neither predict smallest offers to always be rejected nor always proposed but predict interpersonal heterogeneity in proposer behavior and interpersonal as well as intra-personal heterogeneity in response decisions. Specifically, the distinction of a small, $\underline{p}$, and a large, $\bar{p}$, pie size indicates already that we expected more generous offers and more likely rejection of minimal offers for the larger pie size $\bar{p}$. Since the absolute offers are identical across pie sizes, the relative shares forcefully differ.

We implement the impunity game with the following parameters:

$$\underline{p} = 11€, \ \bar{p} = 19€, \text{ and } \ y \in \{1€, 3€, 5€\}$$

All offers are unfair as respondents always get less than proposers. Since by design proposers cannot possibly offer more, maximal offers $y = 5€$ should be received as a sign of consideration by the respondent and always be accepted.

# 3 The experimental design

To avoid deception and cope with the technical requirements of fMRI experiments we elicited proposer and responder behavior in two differently located labs in the same university town.

**240 proposers** took part in a traditional incentivized laboratory experiment, in which they were exposed to the instructions, learned their pie size, chose their offer and underwent a series of controls, including Social Value Orientation and belief elicitation. Proposers knew that they would be notified by email at a later date about the decision of their matched respondent.

**24 respondents** took part in an fMRI study. They were exposed to all the 240 allocations

collected from proposers in the lab, of which nonetheless only 10 were payoff-relevant. The payoff-relevant choices were distributed in such a way to cover all proposer offers, hence guaranteeing that each offer is payoff-relevant for one respondent only. Finally each response reaction was transmitted to one proposer via e-mail, i.e. after the fMRI experimental campaign.

Our data comprises the allocation choices of 240 proposers as well as the response choices and decision times of 24 respondents.[2] No participant was deceived.[3]

## 3.1 Proposers

240 proposers first learned their pie size, either 11 or 19 Euro. 120 proposers got the large and 120 the small pie. Aware of the size of their pie, they chose among three different offers, identical across pie sizes: 1, 3 or 5 Euro. Proposers chose just once.

Before submitting their offers proposers had to go through several control questions to ensure their understanding of the game. Particular attention was devoted to make all subjects aware of the fact that respondents were going to be in another lab and that their matched respondent's decision would later be reported to them, using their email address. They were not told, though, that respondent participants, who had to invest much more time in a more challenging experimental environment, would accept or reject offers from more than one proposer.

After impunity play, proposers were exposed to a battery of questions meant to infer motives and their social preferences. First, participants were asked if they believed the recipient would accept or reject their offer; then, we administered the SVO (Social Value Orientation) questionnaire (Murphy et al., 2011), implemented in z-Tree following Crosetto et al. (2019), to measure their social preferences. Finally, participants answered a short questionnaire including demographics and questions about trust and field of study.

The experiment was programmed in zTree (Fischbacher, 2007), recruitment used ORSEE (Greiner, 2015), and the experiment lasted on average 45 minutes.The English translation of the original German instructions is available in Appendix A. Mean proposer payoffs, including a 2.5 Euro show-up fee, were of 10.7 Euro for the small and 17.9 Euro for the large pie.

## 3.2 Respondents

24 right-handed respondents took part in fMRI brain-scan experiments run in the BioPsy lab in Jena, Germany. Each respondent passed a medical screening, gave her informed consent, took a right-handedness test and was informed about the instructions of the game to be played before entering the scanner. The experiment was subdivided into two parts, with a pause in between allowing the participant to get some rest. The lengthy procedure gave the

[2]The brain scan data is the object of a separate study and not reported here.

[3]Without commenting on the debate among experimentalists whether deception (and debriefing) should be allowed, our experiment demonstrates that deception can be avoided by an appropriate experimental design.

subjects ample time to consider the game and to engage in self priming, i.e. to figure out how to behave in the respondent role.

Each respondent faced all choices by all proposers, in random order, but only 10 different offers for each respondent were payoff relevant: the offer of each proposer was payoff relevant for exactly one respondent.

Respondents learned about the pie size and the offer and then they were given up to two seconds to submit their reaction, using the standard two-button interface employed in fMRI studies. Choices failing to be submitted within the allotted time were recorded as an error.

The recruitment was made with ORSEE and the experiment lasted on average 1 hour and a half, and average respondent payoff was 14.5€(not including the showup fee of 10€).

# 4 Results

## 4.1 Proposers

Figure 1 shows the distribution of choices of proposers, by pie size, and includes the proposers' beliefs. Given the same number of subjects in the two treatments, the absolute and relative count coincide. It can be seen that the share of 3€ offers is the same irrespective of pie size. On the other hand, a pie size of 11 leads to more 1€ and less 5€ offers than a pie size of 19. Proposers held by and large correct beliefs about response behavior but underestimated the rejection rates of 1€ offers. Note that a welfare-maximising proposer driven by efficiency concerns who expects a 3€ or a 5€ offer to be rejected should in principle not offer that much as its rejection would result in a larger efficiency loss than for 1€ offers.

