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« Will Joe the Plumber envy Bill Gates?

The impact of both absolute and relative differences on individual satisfaction and well-being »

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Will Joe the Plumber envy Bill Gates?

The impact of both absolute and relative differences on individual satisfaction and well-being

Jérémy CELSE[1]

Abstract:

We investigate experimentally the impact of unflattering social comparisons on individuals' behaviour. More precisely, we examine the relationship between the satisfaction subjects derive from social comparisons and subjects' decisions to reduce others' income. In our experiment, subjects are randomly paired and receive an endowment. Then subjects have to report their satisfaction level after being informed of their own endowment and of their opponent's endowment. Finally subjects can choose, or not, to reduce their opponent's endowment incurring a personal cost. We observe: (1) most people report their satisfaction to be negatively affected by learning others' endowments; (2) destructive decisions are predominantly undertaken by dissatisfied subjects; (3) individuals' satisfaction is negatively affected by absolute difference (difference between subjects' endowments measured in absolute terms) and (4) relative difference (difference measured by the ratio between subjects' endowments) between subjects' endowments modulates subjects' decisions to reduce the opponent's endowment.

Key words: Subjective well-being, Interdependent preferences, Indignation, Destruction, Income Inequality, Social Comparison, Self-report.

JEL classification: D6, H0, J0.

1. Introduction

Do you prefer to earn more than your colleagues even if it implies to receive a fewer absolute annual income or to earn a higher absolute annual income but less than your colleagues? When Solnick and Hemenway (1998) asked subjects to answer to that question they observed that the majority of subjects (56%) chose to be above average even if it implies receiving a smaller wage. By choosing to be above average, subjects clearly refused Pareto optimal situations. Such a negative behaviour is not an isolated phenomenon, many recent experiments corroborate this observation (Zizzo and Oswald, 2001; Beckman et al., 2002; Abbink et al., 2008). Are social comparisons so important for subjects that they exert them to behave negatively albeit they incur a personal loss?

One can differentiate two lines of research. On the one hand, researches on happiness focus on the impact of social comparisons on individual well-being. They conveyed that others' situations affect individual satisfaction (Easterlin, 1995; Clark and Oswald, 1996; Ferrer-i-Carbonnell, 2005). On the other hand, experimental studies focus on the impact of social comparisons on individual behaviour. they showed that emotions, more precisely social emotions (i.e. emotions triggered by social comparisons), generate specific behaviours (Zizzo and Oswald, 2001; Beckman et al., 2002; Bosman and van Winden, 2002). Then it would be tempting to argue that social comparisons affect individuals' behaviour by influencing their satisfaction. Although researches showed that social comparisons influence subjects' well-being, we still ignore if social comparisons, through their influence on individual well-being, can explain individuals' behaviour. For example why some subjects refuse Pareto improvements or choose to reduce others' income even when they are in a non strategic environment. No study, to our knowledge, has investigated the direct relationship between social comparisons and behaviour[2]. There still is a remaining question: Can social comparisons affect individuals' behaviour and how social comparisons induce subjects to undertake specific actions? We aim at bridging the gap between these two lines of research by exploring the full link between social comparisons and individual behaviour through the concept of interdependent preferences. The latter concept expresses the idea that an agent's utility depends not only on the agent's situation but also on that of other agents.

We implement an experimental protocol in order to answer to two joint issues. First we investigate whether social comparisons change subjects' satisfaction and to determine if these changes can

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[2] Recently some experiments tried to investigate how social comparisons influence subjects' decisions in a Gift-Exchange game (Gächter et al, 2008; Gächter and Thöni, 2009; Mittone and Ploner, 2009) or in an Ultimatum game (Knez and Camerer, 1995; Bohnet and Zeckhauser, 2004, Alewell and Nicklish, 2009). But these studies did not isolate the impact of social comparisons on individual behaviour from other considerations (e.g. strategic behaviour, reputation...).

explain subjects' decisions to undertake a negative action, such as reducing others' income. We measure the impact of social comparison on individual well-being through referring to the concept of interdependent preferences. We aim at revealing directly the existence of interdependent preferences by asking to the subject how satisfied (resp. dissatisfied) he feels after being informed of his endowment and then if his satisfaction (resp. dissatisfaction) has changed after learning the endowment allowed to another person (opponent afterwards) and hence his own inferior position. If, as predicted by standard economic theory, an agent is indifferent between his own situation and his opponent's one thus his satisfaction (resp. dissatisfaction) would not be affected after learning his opponent's allocation. On the contrary, by reporting changes in his satisfaction after learning the opponent's endowment, a subject is said to manifest interdependent preferences. In our paper, we are only interested in revealing interdependent preferences when the subject makes unflattering social comparisons, i.e. when the subject's endowment is inferior to his opponent's one. We focus on unfavourable social comparisons because we expect the emotion of indignation (or resentment) and envy to play a major role in destruction actions[3]. Our experimental design suits for investigating the role of envy rather than indignation in individuals' decisions[4]. As a consequence, we are exclusively interested in one type of behaviour: the decision to reduce the opponent's endowment[5].

