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« Envy in Othello
Can effort explain such a tragic issue? »

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Envy in Othello

Can effort explain such a tragic issue?

Jérémy CELSE[1]

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Abstract:

We aim at disentangling the impact of effort on social emotions and more particularly on envy. Thus we observe the impact of effort on individual well-being and behaviour. In our experiment subjects are paired and receive endowments whether according to their performance in a real-effort task or randomly. We focus on subjects placed in situations of inferiority and ask them to report their satisfaction level before and after being exposed to unflattering social comparison. Finally, subjects can choose to reduce their opponent's endowment by incurring a personal cost. We convey that the introduction of effort does not affect individual well-being and partially subjects' decisions to reduce others' income. Subjects do not reduce more often their opponent's endowment but they cut a greater portion of their opponent's endowment when endowments are attributed according to individual performance. Besides we observe that poor performing subjects are more prone to reduce others' income than high performing ones. We also find evidences suggesting that envy is ought to explain reduction decisions engaged by high performing subjects and disappointment explicates reduction decisions engaged by low performing ones.

Key words: Subjective well-being, Real-Effort, Envy, Destruction, Emotions, Income Inequality, Interdependent preferences.

JEL classification: D6, H0, J0.

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1. Introduction

The destructive power of envy is perfectly highlighted in Shakespeare's *Othello.* Despite fighting loyally for many years under Othello's commands, Iago learns that Othello prefers to select another soldier (Cassio) rather than Iago as his personal lieutenant. Iago aspired for a long time in that promotion and secretly expected to be chosen by Othello. Iago is piqued. Envy arises intensively in Iago and pushes the latter to plan a Machiavellian vengeance aiming at ruining the life of both Othello and Cassio. Despite the social disorder generated by Iago's conspiracy, the play ends dramatically. Indeed consumed by his envy, Iago kills Emilia (his own wife) and Roderigo (his friend and ally), he wounds Cassio (his rival) and succeeds in exerting Othello to kill his wife (Desdemona) and to commit suicide. Finally Iago is led away in chains while Cassio becomes governor of Cyprus, the position so desired by Iago. In *Othello*, Shakespeare chooses to picture the extreme and ugly side of envy. Indeed, not every episode of envy ends in bloodshed. Envy is a protean emotion, i.e. the hostility inherent in envy can take many forms (e.g. nasty looks, sarcastic comments, aggression...).[2] How Iago's envy led to such a dramatic end? We argue that effort might explain such an extreme issue. Indeed, Iago put a lot of efforts during many years so as to improve his position. When Iago realised that all his efforts were invested in vain, this might have amplified his envy exerting Iago to behave extremely and showing him the path to crime. Would the play ended identically if Iago invested no effort in obtaining a promotion?

Envy is a social emotion, i.e. envy arises from unfavourable social comparisons (Ben Ze'ev, 1992, 2000; Celse, 2010; Miceli and Castelfranchi, 2007; Smith and Kim, 2007).[3] Social comparisons have a key role on self-evaluation and self-esteem: they help form the foundations for inferences about the self, assess personal abilities, facilitate in identifying what ingredients are required for obtaining success or for improving one's performance and, finally, determine individual satisfaction (Ben Ze'ev, 2000; Collins, 1996; Festinger, 1954; Heider, 1958; Michalos, 1985; Suls and Wills, 1991). Hence social comparisons can enhance (if they lead to a favourable diagnostic, i.e. success or superiority) or threaten (if they lead to an unfavourable diagnostic, i.e. failure or inferiority) one self-evaluation and self-esteem. Because of their importance on both self-evaluation and self-esteem, social comparisons are connected to emotional and affective states. Collins (1996) states that unfavourable social comparisons generate negative emotions and affects (e.g. jealousy, envy) whereas favourable ones generate positive emotions and affects (e.g. love, pride). Thus social comparisons generate

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[2] See Parrott and Rodriguez Mosquera (2008).
[3] One can differentiate private from social emotions. Private emotions are emotions triggered without social comparisons and by one's choices or thought (e.g. relief, joy).

social emotions. Envy can be roughly sketched as "*a disturbing pain excited by the prosperity of others*" (Aristotle, *Rhetorics*, Book. II, Chap. IX, 1386b) or as "*a negative attitude toward another person's superiority*" (Ben Ze'ev, 1992, p. 552). Envy is considered as a negative emotion since it includes hostility toward the envied and is acknowledged to be involved in violent actions, severe conflicts and for leading to oppositions to social systems (Beckman et al., 2002; Celse, 2009; Foster, 1972; Glick, 2002; Mui, 1995; Schoeck, 1969; Zizzo and Oswald, 2001; Zizzo, 2003, 2004).

Albeit standard economic theory, based on the *Homo Economicus'* concept, states that emotions do not affect individuals' satisfaction and behaviour, empirical evidences suggest the contrary (Bault et al., 2008; Bosman and van Winden, 2002; Bosman et al., 2005; Sanfey et al., 2003; van Winden et al., 2008). Emotions draw growing attention from scholars. In emotion theory, effort is acknowledged to play a key role on individuals' emotions by modulating their intensity. When involving effort, emotional reactions are known to be experienced more intensively and to have more incidences on individual behaviour (Ben Ze'ev, 2000; Lazarus, 1991; Ortony et al., 1988; Wyer and Srull, 1989). Ben Ze'ev (2000) emphasizes the connection between effort and emotional intensity through the following lines: "(...) *the more effort we invest in something, the more significant it becomes and the more intense is the emotion surrounding it*" (p. 141).[4] Wyer and Srull (1989) go further and assume that negative emotions are ought to be particularly amplified by effort and even more in situations in which efforts are invested in vain. van Dijk et al. (1999) corroborate empirically their hypothesis and reveal that the emotions of disappointment and regret are significantly affected by effort. Indeed when the subject fails at achieving his objective, the subject feels more disappointed and regrets more if he has spent a lot of effort in obtaining his goal. Despite the results brought by van Dijk et al. (1999), there still is, to our knowledge, a lack of empirical evidences of a direct connection between effort and emotional intensity and also between effort and individual behaviour. Related to this issue we can point out papers by Bosman et al. (2005) and Rustichini and Vostroknutov (2010). The former observe less destruction of income in a power-to-take game when endowments are earned through effort. The latter find that decisions to subtract income from others' subjects are not affected by how endowments are attributed; but they suggest that individuals differentiate inequalities due to differences of effort from those due to differences of luck.[5] Nevertheless these papers do not disentangle the impact of social comparisons, and more precisely on envy, on individual satisfaction and behaviour.

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[4] To illustrate the impact of effort on emotions, consider the following situation: Bob and John are passing a job audition. Both really desire to have the job. Bob has prepared the job audition for three weeks whereas John has not prepared it. Unfortunately both fail at obtaining the job. John might be pained after failing the job audition but his pain is ought to be less intense than the pain experienced by Bob that spent many efforts in obtaining the job (see van Dijk et al., 1999).

[5] Procedures and results from these papers are developed in the next section.

Would Iago be more pained if he was less invested in getting that promotion? Would Iago be deterred from committing crimes if he put fewer efforts in improving his position? We aim at exploring the direct connection between effort and the intensity of social emotions. Does effort weaken or strengthen social emotions? More precisely we focus on the emotion of envy. Does effort amplify or reduce envy and its impact on individual well-being and behaviour?[6] We conjecture that envy is modulated by effort and that the more efforts subjects engage the more intense is the emotion and its impact on individual behaviour.

Using experimental methods, we capture social emotions by exposing subjects to unfavourable social comparisons and we measure their impact on both individual well-being and behaviour. We then introduce effort and examine how effort affects the impact of unflattering social comparisons on individual well-being and behaviour. To capture the impact of social comparisons on individual well-being (and so to catch social emotions), we replicate the method used in Celse (2009).[7] We ask subjects to declare how satisfied they are at two moments: after learning their endowment and after learning the higher endowment of the person they are paired with (opponent afterwards). Standard economic theory, relying on the *Homo Economicus*' concept, assumes that individual satisfaction depends exclusively on the individual level of consumption and leisure (i.e. on individual income). Thus standard economic theory predicts that a subject would not report different levels of satisfaction. However, if a subject reports different levels of satisfaction, the subject signals his satisfaction to depend not only on his own situation but also on his opponent's one. Hence the subject is said to experience social emotions. We identify envy when the subject indicates a decrease in his satisfaction after being informed of his opponent's endowment. Then we examine the impact of social emotions on individual behaviour by asking to the subject if the latter is willing to reduce his opponent's endowment. We aim at investigating whether a relation between subjects' reported levels of satisfaction (and reported envy) and subjects' decisions to reduce their opponent's endowment exists.

We argue that envy is modulated by effort albeit effort is not the sole determinant of envy. Envy is modulated by other parameters such as the subject-object distance, the self-relevance of the desired attribute (i.e. object of envious feelings), the environment, etc... (Ben Ze'ev, 1992, 2000; Celse, 2010; Miceli and Castelfranchi, 2007; Smith and Kim, 2007). Previous studies convey that the difference between subjects affects individual behaviour. Abbink et al. (2008) and Celse (2009) find that as inequalities between subjects increase, subjects undertake less destructive decisions. Thus we also

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[6] In this paper we use the terms well-being and satisfaction as if they were interchangeable.
[7] We also use its data to compare with our observations. Data from Celse (2009) are referred under the term *Luck* condition.

investigate the role of inequalities between subjects' endowments on individual well-being and behaviour.

We observe that whereas the introduction of effort does not affect subjects' well-being, it affects partially their behaviour. First, whether endowments are attributed randomly or through effort, most subjects report changes, more precisely negative changes, in their satisfaction after exposure to social comparisons. Then we do not observe more reduction decisions when endowments are attributed according to effort but subjects cut a significantly higher fraction of their opponent's endowment when endowments are given according to each effort. Finally, individual performance modulates subjects' decisions to reduce income: the higher the individual performance, the lower the probability for a subject to reduce his opponent's endowment.

The paper is organised as follows. The next section provides a brief review of the related literature on the impacts of effort. As we rely on experimental methods, section 3 provides a description of the experimental protocol we use in the paper. We detail our research hypotheses in section 4. Section 5 is devoted to introduce our results. Whereas section 6 offers a discussion, the last section concludes.

2. Related literature

In this section, we present briefly the few experiments focusing on the impact of effort on emotions or negative behaviour (e.g. reducing income, damaging others' situations). Whereas the impact of effort has received much attention in other domains (e.g. contribution to public good, sharing a fixed sum in an Ultimatum game...), there are few studies dealing on how effort affects emotions and more precisely negative emotions.

The study by van Dijk et al. (1999) is the closest relative to our research question. The authors find empirical support to the impact of effort on the intensity of disappointment and regret. They ask subjects to react to hypothetical scenarios involving a protagonist trying to achieve a certain state or to obtain a certain good. In one version the protagonist made huge efforts to fulfil his objective whereas in another version the protagonist was less involved. Subjects are told to report how the protagonist would feel after being informed that he failed in reaching his goal. van Dijk et al. (1999) convey that subjects report the protagonist to feel more disappointed and to regret more when the latter invested many efforts in vain.

Although they do not focus on envy, one can point out the study by Bosman et al. (2005). The authors investigate the impact of real-effort on emotions in a power-to-take game. To fulfil their

objective, they compare subjects' behaviour in a power-to-take game when subjects played with earned endowments (i.e. earned through real-effort) and when they played with endowments allocated by the experimenter.[8] The power-to-take game involves a dyadic relation. The take authority ($P1$ thereafter) receives an income Y_{P1} and is associated to a responder ($P2$ afterwards) with an income Y_{P2}. The game consists of two stages. In the first stage, $P1$ decides on a take rate $t \in [0,1]$, which corresponds to the part of $P2$'s income left after the second stage that will be transferred to $P1$. In the second stage, after being informed on the value of t, $P2$ decides on $d \in [0,1]$, which corresponds to the part of Y_{P2} that will be destroyed. Thus the payoff for $P1$ is equal to $Y_{P1} + t(1-d)Y_{P2}$ and the payoff for $P2$ is thus equal to $(1-t)(1-d)Y_{P2}$. Respondents are asked, after their decision, to report their emotions on a list including several emotions. Bosman et al. (2005) observe less destruction of one's endowment when endowments are attributed through effort than by the experimenter. They find that whether endowments are earned or not, the probability of destruction depends significantly and positively on the take rates (i.e. the higher the take rate, the higher the probability to destroy one's endowment). They also find that the probability of destroying is higher when endowments are given by the experimenter than when they are earned. Besides emotions behind responders' destruction decisions are different depending on the nature of their endowment. Nevertheless as $P2$ faces decisions from $P1$, Bosman et al. (2005) focus on how emotions generated by others' decisions are affected by effort. They cannot isolate the impact of social comparisons from the impact of $P1$'s decisions on emotions and individual behaviour.