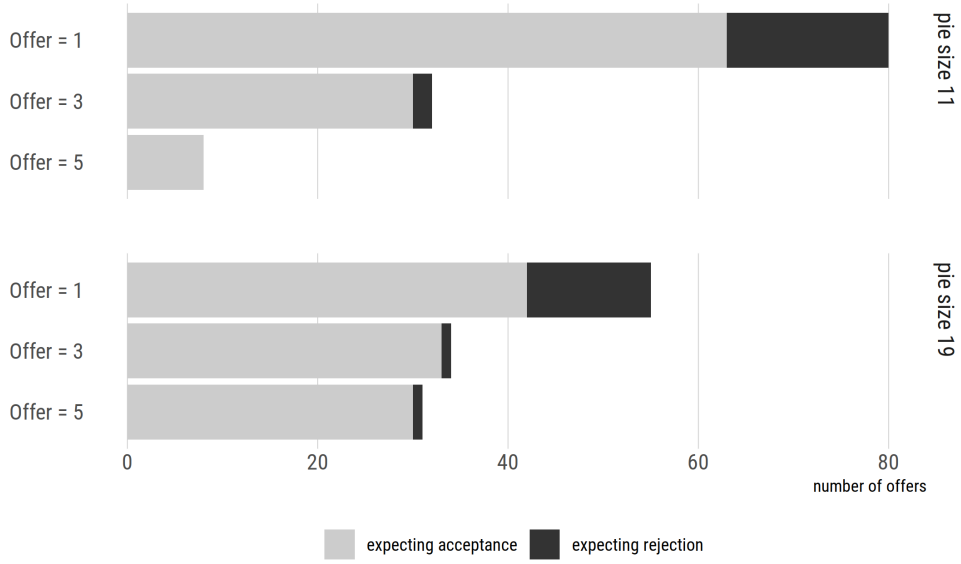



**Figure 1:** *Distribution of offers by pie size and beliefs about respondents reaction*

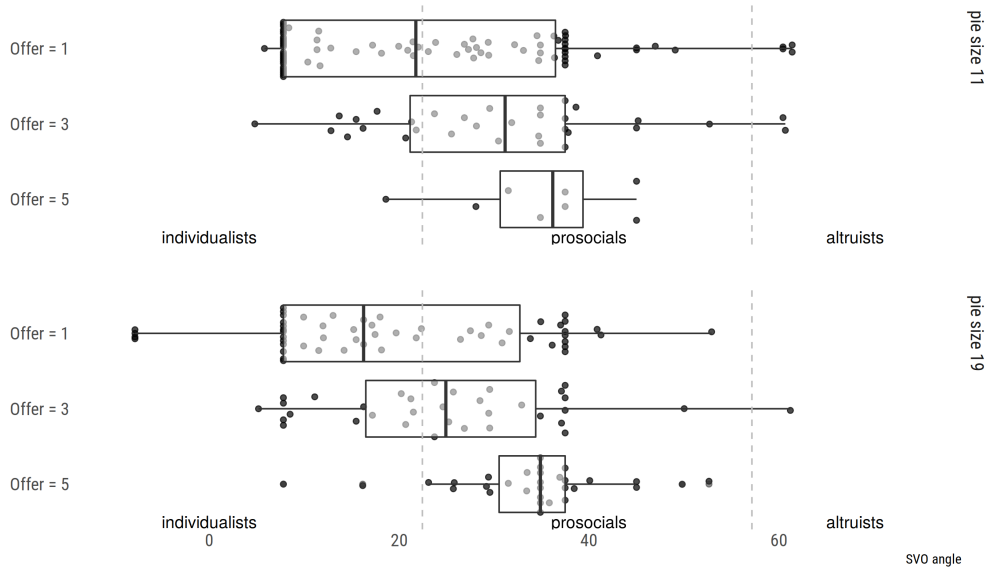



**Figure 2:** *SVO measure distribution by offer and pie size*

Subjects also went through the Social Value Orientation ring measure of (Murphy et al. (2011)). They had to allocate different sums of money to themselves and to another subject. They made 6 choices of which one was paid. The SVO measures a continuous variable that indicates the grade of self- rather than other-regarding attitudes. Subjects can be *competitive* (they prefer the other to have *less* irrespective of their gains); *individualistic* (they prefer more money for themselves and do not care about the other); *prosocial* (they prefer more money for both and more money for the other even when they do not gain more); or *altruistic* (they are willing to sacrifice own money to make the other better off). Results of the SVO measure are summarised in Figure 2. No subject was classified as competitive, a handful of subjects were classified as altruists, and the bulk of subjects was either individualistic or prosocial.

The distribution of the SVO affects the likelihood of a higher offer: there is a positive correlation between being classified as prosocial or altruist by the SVO and higher offers, for both pie sizes.

*Conclusion: Proposers*

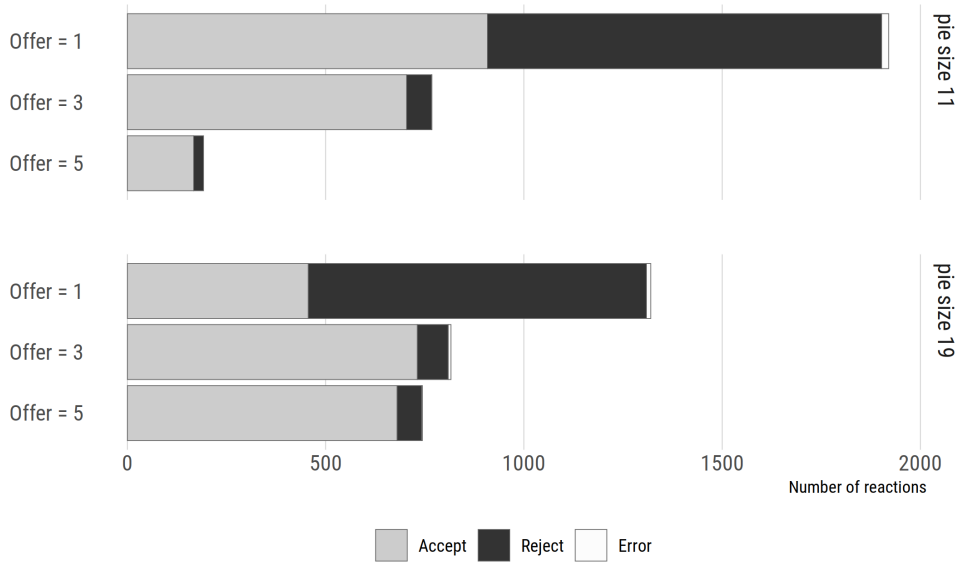
- proposer participants are mostly opportunistic by significantly more often choosing the lowest offer for both pie sizes, although the proportion of lowest offers is significantly smaller for the large than for the small pie.
- the share of 3€compromise offers, which are neither lowest nor most generous, does not depend on the pie size;
- greed (the tendency to selfishly exploit allocation power) reacts monotonically to Social Value Orientation.