The second question we aim at answering concerns the impact of absolute difference (i.e. difference between subjects' endowments measured in absolute terms) and relative difference (i.e. difference captured by the ratio between subjects' endowments) on both individual satisfaction and on decisions to undertake negative actions. We want to examine whether absolute and/or relative differences modulate subjects' well-being and subjects' decisions to reduce others' income. Whereas happiness studies conveyed that others' situations and income affect individual well-being, they consider that both absolute and relative differences have the same effect on individual well-being. In

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[3] We make this expectation for two main reasons. First because both emotions are invasive emotions triggered by unflattering social comparisons and that can lead to hostile action (Heider, 1958; Schoeck, 1969; Ben Ze'ev, 1992; Smith and Kim, 2007). Secondly, because some studies support our intuition, e.g. Beckman et al. (2002) reported that envy was highly responsible for opposition to Pareto efficient distributions. Zizzo and Oswald (2001) also indicated the key role of envy and indignation in "*burning*" decisions.

[4] To disentangle envy from indignation, philosophers often refer to the concepts of desert and moral (Rawls, 1971; Ben Ze'ev, 1992; Smith and Kim, 2007; Celse, 2010). Envy involves a desert claim but not a moral claim whereas indignation involves both claims. Desert claims are based on perceived (subjective) undeserved situations of inferiority. Thus in desert claims, the situation a subject is placed in is not necessarily the consequence of another agent behaving negatively. Conversely, in moral claims, an agent can be held responsible for the subject's situation. Agent *i* can envy the beauty of another agent, his envy involves a desert but not a moral claim: no one is to blame for agent *i* being less attractive. In our experiment, subjects' inferior situation is the result of a random selection and not the consequence of an agent's deliberate choices then the subject may envy his opponent for his superior endowment.

[5] Both philosophers and psychologists agree on the resolute destructive nature of envy (Ben Ze'ev, 1992; Smith and Kim, 2007; D'Arms and Kerr, 2008; Celse, 2010). Envy exerts the subject to remove the rival's advantage rather than obtaining it.

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economic theory some models assume that absolute difference drives subjects' behaviour (Fëhr and Schmidt, 1999) whereas other refer to relative difference to predict subjects' behaviour (Bolton and Ockenfels, 2000).

The paper is organized as follows. The next session presents a brief review of the existing literature concerning the impact of social comparisons on individual well-being and behaviour. As we rely on experimental methods section 3 provides a description of the experimental protocol. We present our research hypotheses in section 4. Section 5 is devoted to our results. The last section offers a discussion and concludes.

2. Literature review

Standard economic theory relies on the basic model of the *Homo Economicus* which assumes that an agent's utility depends exclusively on his own level of consumption and leisure. Therefore the situation of other agents (and hence their income) does not exert an influence on individual situation and more precisely on individual well-being. Running counter the *Homo Economicus*' concept, several authors have claimed that agents take into consideration others' situation when evaluating their well-being. Hence social comparisons may drive to different issues and effects. On the one hand social comparisons might have a negative effect on individual well-being (Veblen, 1909; Duesenberry, 1949). So a negative effect can be the result of experiencing negative emotions such as jealousy, indignation or envy. On the other hand social comparisons might have a positive effect on individual well-being (Becker, 1991). Altruistic feelings, such as intergenerational solidarity and charity, might be held responsible for that latter point. By introducing the concept of interdependent preferences, scholars underlined the fact that social comparisons are inherent to human nature and hence, may exert an impact on individual well-being. An agent exhibits interdependent preferences when his utility depends not only on his own situation but also on that of other agents. Hence an agent whose satisfaction depends both on his situation and on others' situations is said to exhibit interdependent preferences.

An increasing number of studies support the impact of social comparisons on individual well-being and thus the existence of interdependent preferences. Easterlin (1995) revealed that well-being is not entirely shaped by individual income and leisure by conveying a paradox between income and happiness. The author observed that relative income[6] is more important than absolute income (i.e.