Recently Rustichini and Vostroknutov (2010) want to investigate experimentally if subjects' decisions to reduce others' income are modified by how they earned income. In their experiment, subjects play two games against the computer: the game of Luck and the game of Skill. The game of Luck consists, for each subject, to guess a number between 0 and 100. A subject wins if the number he guessed is close to the number randomly selected by the computer. The game of Skill is the classic *Hare and Hounds* and requires some logical and analytical skills.[9] Both games are played consecutively for 10 times.[10] And after each game the subject has the possibility to subtract money

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[8] The effort task consisted during 10 periods in searching for a maximum value that varied over periods.

[9] In the game of *Hare and Hounds*, subjects play the role of hounds and the computer the role of hares. The hounds must catch the hare. The hare must escape. The hare is trapped if no move is feasible when its turn comes. Hounds and hares play sequentially. Subjects has three hounds and he has to choose one to move. Hounds can only move by one cell to the right, up or down. The hare can move by one cell in any direction. The hare succeeds in escaping when it passes to the left of all three hounds (more information on http://www.mazeworks.com/hounds/index.htm).

[10] To control for order effects, the authors reversed the orders of games. In one treatment subjects played first the game of Skill and then the game of Luck whereas in another treatment they played the games in the exact opposite order.

from another participant.[11] Subjects can choose to subtract money from any participant in the session. Thus all subjects can be the target of others' subtracting decisions. On average subjects choose to subtract 67.8% of the times.[12] The frequency of destruction is not significantly different between Luck and Skill games. In both games, subjects subtract most often those occupying the top position (i.e. those having the highest endowments). The main result arises from that subjects, when subtracting income, are more sensitive to the difference between their own income and others' income when the game is a game of Skill. However, as subjects face decisions from others' players they might subtract income so as to retaliate against anticipated reduction decisions engaged by other subjects.

Albeit he does not focus on effort, Celse (2009) disentangles the impact of unflattering social comparisons on individual well-being and behaviour. Subjects are paired and receive randomly endowments. Subjects are asked to report their satisfaction before and after being exposed to unflattering social comparisons. Then they have to indicate if they are willing to reduce the endowment of the player they are paired with. Celse (2009) observes that disadvantageous social comparisons affect subjects' satisfaction: half of the subjects reports a decrease in their satisfaction after exposure to social comparison. He finds that social comparisons have enough impact on individuals to exert a third of them to engage in reduction decisions. He conveys that although most reduction decisions (62.85%) are engaged by envious subjects envy fails at predicting subjects' decisions to reduce income.[13] We chose to replicate this experimental design because it captures subjects' reactions to unfavourable social comparisons both from an affective (by capturing subjects' satisfaction) and a behavioural (by examining subjects' decisions to reduce others' income) perspective.

3. Experimental design

Experimental sessions were conducted in spring 2009 for *Luck* condition and spring 2010 for *Effort* condition at the LEEM.[14] Subjects were randomly recruited in a voluntary pool of subjects including

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[11] To subtract money, each subject has three alternatives. First they can choose to subtract an amount from one of other subjects and pay for this. They can choose to subtract 1$ with probability 0.25 from one other subject and pay nothing. And finally they can choose to do nothing.

[12] Close to this paper, we can also quote Zizzo and Oswald (2001). In which subjects can reduce others' income after betting on a gamble. But this paper suffers from the same problem as Rustichini and Vostroknutov (2010). Zizzo (2003) rectifies the problem of strategic interaction and finds less destruction.

[13] In his experiment a subject is said to experience envy when his satisfaction decreases after exposure to unflattering social comparison. We chose the same definition of envy.

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more than 4000 candidates for experiments. Subjects were mainly students from both sexes, different ages (from 18 to 26 years old) and universities (scientific or not). We ruled 12 sessions of *Luck* condition and 10 sessions of *Effort* condition. On aggregate, 382 subjects participated in our experiment.

We phrased both instructions and game as neutrally as possible (i.e. avoiding any suggestive terms such as opponent, destruction...).[15] All instructions were computerised and displayed during the experiment. We chose to display instructions during the experiment for two main reasons: First because we did not want subjects to know that they will evaluate their satisfaction and so to anticipate their future satisfaction. Second because the game was very easy to understand and thus could be made in very brief time (average time was 35 minutes for a session including payment). As instructions were displayed step by step, we did not check subjects' understanding of the procedures. Nevertheless subjects were informed that they could ask privately understanding questions to a monitor by raising their hands at every moment of the experiment.

Participants were randomly assigned to one of the two possible roles: player A and B. Roles assignments were kept constant throughout each session. There was an identical number of players A and B in each session. After roles assignment each player A was randomly paired with a player B.

To determine the impact of effort on subjects' satisfaction and behaviour, we implemented two conditions: the *Luck* condition (*Luck* thereafter) and *Effort* condition (*Effort* afterwards). Subjects could only participate in one condition. In both conditions, all subjects knew, at the beginning of the experiment, that endowments ranged from 4€ to 32€ (in integer amounts). The difference between these two treatments relies on how endowments are attributed to subjects. In *Luck*, the computer randomly drew endowments and randomly attributed them to subjects whereas in *Effort* the endowment allocated to each player depended on each player's effort.[16] The effort task consisted in clicking on a mouse under time pressure (1 minute): the more they clicked the higher their endowment (see Appendix C).[17] In *Effort*, subjects were, after clicking on their mouse, only informed of their own performance (i.e. number of clicks made).

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[15] Versions of the instructions are supplied in appendix A (for *Luck*) and B (for *Effort*).
[16] Players were informed that endowments are randomly attributed but they ignored that endowments also depended on roles. In both conditions, players A could receive an endowment of 4€ or 16€ and players B could receive an endowment of 8€, 20€ or 32€. In *Luck,* endowments were randomly allocated. In *Effort*, relying on pilot sessions we could set a certain number of clicks as thresholds. More precisely above 230 clicks players A obtained 16€ and below that threshold they obtained 4€. Concerning players B we established two thresholds (below the first threshold players B received 8€, between the first and the second threshold they received 20€ and above the second threshold they received 32€). Thresholds were kept constant in all sessions of *Effort*.
[17] We deliberately chose a one-minute time limit so as to allow comparisons between *Luck* and *Effort* conditions both from an affective and behavioural perspective.

Subjects were also informed that only participants in the role of player A could make a decision and had to participate in the next steps. While players A were doing the experiment, players B were invited to remain silent and were only informed of their final payoff (they were not informed about the decision players A could make).

The following instructions are the one presented to players A. Note that players A had to confirm each decision they took.

The experiment was single shot and consisted in a succession of six steps (only players A are concerned with these steps). The experiment was identical in both sessions except that in *Effort*, previous to step 1, subjects had to perform a task that consisted in clicking on a mouse during 1 minute so as to determine their endowments.

> Step 1: Each player A was informed about his monetary endowment expressed in Euros. The endowment varied according to the treatment (see Table 1).
>
> Step 2: Player A was invited to evaluate and to report his satisfaction level relative to his endowment.[18] To do so, subjects were asked to move a slider on a graduated scale ranging from -50 to +50. At the left extreme of the scale (-50), the slider indicated the state "*Extremely Dissatisfied*" and at the other extreme (+50) the slider indicated the state "*Extremely Satisfied*". The middle position was valued by 0 and indicated "*Neither satisfied nor dissatisfied*" (see appendix). The value of the slider was indicated in a table (see Appendix D).
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> Step 3: The endowment of player B was communicated to player A, revealing that their own endowment is lower.
>
> Step 4: Player A was asked again to evaluate his satisfaction, by using the same device as in Step 2.[19]

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[18] The use of self-report methods is acknowledged to be a reliable method. First, methods based on self-report measures are often used by emotion theorists and recurrent in happiness research and psychology. Second, the satisfaction evaluation procedure did not affect subjects' payoffs. Thus there were neither financial incentives for subjects to report to be satisfied or dissatisfied nor incidence of their reported satisfaction (or dissatisfaction) on subjects' payoffs. Third, recent studies have proved that results provided using self-report methods are supported, and thus reliable, by results supplied using physiological measures (Ben-Shakhar et al., 2007). Finally, Kahneman and Tversky (1979) argued that "*subjects have no special reason to disguise their true preferences*" (p. 265).

[19] There could be an order effect: the second evaluation is conditional to the first one and therefore results may have been very different by asking first to the subject how satisfied he feels after being knowing others' endowments and then how satisfied he feels after being informed of his own endowment. We chose this procedure for two main reasons. First because this procedure suited perfectly for identifying envy that consists

Step 5: Each player A was informed that he has the opportunity to reduce player B's endowment (see Appendix E). If player A decided not to reduce player B's endowment the experiment ended and each member of the pair received his endowment as a final payoff. If player A decided to reduce player B's endowment, the game moved to Step 6. At this stage of the game, the player was neither informed about the cost of reducing the opponent's endowment nor the amount of reduction. We chose to do so in order to differentiate subjects who were willing to reduce others' income from those who were not.

Step 6: Player A had to indicate by how much he wanted to reduce player B's endowment. Player A had to choose an integer amount between 1 to 10 units. As the subject had to confirm his decision, he clearly announced his willingness to reduce his opponent's endowment. As a consequence we did not allow null reductions. Each possible amount cut player B's endowment by some fraction (depending on the treatment) and involved a cost for player A. Both the amount of reduction and the cost for reducing varied depending on the scenario subjects are placed in (see Table 1). We set the cost of reduction so as to allow comparisons in terms of actions undertaken by players A between subjects. To fulfil that purpose, the cost of reduction represented the same weight in player A's initial endowment for each subject. Then in order to reduce his opponent's endowment by 1 unit each player A had to sacrifice 2.5% of his initial endowment. Hence to equalise endowments, each player A had to give 25% of his initial endowment. If player A chose the maximum of 10 units, the final payoff of the two players were equalised. For a lower amount, player B's payoff remained larger than player A's payoff. We chose to do so as not to exert players A from investing the maximum allowed in order to have a superior payoff than players B. Player A could simulate the impact of his decision on the final payoffs of each member of the pair.

At each step, a table summarised information from previous steps: subject's performance (only for *Effort*) subject's endowment, the value given at the first evaluation, the opponent's endowment and the value given at the second evaluation.

As players A could only obtain 4€ or 16€ and players B 8€, 20€ and 32€ and as we focus on unfavourable situations (i.e. when player A has an inferior endowment), there are only 5 possible

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in a sort of dissatisfaction at the sight of others' good fortunes and advantages. Then because we used a very similar procedure to the one used by Miles and Rossi (2007) who test for an order effect. Miles and Rossi (2007) reverse the order of the questions and found that, whatever the order of the questions, results remain robust. They replicate this procedure in two different countries and found no significant differences.

scenarios: A (4€; 8€), B (4€; 20€), C (4€; 32€), D (16€; 20€) and E (16€; 32€).[20] Thanks to these five allocations we can disentangle the impact of absolute inequalities (referring on the gap between players' endowments measured in absolute terms) from the impact of relative ones (it refers to the gap between players' endowments measured in relative terms). For illustration, in scenario A, the absolute difference equals 4€ whereas the relative difference equals 2. Passing from A to E involves two changes: absolute difference increases (equals 16€) and subjects' endowments increase (player A's receives now 16€ instead of 4€). Thus implementing other scenarios allow us to control for absolute and relative difference and to investigate the impact of both differences on individual well-being and behaviour.[21]

Table 1: Parameters used in the experiment.

Scenario	Player A's endowment	Player B's endowment	Absolute difference	Relative difference	Cost of reduction	Amount of reduction
A	4€	8€	4	2	-0.1×e	-0.5×e
B	4€	20€	16	5	-0.1×e	-1.7×e
C	4€	32€	28	8	-0.1×e	-2.9×e
D	16€	20€	4	1.25	-0.4×e	-0.8×e
E	16€	32€	16	2	-0.4×e	-2×e

Note: e represents the amount invested by the subject in reduction decisions, $e \in [1; 10]$. The cost of reduction represents the cost players A had to give for each unit invested in reduction decisions (i.e. for each e). The amount of reduction captures by how much player B's endowment decreases for each unit invested in reduction decision. Then, in scenario C, a player A willing to invest 4 units in reducing player B's endowment will have to incur a cost of 0.4€ (4×0.1) and player B's will incur a loss of 11.6€ ($4 \times (-2.9)$).

4. Behavioural predictions

In this section we present the research hypotheses and expected results from our experiment. We first develop conjectures about the connection between effort and social comparison (H1), then we present assumptions concerning the effect of effort on envy (H2) and concerning the correlation between effort and individual behaviour (H3). Finally we expand our research hypotheses related to the impact of inequalities on both individual well-being and behaviour (H4). From now, by using the term "*subjects*" we refer to players A and to players B by using the term "*opponents*".

H1: Effort and social comparisons.

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[20] We exclude of our analysis data from the scenario (16€ ; 8€).