## 4.2 Respondents

Response data are much richer, compared to the usual experimental choice data. Our design elicits 240 responses from each subject, without using the strategy vector method: all responses react to real offers from real proposers, and all were potentially payoff-relevant. This gives us unprecedented power to explore how subjects react in a situation without sanctioning power but a voice and a choice. In particular, we can shed light on the choice dynamics via the evolution of choices and decision times across 240 choices.

### Distribution of responses

Table and Figure 3 report the distribution of responses, conditional on pie size and proposal. All offers are more often rejected than expected by proposers. This mismatch of proposer beliefs and response actions particularly applies to minimal offers of which more than 50% were rejected and more so when coming from a large pie. Offers of 3 and 5 are overwhelmingly accepted, although also somewhat less than expected by proposers.




| Pie size | Offer | Reject | Accept | Error | % Accept |
|---|---|---|---|---|---|
| 11 | 1 | 994 | 908 | 18 | 47.73% |
| | 3 | 63 | 704 | 1 | 91.79% |
| | 5 | 25 | 167 | 0 | 86.98% |
| 19 | 1 | 853 | 456 | 11 | 34.84% |
| | 3 | 78 | 731 | 7 | 90.36% |
| | 5 | 62 | 680 | 2 | 91.64% |

**Figure 3:** *Distribution of reactions conditional on pie size and offer*

Result R.1: Across all choices and all 24 respondents the overall tendency is to

- essentially always accept offers of 3 and 5€, irrespective of pie size and experience;
- reject more than accept 1€offers with the rejection rate being markedly lower for small (52.3%) than for large (65.1%) pies (Fisher exact test, p-value $< 0.001$).

Result R.1 gives a nice first approximation of the data but is nonetheless biased: it considers the 240 observations from each subject as independent. Since each subject confronted all actual offers, in the table and plot a specific subject may appear all over the place, not taking into account heterogeneity in individual types and strategies. In particular for 1€offers, we next assess whether results are driven by heterogeneity *within* or *across* individuals.

**Individual strategies**

Figure 4 plots the relative shares of acceptance and rejection rates separately for each of the 24 respondents, for each pie size and offer.

The Figure readily suggests two main findings.

Result R.2: respondents clearly differ in their response behavior and can be classified in three main types plus a residual category:

**Opportunistic** subjects accept any offer, irrespective of the offer amount and the pie size. These are subjects 2, 12, 13, and 20.

**Monotonically** reacting subjects are more likely to reject offers when they come from large rather than small pies. This description fits subjects 3, 4, 5, 6, 17, 24.

**Fairness-minded** subjects always reject 1€offers, irrespective of the pie size: subjects 7, 8, 9, 10, 14, 16, 18,19, 21, 22, 23

**Residual** subjects, more likely reject higher than lower offers (11, 15), or reject across the board (1).

Subjects are extremely heterogeneous in behavior, especially when reacting to 1€offers. Putting aside the *Residual* category, more than half of the remaining subjects are fairness-minded in the sense of often rejecting 1€offers, and disproportionately so if coming from the large pie, while also rejecting to a lower extent 3 and 5€offers. Monotonic subjects are a subcategory of fairness-mindedness, since they unconditionally reject 1€offers and seemingly try to trade off opportunism and desire to voice disgust.

Figure 5 visually shows the choice shares for all four types of subjects when pooling data across all subjects belonging to the same type.

Since most of the action takes place with offers of 1€ we will now focus on those choices only. Figure 6 plots the probability of accepting a 1€ offer from a small (x axis) and a large (y axis) pie. It confirms that for most subjects offers were more likely rejected if coming from the large pie. The cluster on the top-right corner is made up mostly of opportunistic subjects who accept all offers, irrespective of pie size. The cluster on the bottom left is instead mainly