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[6] The concept of relative income often used in happiness research is different from the concept of relative difference we use in this paper. The relative income's (or comparison income) concept represents the relative

how much an agent earns in absolute terms) in determining individual well-being. Neumark and Postlewaite (1998) provided a direct example of interdependent preferences. Using a national longitudinal survey of youth, they observed that the probability that a woman is employed depends positively and significantly on her sister-in-law being employed. The most surprising result arises from that currently married women with non-employed sisters tend to participate more in the labour market when the income of their sister's husband is larger than her own husband's. Clark and Oswald (1996) estimated a job satisfaction equation referring on the British Household Panel Survey. They observed that both individual income and one's reference group income have the same coefficient. Nevertheless whereas individual income attracts a positive coefficient, one's reference group income catches a negative coefficient. Their results suggest that job satisfaction is entirely relative[7]. In line with previous work, Ferrer-i-Carbonnell (2005), using German Panel data, revealed that an agent's life satisfaction decreases with the income of the agent's reference group[8]. Miles and Rossi (2007) implemented a quasi-experiment in which subjects are informed about a hypothetical wage they receive for working in a company. They had to report how satisfied they were after being informed of their wage by ranking their satisfaction on a likert scale from 1 (totally unsatisfied) to 10 (totally satisfied). Then subjects had to report their satisfaction after receiving information on the wage offered to another classmate using the same procedure. The authors observed that learning about others' wages affects significantly individual well-being. Indeed, reported levels of satisfaction shrank when the respondent learned that he has earned less than others. More recently, Bault et al. (2008) have examined the impact of social comparisons on a subject's satisfaction by asking to the subject to evaluate and report his subjective feelings on the outcome of a gamble. The authors implemented different conditions: one-player and two-player conditions. In the one-player condition, subjects were informed about the payoff obtained with the gamble they chose and the payoff they could have obtained by selecting the other gamble. The one-player condition was implemented in order to identify the affective consequences of private emotions (regret and relief). In the two-player condition, subjects were informed about the payoff resulting from the gamble they chose and about the payoff another subject received by picking a gamble. The two-player condition supplied information on the affective effects of social emotions (envy and gloating). The authors underlined

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progress in the subject personal income in comparison to the income of some relevant referent (that can be constituted by an agent or a group of persons).

[7] Investigating the neurobiological basis of social comparisons, Fliessbach et al. (2007) observed that the ventral striatum (i.e. a brain area known for being involved in the reward-process) is strongly connected to relative payments. Indeed BOLD (Blood Oxygenation Level Dependent) responses increased with the ratio between a subject's reward and the opponent's reward. The BOLD signal reflects the neural activity by measuring the changes in blood flows. This result might be interpreted as an evidence that relative comparison does not depend on the absolute level of payments but rather on relative payment.

[8] See Senik (2005) for an extensive review of the existing literature.

the key role of social comparisons by observing that social emotions were experienced more intensively by subjects than private ones. Furthermore, situations when the subject received a fewer payoff than his opponent was experienced, by the subject, as the worst situation. Hence, others' income seems to affect individual well-being and satisfaction.

As mentioned previously, Solnick and Hemenway (1998, 2005) exposed that, in some cases, agents were prone to renounce to a certain amount of a specific good and thus to receive less of that good just because others will receive more than them[9]. In another experiment, Beckman et al. (2002) provided experimental evidences that social emotions, more precisely envy and malice[10] are powerful micro-motivations and might explain why individuals refuse Pareto efficient distributions. Zizzo and Oswald (2001) wanted to provide an experimental test for negatively interdependent preferences by observing if people were willing to destroy others' incomes even if they incurred a personal cost. The game consisted in two steps. In the first step, every subject began with a betting stage which was implemented in order to create unequal wealth distributions. At the end of the betting stage, subjects could reduce others' money ("burning" decisions) although reducing the income of others is costly. The authors observed that burning is substantial: the majority of subjects (62.5%) chose to burn others' incomes. A striking result is that subjects who received additional money from the experimenter were more burnt than others. Although this study provides interesting results it does not allow the authors to conclude about the impact of social comparisons on subjects' behaviour: as subjects were associated to other participants they had to face decisions stemming from them. Thus subjects could have adopted a strategic behaviour: to reduce others' income in order to retaliate against others' burning decisions they anticipated. Finally, Bosman and van Winden (2002) focused their attention on how emotions triggered by others' decisions might exert a subject to destroy one's income in a power-to-take game. The authors revealed that emotions could exert an influence on subjects' behaviour. They observed that others' decisions had a great and significant impact on a subject's probability to destroy income. More precisely, they found that a subject's emotions were deeply affected by others' decisions and that negative emotions (irritation and contempt) drove to destruction.