[21] Then absolute difference equals to ($Player\ B's\ endowment - Player\ A's\ endowment$) and relative difference corresponds to ($Player\ B's\ endowment / Player\ A's\ endowment$).

H1a: Exposure to social comparison affects individual well-being.

Social comparison is a deep rooted human behaviour and has a key role on self-evaluation. One can derive useful information from social comparisons. Social comparisons constitute useful devices so as to build inferences about one self (Festinger, 1954; Heider, 1958). They also contribute to ability assessment that can help in augmenting or damaging our self-esteem (Ben Ze'ev, 2000; Festinger, 1954). Social comparisons can have a positive impact on self-evaluation when they lead to a flattering diagnostic (e.g. success or superiority) but they can alter dramatically one self-evaluation if they lead to an unflattering diagnostic (e.g. failure or inferiority). Besides, social comparisons can also serve in identifying what ingredients are required for obtaining success or for improving one's performance (Collins, 1996). Social comparisons have also a key role on satisfaction: satisfaction judgements result from the existing differences between one's situation and the situation of one's reference group that can be constituted by a single person, a group of persons, personal aspirations... (Michalos, 1985). Finally, previous results from happiness studies (Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005; Luttmer, 2005) and from experimental investigations (Celse, 2009; Miles and Rossi, 2007) convey that social comparisons affect significantly individual satisfaction. In Miles and Rossi (2007), after giving information about the wage offered to another classmate (whether superior or inferior to the subject's wage), the great majority of subjects reported changes in their satisfaction. We assume that most subjects will report a different satisfaction level after being informed of their opponent's endowment than the one reported after learning their own, whatever the condition subjects participate in. Hence, we expect that the proportion of subjects reporting changes in their satisfaction after being exposed to social comparison is higher than the proportion of subjects not reporting changes in their satisfaction.

H1b: The introduction of effort does not modulate the impact of social comparison on individual well-being.

As mentioned previously, social comparisons are inherent to human nature and fulfil essential objectives. There are no reasons to anticipate that effort will strengthen or weaken the impact of social comparisons on subjects' satisfaction. We thus make the following conjecture: the proportion of subjects reporting changes in their satisfaction is not different between *Luck* and *Effort* conditions.

H2: Effort, envy and individual satisfaction.

H2a: Unflattering social comparisons affect negatively individual well-being and generates envy.

Social comparisons leading to a diagnostic of inferiority or failure are experienced negatively and even painfully from subjects' perspective. Unfavourable social comparisons are considered as painful experiences because they reveal one's relative inferiority and, as a consequence, they generate feelings of ill-will and inferiority. These feelings have very negative consequences on one's self-evaluation and self-esteem (Collins, 1996; Festinger, 1954; Heider, 1958; Smith et al., 1994). As mentioned previously, we implement an experimental design so as to investigate the impact of effort on envy. Envy can be roughly pictured as a form of painful sadness caused by the awareness of others' relative advantages (Ben Ze'ev, 1992, 2000; Celse, 2010; D'Arms, 2002; D'Arms and Kerr, 2008; Smith and Kim, 2007). Hence in our experiment, a subject reporting a decrease in his satisfaction after being informed of his opponent's higher endowment may indicate to be experiencing envy. Psychological researches convey that the experience of envy has very negative consequences on one self-esteem (Testa and Major, 1990; Smith and Parrott, 1988; Smith et al., 1994). Besides, results from previous experiments strengthen the negative affective consequences of unflattering social comparisons. Bault et al. (2008) reveal that subjects report to experience situations in which their opponent received a superior payoff as the worst situation. Miles and Rossi (2007) and Celse (2009) convey that reported subjective well-being shrinks when subjects are exposed to disadvantageous social comparisons. As our experimental design is close to the latter, we might look forward to observe such a similar result. We expect that the proportion of subjects reporting a decrease in their satisfaction after learning the opponent's higher endowment is higher than the proportion of subjects reporting an increase or no change in satisfaction.

> *H2b: Envy is amplified by effort: the negative impact of unfavourable social comparisons is strengthened through effort.*

Besides, relying on emotion theory, effort is acknowledged to amplify emotions (Ben Ze'ev, 2000; Ortony et al., 1988) and more precisely negative ones (van Dijk et al., 1999; Wyer and Srull, 1989). Hence, based on emotion theory, we predict that the proportion of subjects reporting a decrease in their satisfaction after learning the opponent's endowment would be higher through effort. In other words, we conjecture that there are significantly more subjects reporting negative changes in their satisfaction after being exposed to unflattering social comparison in *Effort*.

H3: Effort, envy and individual behaviour.

> *H3a: Envy explains reduction decisions: a subject is more likely to reduce his opponent's endowment if social comparison affects negatively his satisfaction.*

Although standard economic theory neglects the role of emotions, they are known to have a significant influence on individual behaviour (Camerer et al, 2005 ;Elster, 1998; Hume, 1991). Bosman and van Winden (2002) and also Bosman et al. (2005) convey that emotions constitute a good predictor of individual behaviour: subjects reporting to experience high levels of emotions are likely to destroy their endowment in a power-to-take game. Envy is acknowledged to be a powerful micro-motivation leading to action (Ben Ze'ev, 2000; Smith and Kim, 2007). As a consequence, we expect that if envy explains why subjects report a decrease in their satisfaction after being exposed to social comparison, subjects, motivated by envy (i.e. reporting a decrease in their satisfaction after exposure to social comparison), might be more prone to undertake destructive decisions.

> *H3b: Effort amplifies envy and thus subjects' decisions to reduce others' income.*

As mentioned previously, emotion theorists consider that effort modulates the intensity of emotions and that more effort generates more negative emotions (Ben Ze'ev, 2000; Lazarus, 1991; Ortony et al., 1988; Wyer and Srull, 1989). [22] As emotions are acknowledged to induce specific behaviour, more effort will intensify emotions and their impact on individual behaviour. Hence, relying on emotion theory, we assume that, as endowments depend on individual effort, subjects might experience more intense emotions like envy and might be more prone to reduce their opponent's endowment (H3b). To our knowledge, there are few experiments conveying this connection (van Dijk et al., 1999). We thus assume that there will be more reduction decisions in *Effort* rather than in *Luck*.

> *H3c: Effort is associated to fairness and thus discourage subjects' decisions to reduce others' income.*

Nevertheless, we can make an opposite prediction if we refer to equity theory. According to Equity theory, more precisely to Theory of Desert (Buchanan, 1986), fairness is related to effort. Several quasi-experiments as well as laboratory experiments convey the existence of a connection between fairness and effort. With regard to their results, it sounds like individuals' definition of fairness is deeply associated with the notion of effort (Burrows and Loomes, 1994; Dickinson and Tiefenthaler, 2002; Hoffman and Spitzer, 1985; Lieventhal and Michaels, 1971; Ruffle, 1998; Schokkaert and Capeau, 1991). [23] More precisely, they observe that, from the subject's perspective, a situation or an allocation is considered as fair when the distribution of income depends on the agent's effort or performance (even if situations are characterised by unequal outcomes). Hence equity theory

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[22] Wyer and Srull (1989) underline that the amplification role of effort is particularly true when efforts are invested in vain.

[23] Scholars also convey that fairness is related to efficiency (Andreoni and Miller, 2002; Charness and Grosskopf, 2001; Charness and Rabin, 2002; Kritikos and Bolle, 2001) but we restrict our analysis on the connection between fairness and effort.

suggests that inequalities generated by effort are socially accepted. As a consequence, as endowments depend on individual effort, we might expect subjects to consider inequalities as fair and not to decide to reduce their opponent's endowment (H3c). This does not implies that were be less envy. Subjects can still suffer from envy but as inequalities depend on each individual's performance, they are more prone to accept these inequalities and less tempted to reduce others' income. Then we guess that there will be more reduction decisions in *Luck* rather than in *Effort*.

H4: Inequalities, individual satisfaction and behaviour.

> *H4a: When exposed to unflattering social comparison, individual satisfaction is negatively correlated to the opponent's endowment.*

Previous results both from happiness studies (Ferrer-i-Carbonell, 2005; Luttmer, 2005) and from experimental studies (Celse, 2009) convey that as the referent group's income increases, individual well-being decreases. Relying on these results, we conjecture that as the opponent's endowment increases, reported satisfaction decreases. We set the distribution of endowments so as to investigate the impact of inequalities measured both in absolute and in relative terms on individual satisfaction.

> *H4b: When inequalities between subjects' endowments increase, the probability for a subject to reduce his opponent's endowment decreases.*

The notion of "*sense of alteration*" introduced by Ben Ze'ev (1992, 2000) suggests that social emotions (i.e. emotions triggered by social comparison) are always more intense when differences between subjects are low. This notion captures the reality of every change perceived by the subject and explains that slight changes have more emotional impact because they can alter even dramatically the subject's position and self-esteem (e.g. the subject can pass from a superior position to an inferior one). Indeed as differences between subjects increase (resp. decrease), similarities between them become less (resp. more) obvious, social comparisons are less (resp. more) self-relevant and have less (resp. more) emotional impact. Referring on this notion, we assume that subjects are more prone to undertake destructive decisions in presence of slight differences (absolute or relative)(H4b). The polarization theory (Montalvo and Reynal-Quenol, 2005; Ostby, 2008) also supports this view. This theory postulates that conflicts between groups are more likely to emerge when opposing two similar groups. As similarities are less evident, the probability to engage in conflict decreases. The few experiments related to this issue strengthen the hypothesis (Abbink et al., 2008; Celse, 2009).

5. Results

We analyse the results in two steps. First we present results relative to individual well-being (results 1 to 3) and then we detail those dealing with individual behaviour, i.e. decisions to reduce income(results 4 to 6). We first announce the result and then develop it.

Result 1 : The majority of subjects reports changes in their satisfaction after exposure to social comparisons.

Support: As Table 2 shows, both in Luck and Effort conditions almost 80% of subjects report a different level of satisfaction after learning the opponent's endowment from the satisfaction level reported after being informed of their own endowment.

The first interesting result arises from that social comparisons exert a great impact on individual well-being. On aggregate (i.e. cumulating data from both conditions) 79.89% of subjects indicate that others' endowments affect their satisfaction. We observe that, whatever the condition subjects are placed in (*Luck* or *Effort*), the great majority of them report their satisfaction to be affected, whether positively or negatively, by learning their opponent's higher endowment.

Indeed when endowments are randomly attributed (*Luck*), 87 subjects out of 109 report changes, whether positive or negative, in their satisfaction after being exposed to an unfavourable social comparison. Although, in *Effort*, endowments are attributed according to each subject's effort, we observe the same result as in *Luck*: 60 subjects out of 75 report their satisfaction to be affected by learning the opponent's endowment. Both in *Luck* and *Effort* conditions, there are significantly more subjects reporting changes in their satisfaction than subjects not reporting changes in their satisfaction ($p < 0.01$, two-sample test of proportions). This result suggests that the way endowments are attributed seems to have no effect on subjects' sensitivity to unflattering social comparisons. Hence individual well-being depends largely on others' income. This result supports H1a and corroborates quoted studies suggesting that social comparison is a deep rooted human attitude.

Table 2: Number and proportion (in parentheses) of subjects reporting changes, or not, when evaluating their satisfaction.

	Luck	*Effort*	Overall
Players A reporting changes in their satisfaction	87 (79.82%)	60 (80.00%)	147 (79.89%)
Players A reporting no changes in their satisfaction	22 (20.18%)	15 (20.00%)	37 (20.11%)
Total	109	75	184

We cumulate data from both conditions and we estimate a binary logit model in order to investigate whether the introduction of effort (or others variables) has an influence on the probability for a subject's well-being to be affected by others' situations (i.e. the probability for a subject to report changes in satisfaction after exposure to social comparison). The variable $EffortIntroduction$ catches the implementation of effort and equals 1 when subjects have to make an effort so as to obtain their endowment. Results from logit estimations are given in Table 3. Only one variable has a significant effect: the relative difference between endowments which has a negative effect. As the gap between subjects' endowments measured in relative terms increases, the probability for a subject's satisfaction to be affected by learning the opponent's endowment decreases. This result corroborates hypothesis H1b and is in line with the "*sense of alteration*" theory: as relative differences increase (resp. decrease), similarities between subjects are less (resp. more) obvious and social comparisons are less (resp. more) self-relevant and thus have less (resp. more) emotional impact. Results from logit estimations also indicate that the introduction of effort does not change subjects' awareness to others' situations and income.

Table 3: Results from Logit estimations concerning the probability to report changes in satisfaction after exposure to social comparison (*Luck* and *Effort* conditions).

Logit Regression (*Luck* and *Effort* conditions)

Nb.Obs   184

Adj-R Squared: 0.0273

Dependent Variable: Individual well-being is affected by social comparison ($Eval1 \neq Eval2$).