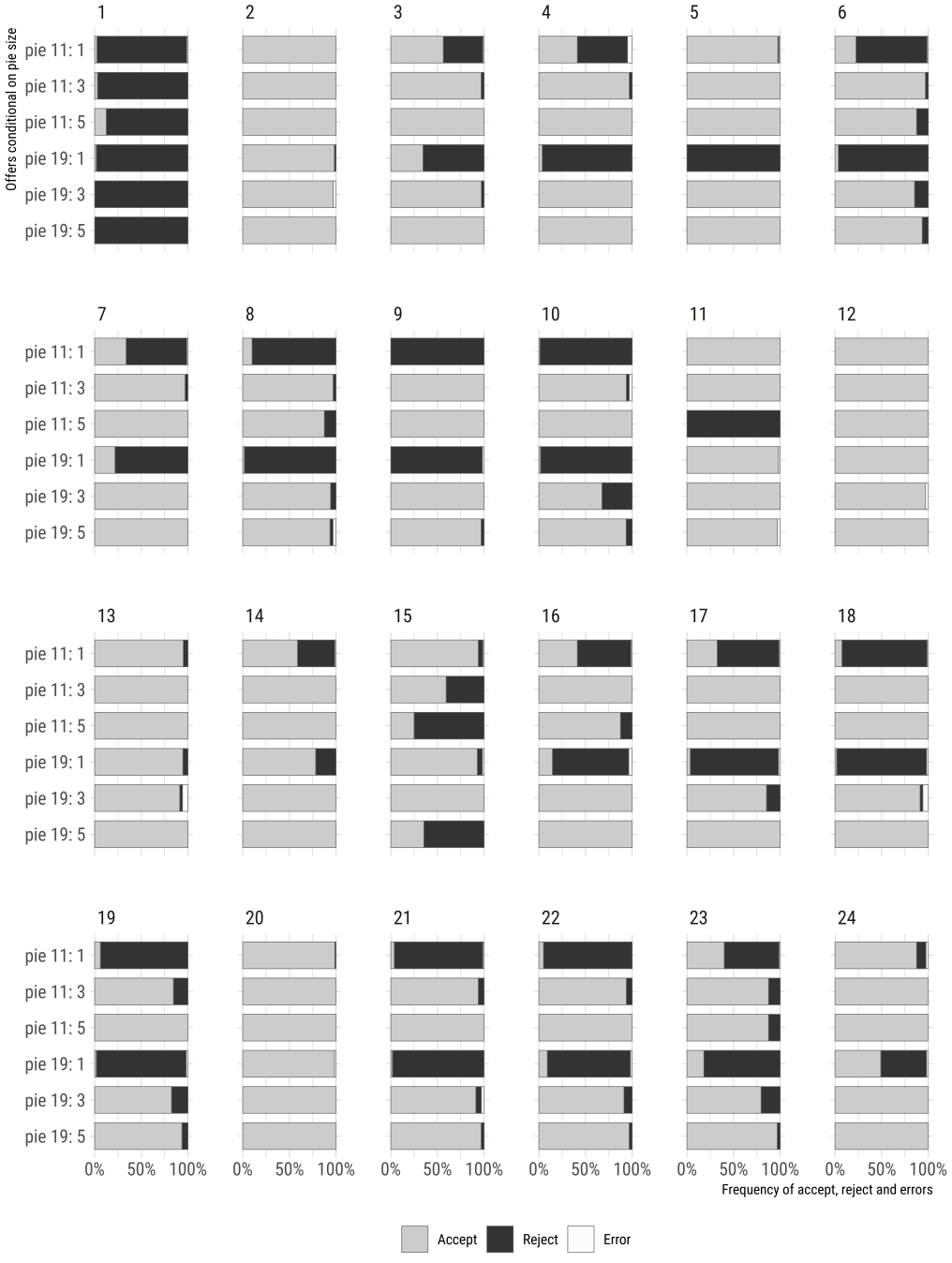



**Figure 4:** *Choice shares for each of the 24 subjects*


**Figure 5:** *Choice shares by behavioral type*

made up of fairness minded subjects who reject all 1€ offers, irrespective of the pie size. All other subjects, with one exception, reduce their acceptance rate when facing minimal offers from the large pie.

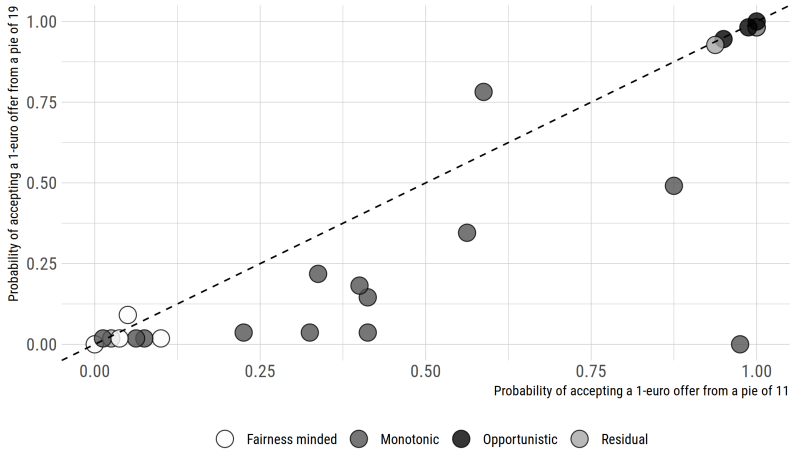



**Figure 6:** *Individual probability of rejection: transition from small to large pies*

*Result R.3:* low offers are substantially more often rejected when the pie size is large. This clearly suggests that most respondents are fairness-minded.

*Conclusion R:* most respondents can be regarded as fairness-minded: they reject quite often positive offers which they deem as unfair, especially when their monetary cost of such "choice and voice" is not too high (does not exceed 1€).

### 4.2.1 Response time

For each of the 240 responses given by each respondent in the scanner the reaction time in milliseconds was measured. Subjects were not allowed to spend more than 2 seconds on each task. Decisions that took longer are recorded as an Error. Errors account for negligible 0.67% of all observations. The response time data is detailed in Table 1.

| pie size | offer | reaction | mean time | st.dev | N | p-value* |
|---|---|---|---|---|---|---|
| all | all | Reject | 673.08 | 255.85 | 2075 | |
| | | Accept | 595.59 | 265.69 | 3646 | <0.001 |
| | | Error | – | – | 39 | |
| 11 | all | Reject | 704.08 | | 936 | |
| | | Accept | 588.86 | | 1567 | <0.001 |
| | | Error | – | | 17 | |
| 19 | all | Reject | 671.63 | | 851 | |
| | | Accept | 582.72 | | 1652 | <0.001 |
| | | Error | – | | 17 | |
| 11 | 1 | Reject | 703.86 | | 913 | |
| | | Accept | 591.96 | | 751 | <0.001 |
| | | Error | – | | 16 | |
| | 3 | Reject | 657.94 | | 19 | |
| | | Accept | 586.81 | | 652 | 0.74 |
| | | Error | – | | 1 | |
| | 5 | Reject | 973.12 | | 4 | |
| | | Accept | 582.79 | | 164 | <0.001 |
| | | Error | – | | 0 | |
| 19 | 1 | Reject | 667.44 | | 796 | |
| | | Accept | 559.79 | | 350 | <0.001 |
| | | Error | – | | 9 | |
| | 3 | Reject | 734.25 | | 44 | |
| | | Accept | 615.21 | | 663 | 0.60 |
| | | Error | – | | 7 | |
| | 5 | Reject | 724.25 | | 11 | |
| | | Accept | 561.56 | | 639 | 0.05 |
| | | Error | – | | 1 | |

*two-sided t-test, Accept *vs.* Reject decision times

**Table 1:** *Reaction time conditional on pie size and offer*

Across the board rejections are significantly slower than acceptances. This is true overall (first lines of Table 1) , conditional on pie size (second part) as well as conditional on pie size and offer (last part of Table 1), reporting no significance only for offers of 3€ irrespective of whether they come from large or small pies. This surprisingly robust and striking finding is at odds with most of the literature finding that accepting requires a conscious effort of overcoming one's (instinctive) disgust and one's intention to reject and hence requires more time.