In conclusion, two different lines of research can be sketched. On the one hand researches on happiness conveyed that social comparisons are important and have a significant effect on individual well-being and thus on satisfaction. According to their results, the existence of interdependent preferences cannot be ignored. On the other hand experimental studies showed that individuals

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[9] See also Frank (1997), Frank and Sunstein (2001) and Lehmann (2001), Grolleau et al. (2008) and Grolleau and Said (2009).

[10] Envy (resp. malice) was defined, by the authors, as the opposition to Pareto improvement when the improvement aimed at a subject occupying a superior (resp. inferior) position.

could behave negatively even by incurring a personal cost. Moreover these studies suggested that emotions, and more precisely social emotions, might induce subjects' behaviour by exerting them to engage specific actions. Although the impact of social comparisons on specific contexts (Ultimatum game, Gift Exchange game...) have already been examined, no study has isolated the impact of others' situations on both individual well-being and behaviour. Indeed we still ignore if and how social comparisons can produce behaviour. To fill in this gap, we propose the following experiment.

3. Experimental Design and Protocol

Experimental sessions were conducted in spring 2009 at the LEEM[11]. Subjects were randomly recruited in a voluntary pool of subjects including more than 1400 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 and 218 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...). All instructions were computerised and displayed during the experiment[12]. 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).

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. Subjects were then told that the computer will randomly allocate an endowment for each player[13]. All subjects knew that endowments ranged from 4€ to 32€ (in integer amounts). Subjects were also informed that only participants in the role of player A could take a decision and had to participate to 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

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[12] 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.

[13] Players are informed that endowments are randomly attributed but they ignore that endowments also depend on roles. Players A can randomly receive and endowment of 4 or 16€. Players B can randomly receive an endowment of 8, 20 or 32€.

could take). From now we will present the procedures players A had to fulfil. 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):

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 for his endowment[14]. 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.

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.

Step 5: Each player A was informed that he has the opportunity to reduce player B's endowment[15]. 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.

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 unities[16]. Each possible amount

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[14] We trust that asking subjects to report their satisfaction is a reliable method. First, methods based on self-report measures are recurrent in happiness research and psychology. Besides these methods are often used by emotion theorists. 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).

[15] 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.

[16] As the subject must confirm his decision by clicking on a button, player A clearly announced his willingness to reduce his opponent's endowment. As a consequence we did not allow null reductions.

cut player B's endowment by some fraction[17] (depending on the treatment) and involved a cost[18] for player A. If player A choosed the maximum of 10 units, the final payoff of the two players were equalized[19]. For a lower amount, player B's payoff remained larger than player A's payoff. Player A could simulate the impact of his decision on the final payoffs of each member of the pair.

At each step, a table indicated subjects' previous decisions (e.g. subject's endowment, value given at first evaluation...).

Since our aim is to investigate the impact of both absolute (i.e. the difference between subjects' endowments measured in absolute terms) and relative differences (i.e. the difference captured by the ratio between subjects' endowments) on individuals' satisfaction and behaviour, we conducted three different treatments. In the treatment *Low Endowments and Low absolute Difference* (treatment LL thereafter), both subjects received low endowments (4€ for player A and 8€ for player B). Then the absolute difference was low (equalled to 4€). In the treatment *High Endowments and High absolute Difference* (treatment HH thereafter), subjects were endowed with 4 times the endowment of the LL treatment: player A received 16€ and player B 32€. Both the subjects' endowments and the absolute difference between players' endowments were multiplied by 4 with respect to the LL treatment. In treatments LL and HH the relative difference was kept constant[20]. Furthermore, moving from treatment LL to HH involved two changes: the absolute difference between players' endowments and the magnitude of their endowments. In order to separate this two effects, we introduced a third treatment, *High Endowments and Low absolute Difference* (treatment HL thereafter), in which player A received 16€ and player B 20€. Treatment HL had the same absolute difference than treatment LL but both endowments were increased by 12€. Therefore the relative difference was smaller: while player B's endowment was twice player A's endowment in the LL treatment (100% larger), in treatment HL player B's endowment was only 1.25 times larger than player A's endowment (25% larger). Hence the comparison of treatments LL and HH keeps the relative difference constant but increases absolute difference and subjects' endowments. Our design

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[17] The amount of reduction varied among treatments (see Table 1). For treatments LL and HH, each unity of reduction reduced player B's initial endowment by 6.25%. For treatment HL, each unity of reduction decreased player B's initial endowment by 4%.