Independent variables	Coefficients (std. errors)
X_A (Subject's endowment)	- 0.044 (0.057)
$EffortIntroduction$ (Introduction of effort)	0.406 (0.457)
D_R (Relative difference)	- 0.731* (0.416)
D_A (Absolute difference)	0.100 (0.066)
$TpEval1$ (Time for first evaluation)	0.0001 (0.011)
$TpEval2$ (Time for second evaluation)	- 0.006 (0.016)
Constant	2.558 (1.077)

Note: * indicates significant at 0.1 level; ** significant at 0.05 level and *** significant at 0.01 level. The probability modelled is the subject's well-being is affected by social comparison ($Eval1 \neq Eval2$). The dependent variable equals 1 when the subject reports changes in his satisfaction after exposure to social comparison. X_A denotes the subject's own endowment. D_A (resp. D_R) represents the difference between the subject's endowment and the opponent's endowment measured in absolute terms (resp. in relative terms). TpEval1 (resp. TpEval2) denotes the time subjects took for first (resp. second) evaluation. The variable $EffortIntroduction$ catches the introduction of effort (it differentiates observations of $EffortIntroduction$ from those of *Luck*). $EffortIntroduction$ equals 0 if the subject participate in *Luck*. Using subjective data, the typical order of magnitude or the R-Squared is relatively low (ranging from 8% to 20%) and level of significance are lower (Senik, 2005).

Result 2 : Exposed to disadvantageous social comparisons, one subject out of two reports a decrease in his satisfaction.

Support: As Table 4 shows, in both conditions the majority of players A reports their satisfaction to be negatively affected by learning their opponent's higher endowment.

On aggregate (i.e. cumulating data from both conditions) 54.89% of subjects report an inferior satisfaction level after being informed of their opponent's endowment than the one reported after learning their own endowment (see Table 4). Hence individual well-being shrinks for the majority of subjects after exposure to unflattering social comparison. A decrease in satisfaction means that individual well-being is negatively affected by others' situations. This might be explained by the experience of negative emotions such as envy. On aggregate, the proportion of subjects reporting negative changes in their satisfaction is significantly higher than the proportion of subjects reporting positive changes or no changes (resp. $p < 0.01$ and $p < 0.01$, two-sample test of proportions). Conversely, on aggregate, we do not find any significant differences when we compare the proportion of players reporting positive changes and no changes in their satisfaction ($p > 0.05$, two-sample test of proportions).

Without distinction on how endowments are attributed, the majority of subjects indicates their satisfaction to be negatively affected by learning others' higher endowments. Indeed in both conditions, 1 subject out of 2 signals that exposure to unfavourable social comparison has a negative effect on individual well-being (55.05% in *Luck* and 54.67% in *Effort*). In both conditions, there are significantly more subjects signaling their satisfaction to be negatively affected by social comparison than subjects reporting positive or no changes in their satisfaction (resp. $p < 0.01$ and $p < 0.01$, two-sample test of proportions). The proportion of subjects reporting a decrease in their satisfaction after knowing the opponent's endowment is not significantly different between *Luck* and *Effort* ($p > 0.05$, two-sample test of proportions). Besides, there are no significant differences concerning the proportion of subjects reporting positive changes or no changes in their satisfaction between the two conditions (resp. $p > 0.05$ and $p > 0.05$, two-sample test of proportions). Finally, in *Luck*, the proportion of subjects that reports an increase in satisfaction is not significantly different from the proportion of subjects reporting no changes in satisfaction ($p > 0.05$, two-sample test of proportions). The same conclusion is drawn in *Effort*.

Table 4: Number and frequency of changes (according to direction) and no changes in satisfaction.

Direction of changes	*Luck*	*Effort*	Overall
Negative changes in satisfaction	60 (55.05%)	41 (54.67%)	101 (54.89%)
No changes in satisfaction	22 (20.18%)	15 (20.00%)	37 (20.11%)
Positive changes in satisfaction	27 (24.77%)	19 (25.33%)	46 (25.00%)
Total	109 (100.0%)	75 (100.0%)	184 (100.0%)

Again we estimate a binary logit model in order to investigate if the introduction of effort or other variables have an impact on the probability for a subject to report a decrease in his satisfaction (i.e. to experience envy) after being informed of his opponent's endowment. Results from logit estimations are given in Table 5 and convey that the subject's own endowment has a significant and positive impact. A subject is more prone to report a decrease in his satisfaction after exposure to social comparison when the subject's endowment increases. The result seems at first sight surprising but the negative correlation between individual income and the probability for a subject to report positive changes in his satisfaction corresponds to the idea that subjects, as individual wealth increases, allow more importance on others' situations and income rather than on their own income (Celse, 2009; Layard, 2005). [24] As in result 1, the introduction of effort has no significant effect on individual well-being: it does not affect the probability for a subject to report a decrease in his satisfaction after exposure to unfavourable social comparison.

Table 5: Results from logit estimates concerning the probability for an individual to report a decrease in his satisfaction after exposure to social comparison (*Luck* and *Effort* conditions).

Logit Regression (*Luck* and *Effort* conditions)

Nb.Obs   184

Adj-R Squared: 0.0954

Dependent Variable: Individual well-being is negatively affected by social comparison ($Eval1 > Eval2$).

Independent variables	Coefficients (std. errors)
X_A (Subject's endowment)	0.104** (0.049)
$EffortIntroduction$ (Introduction of effort)	0.078 (0.941)
D_R (Relative difference)	- 0.139 (0.359)
D_A (Absolute difference)	0.037 (0.053)
$TpEval1$ (Time for first evaluation)	- 0.009 (0.009)
$TpEval2$ (Time for second evaluation)	0.005 (0.014)
Constant	-0.850 (0.941)

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[24] For further evidence of such effect, see next result.

Note: * indicates significant at 0.1 level; ** significant at 0.05 level and *** significant at 0.01 level. The probability modelled is the subject's well-being is negatively affected by social comparison ($Eval1 > Eval2$). The dependent variable equals 1 when the subject report a decrease in his satisfaction after learning his opponent's endowment. The variable $EffortIntroduction$ catches the introduction of effort (it differentiates observations of *Effort* from those of *Luck)*. $EffortIntroduction$ equals 0 if the subject participate in *Luck*.

Hence exposure to disadvantageous social comparison affects negatively individual well-being. The satisfaction subjects derive from unflattering social comparisons is not affected by how endowments are attributed (as observed in previous result). Besides the introduction of effort does not affect the probability for a subject to experience envy. Hypothesis H2a is validated while hypothesis H2b is not.

Result 3 : In both conditions, individual satisfaction is significantly and negatively correlated both to the subject's and to the opponent's endowments.

Support: Tables 6 and 7 report the results from PLS regressions made on the satisfaction subjects derive from social comparisons.

We investigate the determinants of individual well-being in both conditions. To fulfil that objective we order *Partial Least Square* (PLS) regressions for each condition separately. [25] We build a variable, entitled $Diffeval$ which captures the impact of social comparisons on individual satisfaction. $Diffeval$ is made by subtracting the two reported levels of satisfaction. [26] In other words $Diffeval$ catches the direction (positive or negative) and the intensity of the satisfaction subjects draw from social comparisons. $Diffeval$ is positive (resp. negative) when the level of satisfaction reported at the second evaluation is higher (resp. lower) than the one reported at the first evaluation. If $Diffeval$ is positive (resp. negative), it indicates that the subject reports an increase (resp. a decrease) in his satisfaction after learning the opponent's endowment: the subject reports to be more (resp. less) satisfied, or less (resp. more) dissatisfied, after being informed of his opponent's endowment.

When endowments are given like manna from heaven (*Luck*), we observe from Table 6 that three variables are significantly and negatively correlated to the satisfaction subjects derive from social comparisons: the subject and the opponent's endowments and the absolute difference between endowments. Hence when one of these three variables increases, $Diffeval$ decreases. Subjects derive lower satisfaction from social comparisons if any of these variables increases. If the negative relationship between $Diffeval$ and the opponent's endowment (and also the negative relationship

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[25] PLS regression is a method based on the construction of orthogonal factors in order to improve the quality of the model (Tenenhaus, 1998). It suits perfectly for constructing predictive models when the factors are highly collinear and enables regressions without excluding linear variables. Indeed when factors are collinear, *Multiple Linear Regression* is inappropriate. Many variables from our experiment suffer from collinearity. Through ordering PLS regressions, we can observe the importance of each variable on predicting the response.

[26] $Diffeval = satisfaction\ reported\ at\ 2nd\ evaluation - satisfaction\ reported\ at\ 1st\ evaluation.$

between $Diffeval$ and absolute difference) was expected by referring to results from happiness studies (Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005; Luttmer, 2005), the negative correlation between $Diffeval$ and individual income seems more surprising. [27] This suggests that above a certain level of income, subjects put a larger weight on others' situations and allow more importance to others' income and to existing differences rather than to their own income. [28]

Table 6: Results from PLS regression (variable of importance, weight and direction of the relation) on the satisfaction subjects derive from social comparisons (*Luck*).

PLS regression (*Luck*)

Nb. Obs : 109

Adj-R Squared: 0.1074

Dependent Variable: $Diffeval = Eval2 - Eval1$

Independent variables	Model effect weights (vector Wh*)	Model effect loadings (Vector Ph)	Variable Importance for Projection (VIP)	Unstandardised regression parameters
X_A (Player A's endowment)	- 0.538	- 0.547	1.319*	- 0.473
X_B (Player B's endowment)	- 0.622	- 0.625	1.523*	- 0.313
D_R (Relative difference)	- 0.007	0.006	0.017	- 0.107
D_A (Absolute difference)	- 0.555	- 0.551	1.359*	- 0.496
$TpEval1$	0.114	0.069	0.280	0.026
$TpEval2$	0.040	0.041	0.099	0.014
Constant				6.993

Note: Vectors Wh* (weighting vectors) consist of the weight given to each spectral variable in the computation of the latent variable. Vectors Wh* point out the importance of each explanatory variable in explaining each factor (latent variable). Vectors Ph reflect the correlation between latent variables and explanatory variables: they indicate the direction of the connection. The VIP (Variable Importance for Projection) indicates the importance of each explanatory variable both to explain latent variables and to correlate dependent variable. Important (resp. unimportant) explanatory variables possess VIP values larger (resp. lower) than 1 (resp. 0.5). X_B denotes player B's endowment.

When endowments are attributed in proportion to each subject's effort (*Effort*), PLS regressions convey that individual effort (i.e. number of clicks made by the subject), the subject's and the opponent's endowments are significantly and negatively correlated to $Diffeval$ (see Table 7). As in *Luck*, results show that the opponent's endowments has a key role on individual well-being. As the opponent's endowment increases, subjects' satisfaction derived from social comparisons decreases. Thanks to the PLS regression method, we can investigate the relative importance of individual effort and of individual income on predicting $Diffeval$. Both are significantly and negatively correlated to

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[27] The same result is observed in Celse (2009).
[28] This result supports comments from Hirsch (1976). The latter suggest that as individual wealth increases (and as basic needs are satisfied), the portion of wealth devoted to positional goods (i.e. goods assigning status and prestige) increases.

$Diffeval$. Whereas individual income has a larger VIP value than individual effort, unstandardised coefficient of regressions convey that both variables have almost a similar effect on predicting the response (-0.209 vs. -0.174).

Table 7: Results from PLS regression (variable of importance, weight and direction of the relation) on the satisfaction subjects derive from social comparisons (*Effort*).

PLS regression (*Effort*)

Nb. Obs : 75

Adj-R Squared: 0.3453

Dependent Variable: $Diffeval = (Eval2 - Eval1)$

Independent variables	Model effect weights (vector Wh*)	Model effect loadings (Vector Ph)	Variable Importance for Projection (VIP)	Unstandardised regression parameters
X_A (Player A's endowment)	-0.552	-0.567	1.453*	-0.209
X_B (Player B's endowment)	-0.572	-0.480	1.504*	-0.217
D_R (Relative difference)	0.240	0.331	0.632	0.091
D_A (Absolute difference)	-0.114	0.010	0.300	-0.043
$TpEval1$	-0.136	-0.133	0.358	-0.051
$TpEval2$	-0.280	-0.149	0.737	-0.106
Clicks	-0.460	-0.528	1.209*	-0.174
Constant				-0.270

Note: The variable "Clicks" catches the number of clicks made by the subject and represents individual effort.

Hence, both in *Luck* and *Effort* conditions, the opponent's endowment has a key role in evaluating individual well-being. In line with results from happiness studies, we observe a negative correlation between the amount of the opponent's endowment and individual satisfaction. Results corroborate hypothesis H4a. Whereas in *Luck* the absolute difference modulates individual well-being, we do not observe such a result in *Effort*. Why individual well-being on *Luck* is significantly correlated to the absolute difference between subjects' endowments (D_A) and not in *Effort*? Maybe the focus of individual well-being is different between the two conditions. In *Effort*, the subject is focused on his own performance (that determines his endowment) whereas in *Luck* the subject has no control on his endowment, then the subject focuses more on others' endowments.