Result T.1 for most offers and pie sizes (except the medium offers of 3€) rejecting offers is more time consuming than accepting.

This striking general result – rejections take longer than acceptances – nonetheless hides more complexity. Exploiting the type classification proposed above Table 2 shows that types

differ in their reaction time for acceptances and rejections.

| subject type | overall | mean time (st.dev) acceptances | rejections | t-test p.value |
|---|---|---|---|---|
| Fairness minded | 675.35 | 710.91 (230.43) | 653.42 (218.41) | 0.00 |
| Monotonic | 652.28 | 627.1 (268.97) | 702.29 (268.39) | 0.00 |
| Opportunistic | 450.53 | 448.58 (220.92) | 860.22 (192.8) | 0.12 |
| Residual | 628.03 | 670.07 (240.94) | 576.61 (237.51) | 0.00 |

**Table 2:** *Reaction time for each subject type*

Opportunistic subjects, who always accept, take significantly less time to accept than fairness-minded, monotonic and residual subjects who reject (at least) some offers. Moreover, there is an inversion of the main time result across types. For fairness minded and residual subjects, acceptances take longer than rejections; while for opportunistic and monotonic subjects, rejections take longer than acceptances (not significantly so for opportunistic types due to their extremely low number of rejections).

This apparently contradictory result can be rationalized by supposing that subjects are self-primed. That is, subjects chose a course of action which served as an anchor for behavior, via acting in line with the pre-determined plan whose implementation is less time consuming than deviating from what has been planned. Thus the behavioral rule, adopted after reading instructions but before actually responding, acts as a self-priming mechanism, making compliant choices a no-brainer while choices against the self-imposed rule require more thinking and time to be implemented.

One way to check whether this interpretation fits the data is to analyze the relationship between individual acceptance rates – a proxy for the self-imposed behavioral rule – and the average response times of acceptances and rejections. We restrict attention to offers of 1€ – where most of the action takes place – and plot for each subject the likelihood of accepting offers against the average time spent for accepting and rejecting for both pie sizes.

In Figure 7 every subject is represented by two points: her average acceptance and rejection time on the vertical axis, plotted against her acceptance share of 1€ offers on the horizontal axis. The figure readily shows that fairness-minded subjects, who (nearly) always reject, need more time to accept than to reject. Instead opportunistic subjects, who (nearly) always accept, need more time to reject than to accept. The relationship between the rate of acceptance and the time needed to accept is significantly negative, while the relationship with the time needed to reject is significantly positive.

This is confirmed by an interacted regression, reported in Table 3, whose coefficients are used to plot the sloping lines of Figure 7.

Result T.2 response time depends on the self-imposed behavioral rule of a subject. Subjects, who overwhelmingly accept take longer to reject and subjects, who overwhelmingly reject take longer to accept.

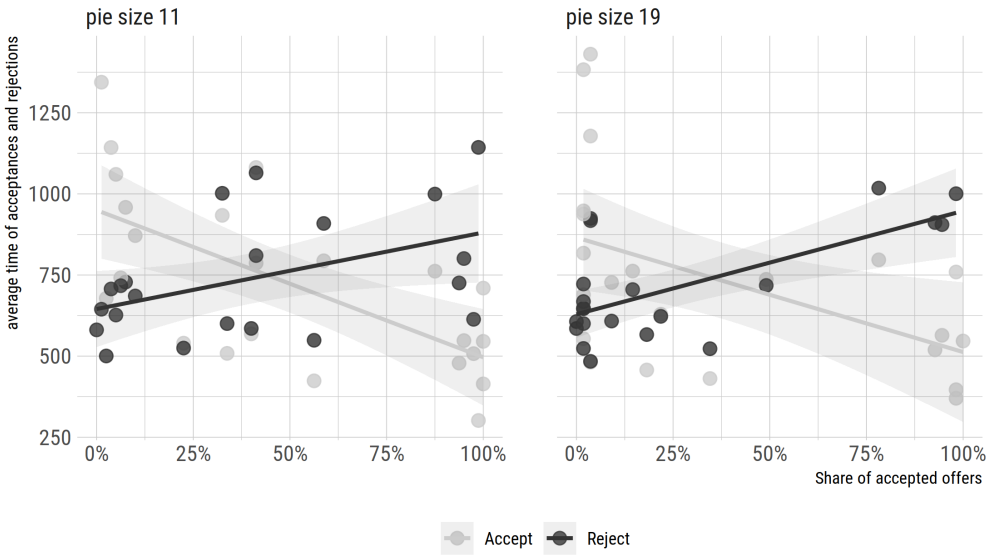



**Figure 7:** *Average response time for offers of 1€ conditional on average acceptance probability, for acceptances and rejections*

| | *reaction time* | |
|---|---|---|
| | Pie size 11 | Pie size 19 |
| Intercept | $949.851^{***}$ | $865.484^{***}$ |
| | (64.745) | (60.695) |
| % share of acceptances | $-453.408^{***}$ | $-352.935^{***}$ |
| | (103.912) | (109.712) |
| rejections | $-304.699^{***}$ | $-236.658^{***}$ |
| | (89.894) | (83.015) |
| % share of acceptances × rejections | $689.256^{***}$ | $671.712^{***}$ |
| | (156.754) | (172.448) |
| Observations | 44 | 43 |
| $R^2$ | 0.366 | 0.294 |
| Adjusted $R^2$ | 0.319 | 0.239 |
| Residual Std. Error | 189.568 (df = 40) | 208.416 (df = 39) |
| F Statistic | $7.709^{***}$ (df = 3; 40) | $5.406^{***}$ (df = 3; 39) |
| *Note:* | | $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01 |