[18] The cost for reducing the opponent's payoff varied among treatments (see Table 1). We set the cost of reduction so as to allow comparisons in terms of actions undertaken by players A between treatments. To fulfill that purpose, the cost of reduction represented the same weight in player A's endowment in each treatment. Then in order to reduce his opponent's endowment by one unity each player A had to sacrifice 2.5% of his initial endowment.

[19] In order not to exert subjects to invest the maximum allowed, it is important to prevent players A from having a superior payoff than players B. Thus even if players A invested the maximum allowed, they could not have a superior payoff but could restore equality.

[20] In both LL and HL, each player A's endowment was half player B's endowment.

allows us to disentangle the effects of both absolute and relative differences on subjects' satisfaction and behaviour.

Table 1: Treatments and parameters used in the experiment.

Treatments	Player A's endowment	Player B's endowment	Absolute difference	Relative difference	Cost of reduction	Amount of reduction
LL	4€	8€	4	2	-0.1×e	-0.5×e
HL	16€	20€	4	1.25	-0.4×e	-0.8×e
HH	16€	32€	16	2	-0.4×e	-2×e

Note: *e* represents the amount invested by the subject in negative actions, $e \in [1; 10]$. The cost of reduction represents the cost players A had to give for each unity invested in negative action. The amount of reduction captures by how much player B's endowment decreases for each unity invested in negative action.

4. Research hypotheses

Through this experiment, we explore 6 hypotheses. From now, by using the term "subjects" we refer to players A and to players B by using the term "opponents".

H1 : Social comparisons affect individuals' satisfaction.

Previously quoted results both from happiness studies and from positional studies tend to corroborate the invasive character of interdependent preferences. Indeed both lines of research convey that individuals attach much importance to others' situations and others' income. Furthermore scholars argue that social comparisons are inherent to human beings. Both philosophers and psychologists agree whether social comparisons have a huge impact on one's self-evaluation. Ben Ze'ev (1992) emphasized on the key role of social comparisons in both self-evaluation and self-esteem. Moreover social comparisons can help in building inferences about one self (Festinger, 1954) and contributes to ability assessments by leading to a diagnostic: being superior/inferior or on success/failure. Social comparisons are also important because they help in identifying the ingredients that are required to perform better or to acquire success. In line with quoted authors, Michalos (1985) argued that satisfaction judgements are strongly linked to the existing differences between one's situation and the situation of one's reference group (which can consist of a solely individual, a group of persons, aspirations, needs…). As a consequence, we expect that the majority of subjects will exhibit interdependent preferences, i.e. will report changes (whether positive or negative) in their satisfaction after knowing their opponent's endowment.

> *H1a: The majority of subjects report changes in their satisfaction after learning player B's endowment.*

Besides, situations of economic inferiority are, according to psychological researches, usually experienced as unpleasant and painful situations by subjects. People dislike unflattering comparisons because they reveal their relative inferiority. These comparisons are to be held responsible for generating feelings of ill-will and displeasure (Heider, 1958; Smith et al., 1994; Smith and Kim, 2007). Such negative feelings are prone to damage one self-image and self-esteem. Besides, Bault et al. (2008) conveyed that subjects reported to experience situations in which they received a fewer payoff than their opponent as the worst situation. As feelings and situations of inferiority have so negative affective consequences, we anticipate that the majority of subjects will indicate to be more dissatisfied (or less satisfied) when learning their opponent's endowment. Furthermore, as our experimental design is close to the one used in Miles and Rossi (2007), it would be plausible to expect similar results concerning the satisfaction subjects derive from social comparisons. Besides, our experiment creates sufficient conditions to generate feelings of envy. Envy can be roughly characterized by sadness at observing others advantages.

H1b: Placed in a situation of economic inferiority, most subjects report to be dissatisfied.

H2: The satisfaction players A derive from social comparisons influence their behaviour.

Although more than half of the subjects, in the experiment ruled by Zizzo and Oswald (2001), chose to reduce others' income, we conjecture to observe less negative decisions. In our experiment, subjects cannot adopt a strategic behaviour since players B cannot undertake any action toward players A. The latter have no incentives to reduce others' income.

H2a: Few subjects choose to reduce player B's endowment.

Bosman and van Winden (2002, 2005), through a power-to-take game, observed that subjects who reported to experience high levels of negative emotions were likely to destroy their endowment. In our experiment, a decrease in one's satisfaction can be explained by the experience of negative emotions and more precisely by envy. An important point about envy is that the emotion is usually sketched as a powerful emotion leading to action (Bacon, 1601; Rawls, 1971). Hence, we expect that subjects reporting to be dissatisfied after learning their opponent's endowment will choose more often to reduce the latter's endowment.