Result 4 : The proportion of reduction decisions is not significantly different between *Luck* and *Effort* conditions. Nevertheless subjects cut a significantly higher fraction of their opponent's endowment when endowments are attributed through effort.

Support: As Table 8 shows, on aggregate, 34.78% of subjects choose to reduce their opponent's endowment. Whereas a non-significantly different number of reduction decisions is undertaken in both conditions, the amount invested in reduction decisions is significantly higher when endowments are attributed through effort. From now, we will refer to the term "intensity" to represent the amount subjects invest in reduction decisions.

On aggregate, one subject out of three indicates to be willing to reduce the opponent's endowment (see Table 8). Although there are few subjects choosing to reduce others' income, this result strengthens the key role of social comparisons on individual behaviour. The exposure to social comparison and the possibility to subtract money from others seem to be sufficient conditions to exert a third of subjects to reduce others' income.

Table 8: Number (and proportion) and average intensity of reductions decisions.

Treatment	*Luck*	*Effort*	Overall
Number of Reduction decisions (proportions)	35 (32.11%)	29 (38.67%)	64 (34.78%)
Average intensity	3.34	6.41	4.73

Note: Average intensity refers to the average amount subjects invest in reduction decisions, $e \in [1; 10]$.

When endowments are randomly attributed, 35 subjects out of 109 (i.e. 32.11%) choose to reduce their opponent's endowment. When endowments are attributed according to each subject's effort, 29 subjects out of 75 (i.e. 38.67%) indicate that they are willing to reduce their opponent's endowment. Although there are proportionally more reduction decisions in *Effort* than in *Luck*, this difference is not significant (p > 0.05, two-sample test of proportions). Hence, the introduction of effort does not seem to exert more subjects to reduce others' income. To corroborate this observation, we gather data from both conditions and estimate a binary logit model in order to test whether the introduction of effort has a significant impact on the probability for a subject to engage in a reduction decision. The dependent variable $Action$ equals 1 if a subject chooses to reduce his opponent's endowment. The independent variable is $EffortIntroduction$. The binary logit model shows that the probability associated to the variable $EffortIntroduction$ (catching the introduction of effort) is not significant (p = 0.529). Although when endowments are attributed according to individual effort subjects choose more often to reduce their opponent's endowment, the introduction of effort plays no role in subjects' decisions to subtract income.

From Table 8 we observe that the intensity of reduction decisions is higher when endowments are attributed according to individual effort. Reduction decisions in *Luck* are not intense: although subjects could invest up to 10 units and thus equalise endowments, they invest, on average, 3.34

units. Conversely in *Effort,* subjects invest more in reducing their opponent's endowment: they choose to invest, on average, 6.41 units. If we take a look at the intensity of reduction decisions, results from a Kolmogorov-Smirnov test convey that the distribution of intensity of actions are different between *Luck* and *Effort* (p = 0.003, Kolmogorov-Smirnov test for equality of distribution). More precisely, subjects cut a significantly higher fraction of their opponent's endowment when endowments are attributed through effort (p = 0.0008, two sided Mann-Whitney). Hence, reduction decisions are significantly more intense in *Effort*. Although the introduction of effort does not exert more subjects to reduce their opponent's income, it pushes subjects to cut a higher portion of their opponent's endowment.

We order *Partial Least Square* regressions (PLS) in order to identify the variables that are correlated to the intensity of reduction decisions in both conditions.[29] Results from PLS regressions are given in Table 9 for *Luck* and Table 10 for *Effort*. When endowments are randomly attributed, we observe that the intensity of destructive decisions is significantly and negatively correlated to the gap between subjects' endowments measured both in absolute and relative terms. Hence as the distance between subjects' endowments decreases subjects invest more when reducing income. This result corroborates the "*sense of alteration*" theory: as similarities between subjects are less evident (inequalities increase), emotions are experienced less intensively, have less incidence on individual behaviour and thus turn subjects to cut a fewer fraction of income. PLS regressions also underline that the intensity of negative actions is negatively correlated to $Diffevalabs$. This variable catches the intensity of changes in satisfaction.[30] Hence, in *Luck*, subjects reporting slight changes in satisfaction cut a higher fraction of the opponent's endowment.

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[29] Again, as variables are highly collinear we cannot implement *Multiple Linear Regressions*.
[30] $Diffevalabs = |Diffeval|$

Table 9: Results from PLS regression on the intensity of reduction decisions (*Luck*).

PLS regression (*Luck*)

Nb. Obs : 35

Adj-R Squared: 0.1698

Dependent Variable: Intensity of reduction decision ($e, e \in [1; 10]$)

Independent variables	Model effect weights (vector Wh*)	Model effect loadings (Vector Ph)	Variable Importance for Projection (VIP)	Unstandardised regression parameters
X_A (Player A's endowment)	0.240	0.123	0.679	0.041
X_B (Player B's endowment)	-0.160	-0.275	0.453	-0.016
D_R (Relative difference)	-0.696	-0.662	1.969*	-1.751
D_A (Absolute difference)	-0.500	-0.579	1.416*	-0.083
$Diffeval$ (= $Eval2 - Eval1$)	0.190	1.133	0.537	0.005
$Diffevalabs$ (= $|Eval2 - Eval1|$)	-0.377	-0.379	1.086*	-0.014
$TpEval1$	-0.045	-0.122	0.128	-0.002
$TpEval2$	-0.003	-0.123	0.009	-0.000
Constant				7.239

In *Effort*, the intensity of negative actions is significantly and negatively correlated to the time subjects take for their first satisfaction evaluation and to the subject's own endowment. The intensity of negative actions is also significantly and positively correlated to the satisfaction subjects derive from social comparisons (captured by the variable $Diffeval$) and to the relative difference (i.e. difference captured by the ratio between subjects' endowments).

Table 10: Results from PLS regression on the intensity of reduction decisions (*Effort*).

PLS regression (*Effort*)

Nb. Obs : 29

Adj-R Squared: 0.3211

Dependent Variable: Intensity of reduction decisions ($e, e \in [1; 10]$)

Independent variables	Model effect weights (vector Wh*)	Model effect loadings (Vector Ph)	Variable Importance for Projection (VIP)	Unstandardised regression parameters
X_A (Player A's endowment)	-0.409	-0.478	1.163*	-0.134
X_B (Player B's endowment)	-0.100	-0.144	0.286	-0.033
D_R (Relative difference)	0.391	0.430	1.114*	0.087
D_A (Absolute difference)	0.267	0.278	0.759	0.128
$TpEval1$	-0.553	-0.095	1.573*	-0.181
$TpEval2$	-0.275	-0.365	0.783	-0.090
$Diffeval$ $_{(= Eval2 - Eval1)}$	0.537	0.341	1.527*	0.176
$Diffevalabs$ $_{(= |Eval2 - Eval1|)}$	-0.087	-0.095	0.249	-0.028
$Clicks$	-0.179	-0.350	0.510	-0.058
Constant				1.816

Note: The variable $Clicks$ catches the number of clicks made by the subject (i.e. subject's performance).

In *Effort*, the negative correlation between the intensity of reduction decisions and the time taken during the first satisfaction evaluation procedure can be considered as an additional evidence for the experience of negative emotions (e.g. envy). Negative emotions (such as anger, disappointment, frustration or envy), despite of arising quickly, are acknowledged to be experienced very intensively and for having a strong influence on individual behaviour (Ben Ze'ev, 2000; Bosman and van Winden, 2002; Bosman et al., 2005; van Dijk et al., 1999; Lazarus, 1991; Ortony et al., 1988; Wyer and Srull, 1989). Hence a subject that takes little time for evaluating his satisfaction is ought to experience negative emotions. This could explain why subjects taking little time for evaluating their satisfaction invest more when subtracting income from their opponent's endowment: they are consumed by negative emotions like envy or disappointment (see subsequently).

A striking result arises from the positive correlation between the intensity of reduction decisions and the satisfaction subjects derive from unflattering social comparison. It indicates that as subjects derive satisfaction from social comparison they cut a higher fraction of their opponent's endowment when reducing income (see Table 11). Indeed, in *Effort*, the intensity of reduction decisions engaged by subjects reporting a decrease in their satisfaction is significantly lower than the intensity of destructive actions from subjects reporting an increase in their satisfaction (p = 0.054, two sided

Mann-Whitney). There are no other significant differences concerning the intensity of reduction decisions in *Effort*. This corroborates results from PLS regressions. [31]

Table 11: Average intensity of reduction decision according to direction of changes in satisfaction.

	Luck	*Effort*
Subjects reporting negative changes in satisfaction	3.05	5.17
Subjects not reporting changes in satisfaction	3.83	7.17
Subjects reporting positive changes in satisfaction	3.86	7.36

To summarise, we observe that effort affects partially individual behaviour. Effort does not exerts more subjects to destroy others' income but it induces subjects to destroy a higher portion of others' income. Indeed when endowments are attributed according to individual effort, subjects do not take more destructive actions but they take more intense ones, i.e. they destroy a higher part of their opponent's endowment. These results do not support hypothesis H3c and partially validate H3b. We also find some evidences in *Luck* for hypothesis H4b (see discussion section for *Effort*).

Result 5 : The majority of reduction decisions is engaged by subjects that report their satisfaction to be affected by others' situation. Although in *Luck* reduction decisions are mostly undertaken by subjects reporting a decrease in their satisfaction, we do not observe such a result in *Effort*.

Support: *Table 12 presents the number of subjects reducing income according to changes in satisfaction whereas Table 13 precises the direction of changes. As Table 13 and 14 show, in both conditions almost 8 subjects out of 10 that reduce their opponent's endowment report their satisfaction to be affected when learning their opponent's endowment. In Luck, 22 reduction decisions out of 35 are undertaken by subjects whose satisfaction is negatively affected by social comparison. Conversely, in Effort, 12 destructive actions out of 29 are the result from decisions of subjects reporting a decrease in their satisfaction.*

On aggregate, the huge majority of reduction decisions (81.25%) is engaged by subjects reporting changes in their satisfaction after being exposed to social comparison (see Table 12). We observe the same result whether endowments are attributed randomly (i.e. 82.86%) or according to individual effort (i.e. 79.31%). In both conditions, subjects that indicate their satisfaction to be affected (whether positively or negatively) by learning their opponent's higher endowment choose significantly more often to reduce the latter's endowment than subjects whose satisfaction is not

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[31] Conversely, in *Luck* subjects reporting their satisfaction to be negatively affected by social comparison do not invest significantly less than others and vice versa ($p > 0.05$, two sided Mann-Whitney).

affected by social comparisons (p < 0.01, two-sample test of proportions). The proportion of subjects reporting changes (resp. not reporting changes) in satisfaction and choosing to reduce income is not significantly different between *Luck* and *Effort* conditions (resp. p > 0.05 and p > 0.05, two-sample test of proportions). This result strengthens the key role of social comparison and their impact on individual behaviour.

Table 12: Number and proportion (in parentheses) of subjects choosing to reduce their opponent's endowment according to satisfaction.

	Luck	*Effort*	Overall
Subjects reporting changes in their satisfaction	29 (82.86%)	23 (79.31%)	52 (81.25%)
Subjects not reporting changes in their satisfaction	6 (17.14%)	6 (20.69%)	12 (18.75%)
Total number of reduction decisions	35 (100.0%)	29 (100.0%)	64 (100.0%)

Who chooses to reduce the opponent's endowment? Table 13 details the number of reduction decision according to the direction of changes in satisfaction. On aggregate, the proportion of destructive decisions engaged by subjects reporting negative changes in their satisfaction is significantly higher than the proportion of actions undertaken by subjects reporting positive or no changes in their satisfaction (resp. p < 0.01 and p < 0.01, two-sample test of proportions). No significant differences are detected between the number of destructive decisions resulting from subjects reporting an increase in their satisfaction and the number of negative actions engaged by subjects not affected by social comparisons (p > 0.05, two-sample test of proportions).

We now consider reduction decisions undertaken in *Luck*. We observe that subjects reporting their satisfaction to be negatively affected by others' situations engage in significantly more destructive decisions than those reporting positive changes or no changes in their satisfaction (resp. p < 0.01 and p < 0.01, two-sample test of proportions). Indeed, when endowments are given like manna from heaven, the majority of destructive decisions (62.86%) results from decisions of subjects reporting a decrease in their satisfaction after learning the opponent's endowment (see Table 13).

Considering behaviour in *Effort*, conclusions are less obvious. When endowments are given according to individual effort, the majority of destructive decisions is engaged by subjects reporting, after exposure to social comparison, negative changes or positive changes in their satisfaction. There are no significant differences if we compare the number of reduction decisions undertaken by subjects reporting a decrease in their satisfaction with the number of reduction decisions engaged by subjects reporting an increase in their satisfaction (p > 0.05, two-sample test of proportions). We do not

detect any significant differences when comparing the number of negative actions undertaken whatever the direction of changes in satisfaction.