**Table 3:** *Response time as a function of the frequency of acceptance – 1€ offers*

# 5 Conclusion

In our experiment acceptances on average need less time than rejections. This aggregate finding runs against our initial intuition when setting up the experiment. We thought, along most of the existing literature on the cognitive status of negative reciprocity (see the excellent review of Capraro (2019) and, among individual papers, Grimm and Mengel (2011); Cappel-

letti et al. (2011); Sutter et al. (2003)), that rejections would be faster than acceptances, as the latter require overcoming one's immediate feelings and emotional intentions.

But, more importantly, our results stress the crucial role played by subject heterogeneity and self-priming when interpreting results from experiments testing the intuitive or reasoned nature of choices. Different behavioral types differ in their response time, with their favorite (or default, or self-primed) action requiring significant less time than the other option.

Our main finding is then that response behavior can be explained by heterogeneity in "self-priming", i.e. devising, after reading the instructions but before actually responding in the scanner, a behavioral plan which in all likelihood is due to heterogeneity in perceiving the non-private impunity experiment: some decide to not yield to disgust and instead to collect all offers whereas others perceive it as a social environment in which they do not want to accept annoying and disgusting proposals like a 1€ offer when the pie size is 19€. When "self-primed" respondents face offers they do so with different intuitions and the corresponding behavioral intentions already in place; deciding according to the intuition needs less time than deliberating whether to decide otherwise.

This result is in line with findings by Alos-Ferrer and Garagnani (2020). Albeit in the different setting of public good games, they also confirm heterogeneity in predispositions. Subjects induced via time pressure to react intuitively more likely fall back on their basic predisposition, while allowing more time dampens their initial attitudes toward more socially acceptable behavior. Our results echo theirs, and offer a simple but powerful insight: people are different, and so are their basic intuition on what is the right course of action in a strategic setup. This basic intuitive action requires less time and, in the case of time-constrained subjects, is chosen more often.

Methodologically, our two innovative aspects are: (i) observing subjects over a large number of choices allows us to identify individual response strategies and how they evolve in time, and use these behavioral types to account for systematic differences in decision time; (ii) employing two physically distinct labs allows us to avoid deception. As experimentalists with main background in economics it has been natural for us to elicit choice data and its covariate, decision time, without deceiving participants in the weak sense of not explaining them all details, related to employing two labs with 10 times more proposers than respondents. So "no-deception" means that the instructions truly represent how participants interact via impunity sharing but do not inform about all procedural details.

Our result has limitations. First, in principle, one could argue that our participants were all time constrained since responders had to decide within the short span of 2 seconds. Looking at the mean response times and their variances in Table 1, however, reveals that this time constraint has rarely been binding. This line of reasoning is also supported by "Error" rates of less than 1 percent. So our experiment differs from the studies with partly stressful (binding) time constraints in that response times resulted endogenously with hardly any fear of censoring (at least after a few choices subjects were confident of deciding in time).

Second, the result can be limited to our chosen game, or to our parameters, and is clearly impacted by the severely limited sample size. While all of this is true, we hope to have provided a solid enough proof of the dangers of relying on average results, and on the

importance of self-priming when time manipulation is used to assess the intuitiveness of one or another behavior in games. Moreover, our general design, allowing to observe several 'live' choices and to assess response strategy at the individual level, can easily be tweaked to accommodate other parameters, other theoretical considerations, even other games.

Most of the literature on the cognitive modes of cooperative vs. selfish, emotional vs. deliberate acts employs experimental designs which induce subjects to rely on intuitive reasoning (via imposed time constraints, ego depletion, cognitive load) and then evaluates the *average* effect of the imposed constraints on behavior. But subjects are heterogeneous and can pre-select different 'default' actions during the instruction phase (what we call self-priming). So results reported in most of the literature can be misleading. Quicker (or constrained to be quicker) choices need not be more emotional or intuitive, but rather those in accordance with a pre-existing plan or in agreement with the behavioral type of the specific subject. This type, as well as the self-prime, in turn, can have come about by intuition or by reflection. While we take no stance on this further problem, it is clear that most experimental designs are silent on the matter.

Our proposed mechanism, self-priming, is not the only possible channel through which individual heterogeneity can impact results of widely used experimental manipulations. Teoh et al. (2020) make a similar point to ours by showing via eye tracking that heterogeneity in early allocation of attention to own or the other's payoff is the main driver of the observed aggregate effects.

In light of our results, the debate on whether the intuitive, or *default* tendency of human agents is cooperation or selfishness (Bouwmeester et al., 2017; Rand et al., 2014) seems to only partly reflect the fundamental heterogeneity of human beings. Any contradictory result in this literature might simply be due to composition effects as the one identified above: on average either one or the other conclusion may prevail. However, the average effect may result from wide and often unaccounted heterogeneity in the population under study. While this effect *might* be cleaned by the usual practice of randomization into between-subjects treatments, the usually small number of subjects per condition coupled with the fact that we do not really know how far the individual heterogeneity can go advise for caution. Had we relied on aggregate effects only, accepting would have been the intuitive response in impunity play – i.e., that subjects find it more intuitive to accept and pocket the money than to send the costly message of a rejection. Only the peculiar nature of our data as repeated measurement on each subject allowed us to identify distinct types and to analyse reaction time as a function of a subject's deeper conviction versus one of deliberate and time consuming choice.