H2b: Dissatisfied subjects engage more destructive actions than others.

As in Bosman and van Winden (2002, 2005), it would be tempting to assume a linear and negative correlation between the intensity of subjects' satisfaction and the decision to reduce others' income. In other words, one can assume that a subject reporting to be highly dissatisfied is more prone to destroy his opponent's endowment than a subject reporting to be slightly dissatisfied. Nevertheless

envy (and more generally social emotions) is a complex and protean emotion. This emotion is made of different affective states that are bound enough together although an emotional episode may not require the occurrence of all affective elements (De Sousa, 1987; Ben Ze'ev, 2000). Episodes of envy are often characterized by feelings of inferiority, longing, sadness, hostility, frustration, depression... (Smith et al., 1988; 1999) but not every episode of envy includes all these affective states. One may envy the success of others without wanting to improve his situation or without exhibiting some hostility (Smith and Kim, 2007). As we restrict our analysis to the satisfaction subjects' derive from social comparisons (partial aspect of envy), it is then very unlikely to observe such linear correlation.

H3: The inequality, captured by the difference between players A and B's endowments, exerts an impact on both individual satisfaction and behaviour.

As mentioned previously, researches on happiness, through econometric analyses, suggest that as the referent group's income increases, individual satisfaction decreases. Luttmer (2005) showed that when the income of the reference group increased, subjects reported lower levels of happiness. But happiness researchers consider that subjects are equally sensible to absolute and relative differences. We conjecture that the satisfaction subjects obtain from unfavourable social comparisons is negatively correlated to player B's endowment.

H3a: Individual satisfaction is significantly and negatively correlated to player B's endowment.

Abbink et al. (2008) observed that riots were more likely to emerge when opposing two similar groups. They also found that as differences between groups increased, less riots were observed. Their results are in accordance with the polarization theory (Montalvo and Reynal-Quenol, 2005; Ostby, 2008). This theory postulates that conflicts and aggressive acts are more often observed when differences between subjects (or groups) are low. The notion of "*sense of alteration*" introduced by Ben Ze'ev (1992) also supports this view. This notion captures the reality of every change perceived by the subject. It explains why social emotions are always more intense when differences are low. Hence referring on previous researches and as we expect that negative emotions exert subjects to undertake negative actions, one would also assume that as differences between subjects' endowments increase subjects are less likely to reduce their opponent's endowment. We do not know whether absolute or relative differences modulate subjects' behaviour.

H3b: Less negative actions are observed when differences between endowments are high.

5. Results

Through this section we present and develop the main results we obtain from the experiment.

Result 1: The majority of subjects report their satisfaction to be affected by others' situations.
Support: Table 2 shows that 87 out of 109 players A report to be affected by learning their opponent's situation. The great majority of players A reacts significantly to the announcement of player B's endowment.

Whereas standard economic theory predicts that subjects will not report any changes in their satisfaction after learning their opponent's endowment, 79.82% of players A report changes (whether positive or negative). Reporting changes in one's satisfaction is a signal that one exhibits interdependent preferences. We observe that there are significantly more subjects exhibiting interdependent preferences than subjects who do not (p < 0.01 for all treatments, two-sample test of proportions). Whatever the treatment subjects are placed in (LL, HL or HH), the great majority of them report to be affected, whether positively or negatively, when hearing their opponent's higher endowment. Result 1 underlines the importance and omnipresence of social comparisons. By reporting changes in their satisfaction when they learned their opponent's payoff, people seem to attach much importance to income comparisons. H1a is thus supported. We also use a binary logit model to test if some parameters have an influence on the probability for a subject to exhibit interdependent preferences, i.e. to report changes when evaluating his satisfaction. We measure time subjects took for evaluating their satisfaction[21] and introduce it to our analysis. The binary logit model shows no significant results.

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

	Overall	LL	HL	HH
Players A reporting changes in their satisfaction	87 (79.82%)	30 (75.00%)	26 (81.25%)	31 (83.78%)
Players A reporting no changes in their satisfaction	22 (20.18%)	10 (25.00%)	6 (18.75%)	6 (16.22%)
Total	109	40	32	37

Note: No significant differences between treatments have been found.

Result 2: The majority of subjects announces to be dissatisfied when learning their opponent's endowment.

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[21] Before reporting their satisfaction, subjects had to read instructions about how to report their satisfaction. 8 seconds after displaying instructions (resp. 12 seconds for second evaluation), the graduated scale was displayed on subjects' screen. Time was measured, in seconds, as soon as the graduated scale was displayed.