In other words, subjects that report their satisfaction to be negatively affected by social comparison are ought to experience negative emotions as envy. When endowments depend on luck, envy is responsible for the majority of destructive actions (22 actions out of 35, i.e. 62.86%). When endowments depend on effort, envy is responsible for less than half the actions engaged (12 actions out of 29, i.e. 41.38%). Besides, the most surprising result arises from that, in *Effort*, 11 actions out of 29 (i.e. 37.93%) are undertaken by subjects indicating their satisfaction to be positively affected by unflattering social comparisons. In other words, in *Effort*, there are 4 actions out of 10 resulting from choices of subjects who derive satisfaction from unflattering social comparisons. This puzzling result suggests the existence of additional motives behind subjects' motivations and decisions in *Effort* (see the discussion section).

Table 13: Number and proportion (in parentheses) of reduction decisions undertaken according to direction of changes in satisfaction.

	Luck	*Effort*	Overall
Subjects reporting negative changes in their satisfaction	22 (62.86%)	12 (41.38%)	34 (53.13%)
Subjects not reporting changes in their satisfaction	6 (17.14%)	6 (20.69%)	12 (18.75%)
Subjects reporting positive changes in their satisfaction	7 (20.00%)	11 (37.93%)	18 (28.13%)
Total number of reduction decisions	35	29	64

Although in *Luck*, reduction decisions are mostly undertaken by subjects reporting negative changes in satisfaction, we observe that satisfaction fails at predicting individuals' behaviour (see Table 14). Indeed 60 subjects out of 109 report negative changes in their satisfaction after learning their opponent's endowment. Among these 60 subjects 22 choose to reduce their opponent's endowment (i.e. 36.66%). Besides 27 subjects out of 109 indicate positive changes in their satisfaction after being exposed to social comparison. Among these 27 subjects, 7 decide to reduce their opponent's endowment (i.e. 25.92%). If we compare the proportion of subjects reporting negative changes in satisfaction and choosing to reduce income with the proportion of subjects reporting positive changes in satisfaction and choosing to reduce income, we do not find any significant differences (p > 0.1 ,two-sample test of proportions).[32]

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[32] Same conclusions are drawn when comparing the proportion of subjects reporting negative changes (resp. positive) in satisfaction and choosing to reduce income with the proportion of subjects not reporting changes in satisfaction and choosing to reduce income (resp. p > 0.05 and p > 0.05, two-sample test of proportions).

In *Effort*, 41 subjects out of 75 report a decrease in satisfaction after being informed of their opponent's endowment. Among these 41 subjects, 12 choose to reduce income (i.e. 29.26%). Besides, 19 subjects out of 75 indicate an increase in satisfaction. Among these 19 subjects, 11 decide to reduce their opponent's endowment (i.e. 57.89%). If we compare the proportion of subjects whose satisfaction decreases after social comparison and that choose to reduce income with the proportion of subjects whose satisfaction increases after social comparison and that choose to reduce income, we do observe a significant difference ($p < 0.05$, two-sample test of proportions). Nevertheless there are no significant differences between the proportion of indifferent subjects choosing to reduce income and the proportion of subjects whose satisfaction increases (resp. decreases) and choosing to reduce income ($p > 0.05$ for both comparisons, two-sample test of proportions).

Hence resorting to satisfaction reports has some limit when predicting individuals' decisions to reduce income. Besides, in *Effort*, we observe that subjects reporting positive changes in satisfaction reduce significantly more income than subjects reporting negative changes.

Table 14: Proportion of subjects reducing income and according to direction of changes in satisfaction.

Direction of changes in satisfaction	Luck			Effort		
	Nb. of subjects ①	Nb. of reduction decisions ②	Proportion ②/①	Nb. of subjects ③	Nb. of reduction decisions ④	Proportion ④/③
Negative changes	60	22	36.66%	41	12	29.26%
No changes	22	6	22.22%	15	6	40.0%
Positive changes	27	7	25.92%	19	11	57.89%

Result 6 : When endowments are randomly attributed, the probability of reducing the opponent's endowment depends negatively on the relative difference (i.e. difference captured by the ratio between subjects' endowments) whereas when endowments are attributed according to individual effort, the probability of reducing depends negatively on individual effort.

Support: Table 15 (for Luck) and 16 (for Effort) report the results from logit estimations concerning the probability for a subject to reduce his opponent's income.

In result 4, we observe that the introduction of effort does not play a significant role on the probability to reduce the opponent's endowment. Thus we estimate binary logit models, for each condition separately, in order to identify the determinants of individual behaviour (i.e. subjects' decisions to reduce others' income). We observe that the parameters modulating individual behaviour are different whether endowments are attributed like manna from heaven (*Luck*) or according to individual effort (*Effort*).

In *Luck*, the probability to reduce others' income is significantly and negatively correlated to the relative difference between subjects' endowments (see Table 15).[33] In other words, as the relative difference increases the probability for a subject to engage in a reduction action decreases. When endowments are randomly attributed, we find evidences supporting the "*sense of alteration*" suggesting that social emotions have less emotional impact and thus are less prone to exert subjects to take action in presence of high differences.

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[33] Senik (2005) argue that the order of magnitude of the R-Squared and level of significance are low when using subjective data. This explains why we choose to increase our level of significance from 0.05 to 0.1 when trying to isolate the determinants of individual behaviour.

Table 15: Results on Logit regression concerning the probability to reduce the opponent's endowment (*Luck*).

Logit Regression (*Luck*)

Nb. Obs : 109

Adj-R Squared: 0.0446

Dependent Variable: Subject reduces the opponent's endowment ($Action = 1$)

Independent variables	Coefficients (std. errors)
$Diffeval\ (= Eval2 - Eval1)$	0.001 (0.012)
$Diffevalabs\ (= |Eval2 - Eval1|)$	0.013 (0.010)
D_R (Relative difference)	-1.338* (0.718)
D_A (Absolute difference)	0.015 (0.045)
$TpEval1$ (Time for first evaluation)	-0.004 (0.012)
$TpEval2$ (Time for second evaluation)	-0.015 (0.012)
Constant	1.746 (1.203)

Note: * indicates significant at 0.1 level; ** significant at 0.05 level and *** significant at 0.01 level. The probability modelled is subject chooses to reduce the opponent's endowment. The dependent variable is $Action$, it equals 1 when the subject chooses to reduce the opponent's endowment.
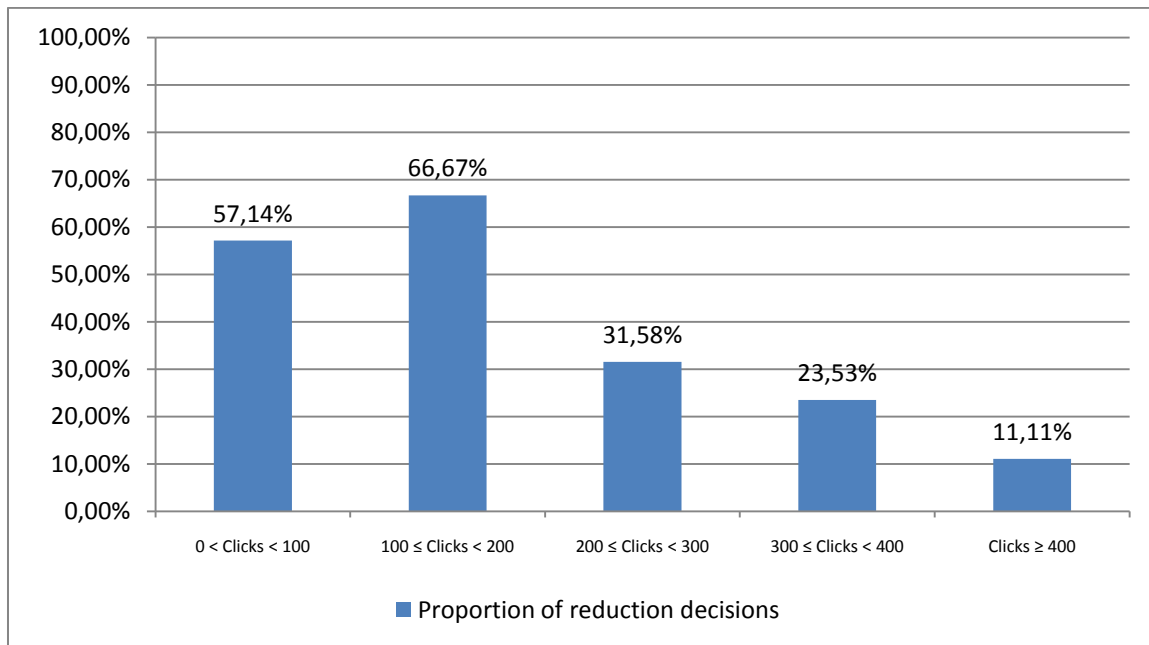
When endowments are attributed according to individual effort, we observe that subjects making low efforts levels are more prone to reduce others' endowments. Indeed the probability to destroy the opponent's endowment is significantly and negatively correlated to individuals' effort (see Table 16). This result underlines the key role of effort on individual behaviour. Figure 1 represents the proportion of reduction decisions engaged according to individual effort. In spite of the results from logit estimations, we can observe from Figure 1 that as effort increases, less subjects choose to reduce others' endowments. Indeed the highest proportions of reduction decisions are reached when efforts are low (i.e. inferior to 200 clicks). If we take a look at the behaviour of subjects performing poorly (i.e. reaching less than 100 clicks in a minute), we observe that almost 2 subjects out of three engage in a destructive decision. The proportion shrinks dramatically if we consider better performing subjects (i.e. reaching more than 400 clicks in a minute). Indeed, concerning high performing subjects, only 1 subject out of 10 subjects chooses to reduce his opponent's endowment.

Table 16: Results on Logit regression concerning the probability to reduce the opponent's endowment (*Effort*).

Logit Regression (*Effort*)

Nb. Obs : 75

Adj-R Squared: 0.1477

Dependent Variable: Subject reduces the opponent's endowment ($Action = 1$)

Independent variables	Coefficients (std. errors)
$Diffeval (= Eval2 - Eval1)$	0.003 (0.012)
$Diffevalabs (= \|Eval2 - Eval1\|)$	0.021 (0.015)
D_R (Relative difference)	0.349 (0.431)
D_A (Absolute difference)	-0.094 (0.100)
$TpEval1$ (Time for first evaluation)	0.003 (0.024)
$TpEval2$ (Time for second evaluation)	-0.004 (0.002)
$Clicks$	-0.004* (0.002)
Constant	1.746 (1.203)

Note: * indicates significant at 0.1 level; ** significant at 0.05 level and *** significant at 0.01 level. The probability modelled is subject chooses to reduce the opponent's endowment. The dependent variable is *Action* and it equals 1 when a subject chooses to reduce his opponent's endowment.

Figure 1: Proportion of reduction decisions according to individual effort (*Effort*).

To summarise, determinants of individual behaviour are different whether endowments are attributed randomly or according to individual performance. Besides individual performance predicts whether a subject choose to reduce or not. Poor performing subjects are more prone to destroy income than high performing ones.

6. Discussion

In condition *Effort*, subjects reporting an increase in their satisfaction after being exposed to unflattering social comparison engage in as many destructive actions as subjects reporting a decrease in their satisfaction. Besides subjects whose satisfaction increases after exposure to social comparison cut a higher fraction of their opponent's endowment than subjects whose satisfaction decreases after exposure to social comparison (see result 4). A subject whose satisfaction decreases after social comparison is said to experience negative social emotions (e.g. envy). On the contrary, a subject whose satisfaction increases after exposure to social comparison is said to experience positive social emotions (e.g. altruism, generosity…). Then one would not expect such a subject to undertake as many reduction decisions and to cut a higher fraction as subjects experiencing negative emotions. This puzzling result suggests the existence of additional motives (other than altruism or generosity) behind subjects' motivations and decisions in *Effort*. A plausible explanation would be disappointment and frustration. Although subjects indicate that they are happy for others' higher situation, they might be disappointed of their performance or frustrated of having failed to achieve a higher income. In that later case, social comparison damages more the subject self-evaluation: the subject receives less and he performs poorly (or he fails at achieving a better income). In line with envy, disappointment and frustration are very invasive emotions. Disappointment is experienced after failure on a task and is closely related to decision making (Gill and Prowse, 2009; Loomes and Sugden, 1982, 1986; Zeelenberg, 1999; Zeelenberg et al., 2000). Frustration is acknowledged to be a very powerful emotion leading to aggressive and violent behaviour (Berkowitz, 1989, 1990; Dill and Anderson, 1995; Kulik and Brown, 1979; Rule et al., 1978).[34] On the one hand, our design creates sufficient conditions for generating disappointment. On the other hand, frustration is unlikely to appear in our design: subjects ignore they can only receive 4€ or 16€ and they also ignore the exact number of clicks required to obtain the endowments.