# References

**Alos-Ferrer, Carlos and Michele Garagnani**, "The cognitive foundations of cooperation," *Journal of Economic Behavior and Organization*, 2020, *175*, 71 – 85.

**Bolton, Gary E. and Rami Zwick**, "Anonymity versus Punishment in Ultimatum Bargaining," *Games and Economic Behavior*, 1995, *10* (1), 95–121.

**Bouwmeester, Samantha, Peter PJL Verkoeijen, Balazs Aczel, Fernando Barbosa, Laurent Bègue, Pablo Brañas-Garza, Thorsten GH Chmura, Gert Cornelissen, Felix S Døssing, Antonio M Espín et al.**, "Registered replication report: Rand, greene, and nowak (2012)," *Perspectives on Psychological Science*, 2017, *12* (3), 527–542.

**Cappelletti, Dominique, Werner Güth, and Matteo Ploner**, "Being of two minds: Ultimatum offers under cognitive constraints," *Journal of Economic Psychology*, 2011, *32* (6), 940–950.

**Capraro, Valerio**, "Does the truth come naturally? Time pressure increases honesty in one-shot deception games," *Economics Letters*, 2017, *158*, 54–57.

_ , "The Dual-Process Approach to Human Sociality: A Review," *SSRN Electronic Journal*, 2019.

**Cooper, David J. and John H. Kagel**, *Other Regarding Preferences. A Selective Survey of Experimental Results*, Princeton University Press, 2015.

**Crosetto, Paolo, Ori Weisel, and Fabian Winter**, "A flexible z-Tree and oTree implementation of the Social Value Orientation Slider Measure," *Journal of Behavioral and Experimental Finance*, 2019, *23*, 46 – 53.

**Di Cagno, Daniela, Werner Güth, Luca Panaccione, and Maria Cristina Scarafile**, "The Psychological Cost of Disagrement:An Impunity Experiment with Concession," Technical Report 2020.

**Ferguson, Eamonn, John Maltby, Peter A Bibby, and Claire Lawrence**, "Fast to forgive, slow to retaliate: Intuitive responses in the ultimatum game depend on the degree of unfairness," *PloS one*, 2014, *9* (5), e96344.

**Fischbacher, Urs**, "z-Tree: Zurich toolbox for ready-made economic experiments," *Experimental Economics*, 2007, *10* (2), 171–178.

**Forsythe, Robert, Joel L. Horowitz, N.E. Savin, and Martin Sefton**, "Fairness in Simple Bargaining Experiments," *Games and Economic Behavior*, 1994, *6* (3), 347–369.

**Greiner, Ben**, "Subject pool recruitment procedures: organizing experiments with ORSEE," *Journal of the Economic Science Association*, 2015, *1* (1), 114–125.

**Grimm, Veronika and Friederike Mengel**, "Let me sleep on it: Delay reduces rejection rates in ultimatum games," *Economics Letters*, 2011, *111* (2), 113–115.

**Güth, Werner and Martin G. Kocher**, "More than thirty years of ultimatum bargaining experiments: Motives, variations, and a survey of the recent literature," *Journal of Economic Behavior & Organization*, 2014, *108*, 396 – 409.

**Hallsson, Bjørn G, Hartwig R Siebner, and Oliver J Hulme**, "Fairness, fast and slow: A review of dual process models of fairness," *Neuroscience & Biobehavioral Reviews*, 2018, *89*, 49–60.

**Kahneman, D.**, *Thinking, Fast and Slow*, Farrar, Straus and Giroux, 2011.

**Mitzkewitz, Michael and Rosemarie Nagel**, "Experimental Results on Ultimatum Games with Incomplete Information," *International Journal of Game Theory*, 1993, *22* (2), 171–98.

**Murphy, R., K. Ackermann, and M. Handgraaf**, "Measuring social value orientation," *Judgment and Decision Making*, 2011, *6* (8), 771–781.

**Neo, Wei Siong, Michael Yu, Roberto A Weber, and Cleotilde Gonzalez**, "The effects of time delay in reciprocity games," *Journal of Economic Psychology*, 2013, *34*, 20–35.

**Rand, David G**, "Cooperation, fast and slow: Meta-analytic evidence for a theory of social heuristics and self-interested deliberation," *Psychological science*, 2016, *27* (9), 1192–1206.

_ , "Intuition, deliberation, and cooperation: Further meta-analytic evidence from 91 experiments on pure cooperation," *Available at SSRN 3390018*, 2019.

_ , **Alexander Peysakhovich, Gordon T Kraft-Todd, George E Newman, Owen Wurzbacher, Martin A Nowak, and Joshua D Greene**, "Social heuristics shape intuitive cooperation," *Nature communications*, 2014, *5* (1), 1–12.

**Spiliopoulos, Leonidas and Andreas Ortmann**, "The BCD of response time analysis in experimental economics," *Experimental economics*, 2018, *21* (2), 383–433.

**Sutter, Matthias, Martin Kocher, and Sabine Strauß**, "Bargaining under time pressure in an experimental ultimatum game," *Economics Letters*, 2003, *81* (3), 341–347.

**Takagishi, Haruto, Taiki Takahashi, Akira Toyomura, Nina Takashino, Michiko Koizumi, and Toshio Yamagishi**, "Neural correlates of the rejection of unfair offers in the impunity game," *Neuro Endocrinol. Lett*, 2009, *30*, 496–500.

**Teoh, Yi Yang, Ziqing Yao, William A. Cunningham, and Cendri A. Hutcherson**, "Attentional priorities drive effects of time pressure on altruistic choice," *Nature Communications*, 2020, *11* (3534).