Support: As Table 3 shows, 60 out of 109 players A report their satisfaction to be negatively affected by learning their opponent's endowment. There are significantly more subjects indicating to be dissatisfied.

Facing an unfavourable social comparison, 55.05% of players A report a decrease in their satisfaction level. A decrease in subjects' satisfaction indicates that subjects express to be dissatisfied after learning their inferior situation. On aggregate, there are significantly more individuals reporting negative changes in their satisfaction than positive or no changes (resp. $p < 0.01$ and $p < 0.01$, two-sample test of proportions). Result 2 corroborates H1b.

Table 3: Number and frequencies of changes (according to direction) and no changes in satisfaction.

Direction of changes	Overall	LL	HL	HH
Negative changes in satisfaction	60 (55.05%)	15 (37.50%)	20 (62.20%)	25 (67.56%)
No changes in satisfaction	22 (20.18%)	10 (25.00%)	6 (18.75%)	6 (16.22%)
Positive changes in satisfaction	27 (24.77%)	15 (37.50%)	6 (18.75%)	6 (16.22%)
Total	109	40	32	37

Result 3: The satisfaction subjects derive from unfavourable social comparison is negatively correlated by players' endowments and by absolute difference. Then as both players A and B's endowments and absolute difference increase, more subjects report to be dissatisfied.

Support: From Table 3, we observe that as endowments increase there are significantly more individuals reporting negative changes in their satisfaction ($p < 0.05$, two-sample test of proportions). Both Spearman Rank Correlation test and *Partial Least Square* (PLS) regressions convey that absolute difference and both players' endowments have a significant and negative impact on the satisfaction players A's derive from social comparisons. Results from PLS regression are given in Table 5.

We now compare the number of persons reporting to be dissatisfied, indifferent and satisfied in each treatment. In treatments HL and HH, there are significantly more dissatisfied players A than indifferent or satisfied ones (resp. $p < 0.01$ and $p < 0.01$, two-sample test of proportions). Nevertheless, if we consider treatment LL, we do not observe any significant differences between the number of players A reporting to be dissatisfied, indifferent and satisfied (resp. $p > 0.1$ and $p > 0.1$,

two-sample test of proportions). Then there are more dissatisfied subjects in presence of high endowments (HL and HH).

Are subjects' satisfaction modulated by some parameters? We investigate whether there is correlation between the intensity and nature of the satisfaction subjects' derive from social comparison and other parameters (e.g. subjects' endowments, absolute difference…). The intensity and nature of the satisfaction players A draw from social comparisons are captured by the variable $Diffeval$[22]. This variable represents the difference between the two reported levels of satisfaction. If $Diffeval$ is positive, it is because reported satisfaction at second evaluation is higher than at the first one (i.e. a subject reports to be more satisfied, or less dissatisfied, after learning his opponent's situation). Results on Spearman Rank Correlation test are given in Table 4. We observe that four variables have a significant correlation with $Diffeval$. The subject's own endowment, the opponent's endowment and absolute difference are negatively and significantly correlated to the satisfaction subjects derive from unflattering social comparisons. In other words, as player A's endowment, player B's endowment and absolute difference increase, subjects' satisfaction decrease. Hence more subjects indicate to be dissatisfied. Besides the time subjects took for evaluating their satisfaction at first evaluation is significantly and positively correlated to $Diffeval$. Thus dissatisfied subjects took significantly less time than others for evaluating their satisfaction. This last point might be interpreted as an evidence of the presence of negative emotions such as envy or anger: these emotions are known for being experienced very intensively and arising quickly.

Table 4: Results on Spearman Rank Correlation test made on the nature and intensity of satisfaction.

Spearman Rank Correlation Test

Nb. Obs: 109

Dependent Variable: $Diffeval = Eval2 - Eval1$

Independent variable	Spearman Correlation
X_A (Player A's endowment)	-0.292***
X_B (Player B's endowment)	-0.330***
D_R (Relative difference)	0.008
D_A (Absolute difference)	-0.289***
$TpEval1$ (Time for first evaluation)	0.238**
$TpEval2$ (Time for second evaluation)	0.125

Note: * indicates significant at 0.1 level; ** significant at 0.05 level and *** significant at 0.01 level.