In our experiment, disappointment can be captured by observing the satisfaction level reported at the first evaluation. If the subject indicates a negative level of satisfaction at the first evaluation, he might express his disappointment: he is not satisfied with his endowment (he expects a better endowment or to perform better). On the contrary, if the subject indicates a positive level of satisfaction at the first evaluation, he is ought to indicate his contentment relative to his endowment. For a convenient reading, we refer to the term "disappointed subject" in order to represent a subject

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[34] Disappointment is defined as « *the displeasure about the nonoccurrence of a desirable outcome* ». Definition quoted from van Dijk et al. (1999, p. 205). Frustration is defined as « *the act of blocking someone from gaining an expected gratification* ». Definition quoted from Dill and Anderson (1995, p. 360).

reporting a negative level of satisfaction at the first evaluation and we refer to the term "not disappointed subject" so as to characterise a subject reporting a positive level of satisfaction at the first evaluation.

In order to investigate the implication of disappointment in individual behaviour, we take a look at the reduction decisions engaged by subjects according to the first reported level of satisfaction. If most reduction decisions result from choices of subject reporting a negative value at the first evaluation of satisfaction, then disappointment can be held responsible for leading subjects to reduce income. Table 17 pictures the number (and proportion) of reduction decisions engaged by subjects according to the first reported level of satisfaction. From Table 17, we can observe that there are significantly more reduction decisions engaged by disappointed subjects (i.e. subjects indicating a negative value at the first evaluation of satisfaction) than reduction decisions engaged by not disappointed subjects (p < 0.05, two-sample test of proportions). Hence disappointment is ought to explain why subjects reduce others' income.

Table 17: Number (and proportion) of reduction decisions engaged in *Effort* according to the first reported level of satisfaction.

	Nb. of reduction decisions	Proportion of reduction decisions
$Eval1 < 0$	19	65.52%
$Eval1 \geq 0$	10	34.48%
Total	29	100.0%

Note: $Eval1$ refers to the satisfaction level reported at the first evaluation of satisfaction. $Eval1 < 0$ (resp. $Eval1 \geq 0$) means that the satisfaction level reported by the player at the first evaluation is negative (resp. positive or null).

If disappointment is involved in reduction decisions engaged by subjects reporting an increase in their satisfaction after exposure to social comparison then we would observe that most reduction decisions engaged by subjects reporting positive changes in their satisfaction are undertaken by subjects reporting a negative value (i.e. disappointed subjects) at the first evaluation of satisfaction. Table 18 represents the value (positive, null or negative) of the satisfaction level reported at the first evaluation of satisfaction by subjects whose satisfaction increases after exposure to social comparison. From Table 18, we can observe that most subjects report a negative value at the first evaluation: 17 subjects out of 19 (i.e. 89.47%) experience disappointment when they learn their own endowment. There are significantly more disappointed subjects than not-disappointed ones (p < 0.05, two-sample test of proportions). Table 18 also pictures the proportion of reduction decisions engaged by subjects whose satisfaction increases after exposure to social comparison according to the value they give at the first evaluation of satisfaction. When we take a look at the reduction decisions engaged by subjects reporting an increase in their satisfaction after exposure to social comparison, we can observe that the huge majority of reduction decisions is engaged by

disappointed subjects (i.e. 91.0%). There are significantly more reduction decisions engaged by disappointed subjects than reduction decisions engaged by not disappointed ones (p < 0.05, two-sample test of proportions). Hence, concerning subjects whose satisfaction increases after learning the opponent's endowment, the majority of reduction decisions results from decisions of disappointed subjects, i.e. subjects indicating a negative satisfaction level at the first evaluation.[35] We find some evidences explaining that disappointment is responsible for leading subjects whose satisfaction increases after exposure to social comparison to engage in as many reduction decisions as subjects experiencing envy.[36] This hypothesis could also explain why the intensity of destructive actions in *Effort* is positively correlated to the difference measured in relative terms. The higher the relative difference, the higher is the gap between subjects' performances and the higher is the disappointment relative to the subject's performance. The few experiments dealing with disappointment convey its negative impact on subjects, both from an affective and behavioural perspective. van Dijk et al. (1999) reported through an experiment that the emotions of regret and disappointment were amplified through instrumental effort.[37] Gill and Prowse (2009) observed that disappointment deterred second movers to exert efforts so as to win the competition. In our experiment, we also observe a negative impact of disappointment on individual behaviour: disappointed subjects engages in more reduction decisions than others. Then we give partial support to H4b.

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[35] We observe the same significant result among subjects reporting no changes in their satisfaction after exposure to social comparison. Indeed 5 reduction decisions out of 6 (i.e. 83.33%) result from decisions of disappointed subjects.

[36] At the end of the experiment subjects were invited to answer to different questions relative to the experiment. Among these questions we asked them to indicate the motivations and reasons when evaluating their satisfaction. Among subjects that report an increase in their satisfaction, 8 subjects out of 15 answer to these questions. Most of them report to experience disappointment: 4 subjects indicate to be dissatisfied of their performance and 3 subjects write that they expected, before clicking, to receive a higher endowment.

[37] Ortony et al. (1988) disentangled instrumental effort from non-instrumental effort. We quote : "*instrumental effort pertains to plans (actual or possible) for achieving (or avoiding) states, whereas non-instrumental effort pertains to plans (actual or possible) that are related to the state, but are carried out on the assumption that the state will be achieved*" (p. 73). Consider a student spending hours to revise for an exam. The effort (i.e. hours invested in studying) he makes is considered as instrumental since it is associated with a higher likelihood of passing the exam. Conversely, imagine that after the exam, he wants to ask a girl for dining out. In this case, revising for the exam is considered as a non-instrumental effort since it does not increases the likelihood of seducing the girl. In our paper, the clicking task is instrumental since it increases the likelihood of achieving a high endowment.

Table 18: Number of subjects and reduction decisions undertaken by subjects whose satisfaction increases after exposure to social comparison according to the value given at the first evaluation of satisfaction.

	Nb. Observation (proportion)	Nb. Of reduction decisions (proportion)
$Eval1 < 0$	17 (89.47%)	10 (91.0%)
$Eval1 = 0$	0 (0.0%)	0 (0.00%)
$Eval1 > 0$	2 (10.53%)	1 (9.00%)
Total	19 (100.0%)	11 (100.0%)

Note: $Eval1$ refers to the satisfaction level reported at the first evaluation of satisfaction. $Eval1 < 0$ (resp. $Eval1 > 0$) means that the satisfaction level reported by the player at the first evaluation is negative (resp. positive). $Eval1 = 0$ represents a player whose satisfaction does not change after exposure to social comparison.

Can disappointment also explains why subjects reporting negative changes in their satisfaction after social comparison choose to reduce their opponent's endowment? To answer to that question, we investigate within subjects whose satisfaction decreases after exposure to social comparison whether the majority of reduction decisions is undertaken by disappointed subjects. Table 19 pictures the proportion of reduction decisions engaged by subjects whose satisfaction decreases after exposure to social comparison according to the value they give at the first evaluation of satisfaction. We observe that 8 actions out of 12 (i.e. 66.67%) result from decisions of not disappointed subjects. Hence most reduction decisions undertaken by subjects reporting negative changes in their satisfaction are not explained by disappointment. Concerning subjects whose satisfaction decreases after learning the opponent's endowment, the difference between the proportion of reduction decisions engaged by disappointed subjects is not significantly different from the one engaged by not disappointed subjects (p > 0.05, two-sample test of proportions). Besides the proportion of reduction decisions engaged by disappointed subjects whose satisfaction increases after exposure to social comparison is significantly higher than the proportion of reduction decisions engaged by disappointed subjects whose satisfaction decreases after exposure to social comparison (p < 0.01, two-sample test of proportions).

Table 19: Number (and proportion) of subjects and reduction decisions undertaken by subjects whose satisfaction decreases after exposure to social comparison according to the value given at the first evaluation of satisfaction.

	Nb. Observation (proportion)	Nb. Of reduction decisions (proportion)
$Eval1 < 0$	9 (21.95%)	4 (33.33%)
$Eval1 = 0$	1 (2.44%)	0 (0.00%)
$Eval1 > 0$	31 (75.61%)	8 (66.67%)
Total	41 (100.0%)	12 (100.0%)

Note: $Eval1$ refers to the satisfaction level reported at the first evaluation of satisfaction. $Eval1 < 0$ (resp. $Eval1 > 0$) means that the satisfaction level reported by the player at the first evaluation is negative (resp.

positive). $Eval1 = 0$ represents a player whose satisfaction does not change after exposure to social comparison.

Then we find that individual performance is very important in subjects' decisions to reduce: low performance generates disappointment and disappointment pushes some subjects to reduce income (see Result 6). We now observe who choose to reduce according to individual effort. Figure 2 represents graphically the proportion of reduction decisions engaged according to the direction of changes in satisfaction and to individual effort. From Figure 2, we observe that the majority of subjects performing poorly and choosing to reduce income report positive changes in their satisfaction. If we take a look at subjects who reached less than 100 clicks ($0 < Clicks < 100$), we observe that 41.67% of reduction decisions are undertaken by subjects reporting positive changes in their satisfaction after learning their opponent's endowment whereas only 25.0% of reduction decisions result from decisions of subjects indicating negative changes in their satisfaction after exposure to social comparison. If we consider better performing subjects, i.e. who reached between 300 and 400 clicks, we find that 25.0% of reduction decisions are engaged by subjects indicating their satisfaction to be positively affected by social comparison whereas 75.0% of reduction decisions are engaged by subjects whose satisfaction decreases after social comparison. Concerning subjects reaching more than 400 clicks, all reduction decisions are engaged by subjects whose satisfaction decreases after exposure to social comparison. Then as effort increases, the proportion of subjects reporting positive changes in satisfaction and reducing the opponent's endowment decreases. We detect the exact opposite effect concerning the proportion of subjects reporting their satisfaction to be negatively affected and reducing income. As effort increases the proportion of subjects reporting a decrease in their satisfaction and choosing a destructive action increases. Again this observation suggests that subjects reporting their satisfaction to be positively affected by social comparison choose to reduce others' endowment not because they are motivated by envy but because they are disappointed by failing to achieve a better endowment. Hence disappointment explains reduction decisions among poor performing subjects and envy among high performing ones. [38]

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[38] Philosophers as well as psychologists claim that envy is more intense in competitive settings. In competitive environments, social comparisons are more self-relevant (the desired attribute is very important for subjects: all desire to obtain it), subjects share very similar characteristics (goals, aspirations, positions) and the desired attribute is limited (only one gold medal, one job). Then envy is ought to be experienced intensively within competitive persons. See Ben Ze'ev (1992, 2000), D'Arms and Kerr (2008) and Hill and Buss (2006).

Figure 2: Proportion of reduction decisions according to effort and direction of changes in satisfaction (*Effort*).
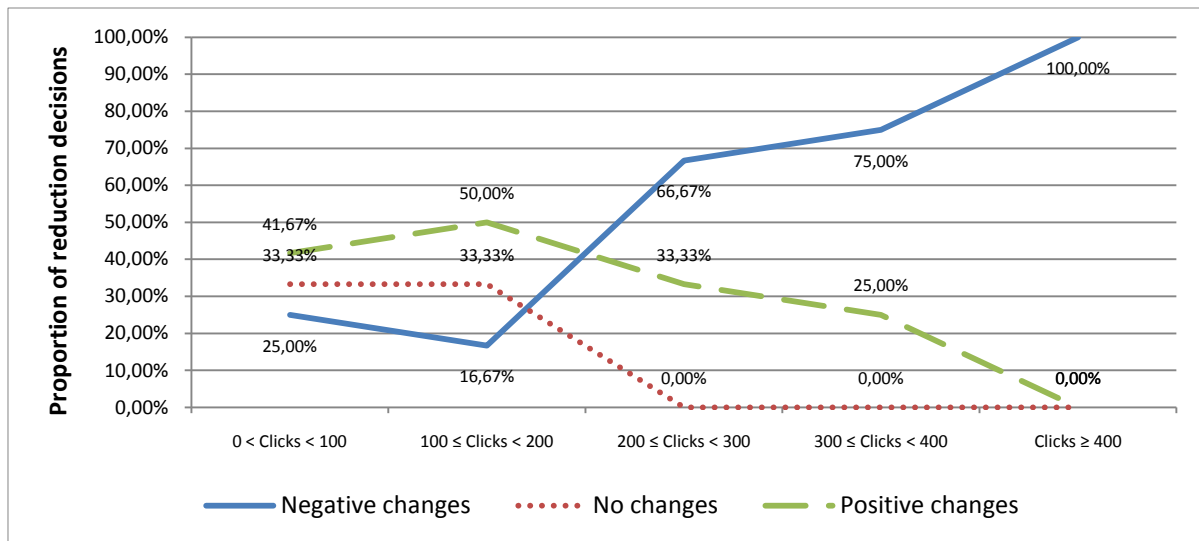
7. Conclusion

We investigate, through referring on experimental methods, the impact of effort on social emotions and more particularly we focus on envy. To fulfil that objective, we implement two treatments: one in which subjects have to perform a task to obtain an endowment and one in which they receive endowments randomly. Then we expose subjects to unflattering social comparisons and ask them to indicate their satisfaction level before and after being exposed to unfavourable social comparison. Finally subjects can choose to reduce their opponent's endowment. Would Iago be more pained if he was less invested in getting that promotion? No, individual well-being is not affected by how endowments are attributed: no matter how endowments are attributed, unflattering social comparisons have the same negative impact on individual well-being. Would Iago be deterred from committing crimes if he put fewer efforts in getting that promotion? Yes, if Iago invested no effort in getting that promotion his envy would not have exert him to such an extreme issue.