**Tinghög, Gustav, David Andersson, Caroline Bonn, Harald Böttiger, Camilla Josephson, Gustaf Lundgren, Daniel Västfjäll, Michael Kirchler, and Magnus Johannesson**, "Intuition and cooperation reconsidered," *Nature*, 2013, *498* (7452), E1–E2.

**Wang, Cynthia S, Niro Sivanathan, Jayanth Narayanan, Deshani B Ganegoda, Monika Bauer, Galen V Bodenhausen, and Keith Murnighan**, "Retribution and emotional regulation: The effects of time delay in angry economic interactions," *Organizational Behavior and Human Decision Processes*, 2011, *116* (1), 46–54.

# A Instructions

This is the English version of the original German Instructions. The original instructions, as well as the zTree software used for the Proposers experiment, are available upon request.

## A.1 Proposers

**Intro and practicalities**

You are about to participate in a computerized experiment. You get 2.5€ as show-up fee. Please read the following instructions carefully. Before the beginning of the experiment you will be asked to reply to some control questions. To facilitate the reading during the whole experiment we have not adopted a gender-neutral formulation. This means that all that is here exposed in the masculine form is equally valid for both genders. During the experiment you are not allowed to talk to other participants. Should you have a question, please raise your hand. An experimenter will come to you and reply individually. Please turn off your mobile phones now. Should you not comply with any of these rules, we would unfortunately have to exclude you from the experiment and all related further payments. The choices that you would make during the experiment will impact your final payoff.

**Game details**

In the experiment you will be randomly paired with another participant. This participant is not now with you in the lab, but will participate to this experiment in another lab in February 2013, since in this year no more experiments are possible. You will be given an endowment. This endowment will be either of 17 or of 11 euro. You will then face a simple choice: you will have to choose how much of this endowment you want to transfer to your paired partner. You can choose to transfer 1, 3, or 5 euro to your partner. The share of your endowment that you do not transfer to your partner is what you will keep for yourself. Your partner will receive this share when he or she will take part to the experiment, next year. Your partner can either accept or reject the transfer you sent him. If he accepts the transfer, he will keep the money you transferred to him. If he rejects the money, the money you transfered to him is lost for both of you, i.e., your partner does not accept it and you will not get it back. In any case, you will be informed about the decision of your paired partner. You will receive next year an email informing you about the choice of your partner. Your partner will know, when making a decision, that you will be informed of it. Your partner will never know your name, or other personal details. He will simply react to your transfer by either accepting or rejecting it. [INTERFACE DETAILS (English so far)] After having read the instructions, we will go through some control questions, to ensure that all have understood the rules of the experiment. After this, you will be shown the main interface of the experiment. You will see on the screen a green pie chart, representing your full endowment which can be of 17 or 11 euro. You will be informed in your decision screen which of the values of the endowment, 17 or 11, applies to you personally. The amount that applies to you is randomly determined by the computer. You will be able to choose, using buttons on the screen, the amount you

want to transfer to your partner, that is, one of 1, 3, or 5 euro, irrespective of your amount being 11 or 17. Your share will be displayed on the pie in green, whereas your partner's share will be visualised in blue. You can explore the three choices and change your mind as many times as you want. Your choice is final when you hit the CONFIRM button. Your partner, when he will take part to the experiment, will see the same interface: he will see a pie, with your green share and his blue share of it, according to your decisions. He will then have buttons to decide whether to reject or to accept your transfer.

**Final remarks and questionnaire**

After the main choice, you will be asked to answer a series of short questions. After all participants will have completed the additional questions, your payoff will be calculated and paid to you in cash in private. We will now give you some more time to go through the instruction on your own. Should you have any questions, please raise your hand: an experimenter will then come to your place to answer them individually.

**Control questions**

1. How big can be your Endowment, in Euro? [11 or 19]
2. How will the endowment be assigned? [randomly]
3. Is your paired partner in this experimental lab? [no]
4. What happens if your paired partner accepts the offer? [gets the money, and I receive an email]
5. What happens if your partner rejects the offer? [partner gets zero, I get notified]
6. Will you get informed about the choice of your paired partner? [Yes]

## A.2 Respondents

In this experiment you will be facing many decisions. All decisions are of the same type. For each decision, you are paired with another participant. This participant is not in this lab, but has participated in December 2012 in laboratory sessions at the Max Planck lab here in Jena. Each participant of the first part of the experiment was aware that you would be taking part, and that you will be paired with him or her.

Your paired participants have received an endowment. This endowment could be of 11 or 19 euro. They were then asked to decide how much of their endowment to transfer to you. They could choose to transfer you 1, 3 or 5 euro, irrespective whether their endowment was 11 or 19.

For each choice, you will see your partner's endowment (11 or 19) and the amount he or she transferred to you (1, 3 or 5). You can decide to accept or to reject the transfer. You will see, on the screen, a pie showing the full amount, the share of it that has been transferred in

green to you and the share that your partner kept for him or herself in blue. You will also see two buttons, one to accept and one to reject.

You will make 240 decisions, one for each participant in the first part of the experiment. At the end of the experiment, 10 of your 240 decisions will be randomly drawn. These decisions will be relevant for your final payment; the 10 participants you will be paired with will be informed by us about whether you accepted or rejected their offers via email.

If you accept the transfer, you may receive it as payment for this experiment, as each of the 240 choices has a chance of being among the 10 paid ones. If you reject it, you may earn zero for this choice, again, in case it is selected as one of the 10 relevant choices.

Both if you accept or you reject the offer, your partner will be informed of your choice. An email will be sent to him or her, reporting your choice. Your paired partner knew, when deciding, that you will be able to accept and reject, and that he or she would receive an email informing him or her of your decision.