More precisely, we observe that effort does not affect the impact of social comparisons on subjects' well-being. Indeed whether subjects earn their endowments through effort or no, most of them report their satisfaction to be affected and the majority reports a decrease in their satisfaction. Besides the determinants of individual well-being are almost identical in the two treatments. Furthermore the impact of effort on individual behaviour is partial. We do observe almost the same proportion of reduction decisions whether endowments are attributed through effort or luck. Nevertheless we find that when endowments depend on effort, subjects cut a higher fraction of their

opponent's endowment than when endowments depend on luck. Individual performance modulates subjects' decisions to reduce: poor performing subjects are more prone to reduce their opponent's endowment than high performing ones. Albeit envy explains why high performing subjects reduce others' income, we find evidences that disappointment might be involved in reduction decisions from poor performing subjects.

To predict behaviour from our experiment, we refer to two different theories: emotion and equity theories. Albeit equity theory predicts that if endowments depend on individual effort then subjects would be less prone to reduce income, emotion theory predicts the exact opposite effect. Our experiment tend to corroborate predictions from emotion theory rather than for equity. Indeed we find empirical evidences validating the "*sense of alteration*" theory and observe that subjects cut a higher fraction of income through effort.

Why are poor performing subjects more prone to reduce income than high performing ones? Maybe the hypothesis of Perceived Control developed by psychologists might help us in understanding this result. This hypothesis refers to the perceived possibility for the subject to obtain the desired attribute (i.e. subject's goal). An agent is ought to behave differently when he perceives his objective as attainable or very difficult to obtain. More precisely, an agent that perceives his objective to be under his range are more prone to experience positive emotions and feelings (e.g. emulation, joy, relief) and to behave constructively, i.e. making additional efforts so as to reach his goal. Conversely, an agent that perceives his objective to be out of his range is ought to experience negative feelings (e.g. envy, sadness, hostility) and to behave destructively, i.e. damaging or destroying the rival's situation. Testa and Major (1990) convey that subjects with pessimistic beliefs concerning the possibility to achieve their objectives exhibit more depressive and hostile reactions than those with optimistic beliefs. They implemented an experiment in which subjects are informed, after completing a task, that they performed poorly. They are exposed to unflattering social comparisons by learning other participants' higher performance. Some subjects are told that they could improve their performance (high control condition) whereas other could not (low control condition). Subjects were then asked to report their subjective feelings. Testa and Major (1990) convey empirical evidences that Perceived Control modulates subjects' depressive and hostile reactions: subjects from the low control condition exhibit significantly more depressive and hostile reactions than subjects from the high control condition (see also Lockwood and Kunda, 1997).

Our study provides interesting results that could be used in management when designing new incentive schemes, in team management or more generally in human resources. Indeed the workplace gathers all conditions required in order to generate intense envy among colleagues

(Bedeian , 1995; Vecchio, 2005; Vidaillet, 2007, 2008). Indeed it provides a great number of relevant social comparisons involving individuals that share similar characteristics and job aspirations. Besides, by assigning limited organizational resources, it also generates inequalities among co-workers: wages, job promotions, windowed offices, secretarial support, company cars… Employees' performance is not observable in all firms. When employees' performance is observable it is very easy for managers to propose wages that depend on individual performance but when performance is not observable, managers propose wages relying on factors that are beyond employees' control (e.g. manager's beliefs about employee's performance, employee's physical attractiveness…). Employees' reactions are ought to be very different in these two settings. Which configuration minimises the probability for an employee to engage in negative behaviour (e.g. deter job atmosphere, sabotage…) toward co-workers? Thanks to our paper, we can offer an answer to this issue.

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Appendix A: Instructions from *Luck* condition (translated from French).

Welcome,

Thank you for accepting to participate in this experiment. This experiment is paid for real and lasts about half an hour. Your final payoff will depend on your endowment and on your decisions or on decisions of other participants, depending on your role. All decisions are anonymous and there are neither good nor bad answers. All amounts will be directly expressed in Euros. You will learn your final payoff at the end of the experiment and it will be paid for real in cash. If you have, during the experiment, any question, raise your hand and a monitor will come to answer you privately.

In that experiment, we distinguish two roles: role of player A and role of player B. From now when speaking about a player who received the role A, we will refer to player A and to player B for a player who received the role B. Roles are fixed during the whole experiment and are randomly attributed by the computer. There are as many players A as there are players B. Each player A is randomly associated to a player B. Whatever your role you are always associated with the same player. The computer is going randomly to allocate an endowment for each player. Possible endowments range from 4 Euros (minimum endowment) to 32 Euros (maximum endowment). Only players A are going to take a decision. Players B have no decision to take and are invited to remain silent during the experiment.

After each participant has finished reading instructions, the computer will randomly attribute the roles. Your role will be displayed on the screen. Then players A will be invited to take a decision, which is going to be explained after, while players B will wait. Once all players A have indicated their decision, then all players (players A and B) will be informed of their final payoff.

Appendix B: Instructions from *Effort* condition (translated from French)

Welcome,

Thank you for accepting to participate in this experiment. This experiment is paid for real and lasts about half an hour. Your final payoff will depend on your endowment and on your decisions or on decisions of other participants, depending on your role. All decisions are anonymous and there are neither good nor bad answers. All amounts will be directly expressed in Euros. You will learn your final payoff at the end of the experiment and it will be paid for real in cash. If you have, during the experiment, any question, raise your hand and a monitor will come to answer you privately.

In that experiment, we distinguish two roles: role of player A and role of player B. From now when speaking about a player who received the role A, we will refer to player A and to player B for a player who received the role B. Roles are fixed during the whole experiment and are randomly attributed by the computer. There are as many players A as there are players B. Each player A is randomly associated to a player B. Whatever your role you are always associated with the same player.

Each player whatever his role is going to receive an endowment. Possible endowments range from 4 Euros (minimum endowment) to 32 Euros (maximum endowment). Endowments are attributed according to the number of clicks made by each player. More precisely, each player from both roles has one minute to click using his mouse. The higher the number of clicks made by a player, the higher his endowment. Then the attribution of endowments only depends on the number of clicks made by each player. There is a minimum number of clicks required for each endowment possible. The higher the endowment, the higher the number of clicks required to obtain that endowment. No player from this experiment is informed about the exact number of clicks required for each endowment.

Only players A are going to take a decision. Players B have no decision to take and are invited to remain silent during the experiment.

After each participant has finished reading instructions, the computer will randomly attribute the roles. Your role will be displayed on the screen. After being informed of your role, you will have one minute to click using your mouse. Then players A will be invited to take a decision, which is going to be explained after, while players B will wait. Once all players A have indicated their decision, then all players (players A and B) will be informed of their final payoff.

Appendix C: Screenshot relative to real-effort task (only for *Effort* condition)
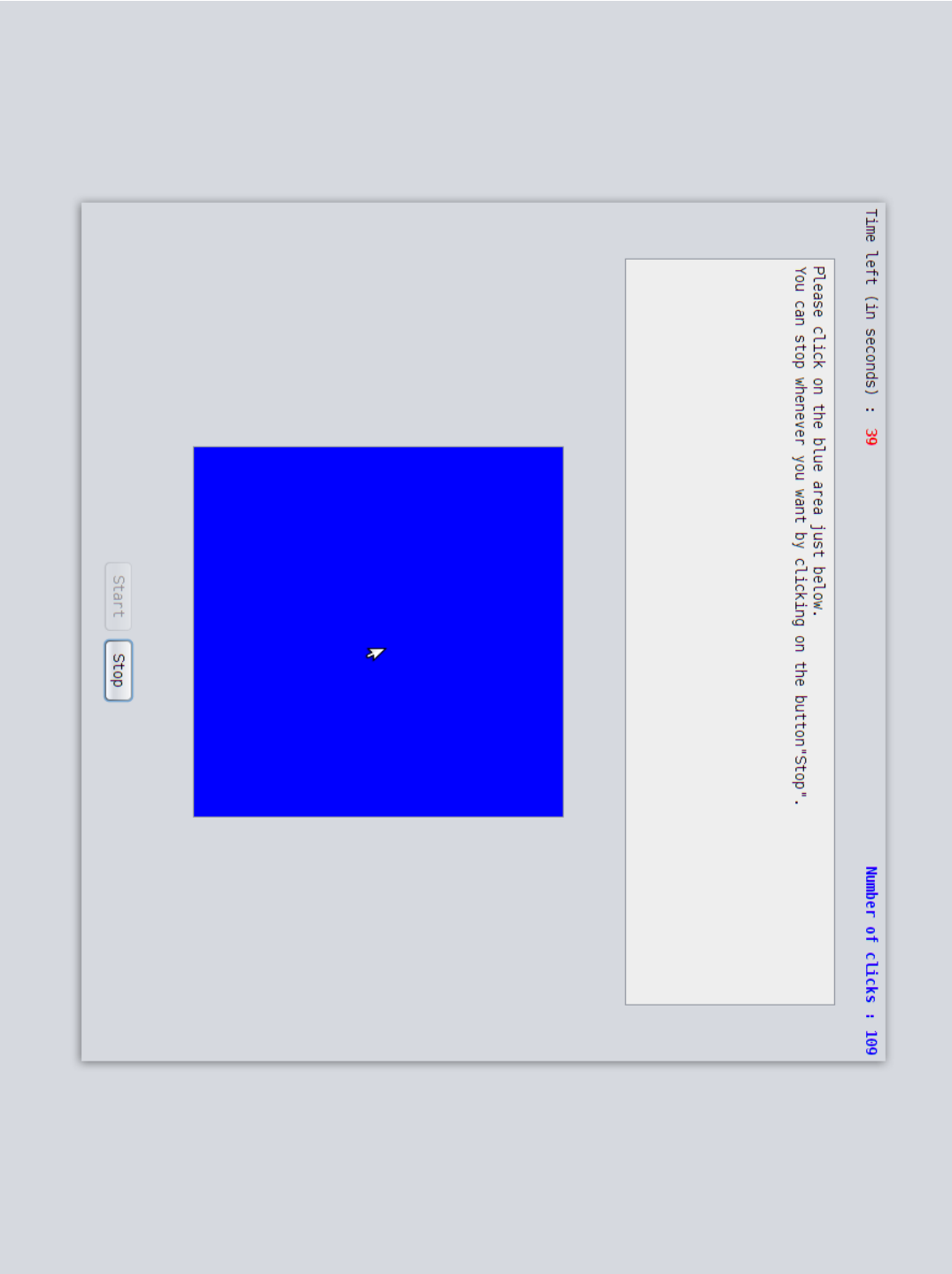
Appendix D: Screenshot relative to the evaluation of satisfaction.

Your endowment: 4 euros
Your first evaluation: 10
B's endowment: 8 euros

Your endowment is 4 euros.

Player B's endowment is 8 euros.

Indicate your satisfaction level on the following scale. In order to report your satisfaction level, you have to move the slider along the scale. The scale ranges from -50 which indicates that you are extremely dissatisfied, to +50 which indicates that you are extremely satisfied.

-50
Extremely dissatisfied

-25

0
Neither dissatisfied nor satisfied

25

50
Extremely satisfied

OK

Value
- 10

Appendix E: Screenshot relative to reduction decisions.

Your endowment: 4 euros
Your first evaluation: 10
B's endowment: 8 euros
Your second evaluation: -10

You can reduce player B's endowment. Player B will not be informed of your decision and has no decision to take.

Do you want to reduce plater B's endowment?

● yes ○ no

OK

You can invest from 1 to 10 units in order to reduce player B's endowment. Each unit you invest decreases by 0.5 euros players B's endowment and costs you 0.1 euros.

Indicate in the next area the number of units you want to invest. You can observe the impact of your decision on your final payoff and on player B's final payoff on the table located behind.

Please indicate the number of unities you want to invest

OK

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