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[22] $Diffeval = Satisfaction\ reported\ at\ second\ evaluation - Satisfaction\ reported\ at\ first\ evaluation.$

We have also ordered *Partial Least Square* (PLS) regressions in order to investigate which parameters have more influence on the nature and intensity of $Diffeval$. When the factors (i.e. independent variables) are few in number, not significantly redundant (collinear) and have a well-understood relationship to the responses then *Multiple Linear Regression* (MLR) can be a good way to turn data into information. However if any of these three conditions breaks down, MLR is inappropriate. On the contrary, PLS regression is a method based on the construction of orthogonal factors in order to improve the quality of the model (Tenenhaus, 1998). Thus PLS suits perfectly for constructing predictive models when the factors are highly collinear: it enables regressions without excluding linear variables. Many variables from our experiment suffer from collinearity. As absolute difference is equal to the difference between subjects' endowments and relative difference corresponds to the ratio between the opponent's and the subject's endowment. Then it is impossible to make a MLR introducing both the subjects' endowments and absolute difference (and then relative difference). Using PLS regression, we can observe the importance of each variable on predicting the response. We try to investigate which parameters have more influence on the satisfaction (resp. dissatisfaction) subjects draw from social comparison. We also measure time subjects took for evaluating their satisfaction and introduce it in our analysis. Three parameters have a significant and negative impact on $Diffeval$: the opponent's endowment, absolute difference and the subject's endowment (see Table 5). In other words, as absolute difference increases dissatisfaction increases. This result highlights the importance of others' situations (and more precisely others' income) in individual well-being. Subjects' satisfaction is deeply connected to others' income and to existing absolute differences between their own income and others' income. Hence result 3 confirms H3a.

Table 5: Results from PLS regression (variable of importance, weight and direction of the relation) on Diffeval.

PLS regression

Nb. Obs : 109

Adj-R Squared: 0.1074

Dependent Variable: $Diffeval = Eval2 - Eval1$

Independent variable	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 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). TpEval1 (resp. TpEval2) denotes the time subjects took for first (resp. second) evaluation. Using subjective data, the typical order of magnitude of the R-Squared ranges from 8% to 20% (Senik, 2005).

Result 4: On average, one subject out of three chooses to reduce the opponent's endowment.

Support: As Table 6 shows, on aggregate, 32.11% of subjects choose to undertake a negative action aiming at reducing the opponent's situation. Besides reduction decisions are not intense.

In absence of interactions, only 35 subjects on 109 indicate that they were willing to reduce their opponent's endowment. Unfavourable social comparisons have enough effect on subjects' behaviour to exert almost a third of them to reduce others' income whereas others cannot retaliate. There are no significant differences in terms of the number of negative actions undertaken between treatments ($p > 0.1$, two-sample test of proportions). Result 4 supports H2a. Results 1 and 4 strengthen the key role of social comparisons on subjects' satisfaction and behaviour.

Table 6: Number (and proportions) and intensity of negative actions undertaken by treatment.

Treatment	Overall	LL	HL	HH
Negative actions	35	10	14	11
(proportions)	(32.11%)	(25.00%)	(43.75%)	(29.73%)
Average intensity	3.34	3.05	3.83	3.86

Negative actions are not very intense (see Table 6). Whereas subjects could invest up to 10 unities, they invest, on average, 3.34 unities. Besides subjects who report to be dissatisfied did not invest more in negative actions than others (and vice versa). When comparing the amount invested between treatments, we do not find significant differences except between treatments HL and HH ($p = 0.061$, two sided Mann-Whitney U-Test). This difference can be explained by the fact that more subjects choose to invest the maximum allowed in treatment HL. Indeed 4 subjects out of 14 invested 10 units in HL whereas only 1 subject out of 11 invested 10 units in HH. In line with this result, we observe that the intensity of negative actions is significantly and negatively correlated to the absolute and relative difference between subjects' endowments (see Table 7). Then as

differences (both absolute and relative) between subjects' endowments decrease, negative actions are more intense. These observations tend to support the polarization theory. We also find that the absolute value of changes in satisfaction (captured by the variable $Diffevalabs$ that measures the intensity of changes in subjects' satisfaction) is significantly and negatively correlated to the intensity of reduction decisions. Hence a subject reporting high changes (whether positive or negative) in his satisfaction invest less in reduction decisions than a subject reporting slight changes in his satisfaction.

Table 7: Results from PLS regression on the intensity of reduction decisions.

PLS regression

Nb. Obs : 35

Adj-R Squared: 0.1698

Dependent Variable: Intensity of reduction decision

Independent variable	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

Result 5: Negative actions are mostly undertaken by dissatisfied subjects.

Support: Table 8 shows that dissatisfied subjects choose significantly more often to undertake a destructive action than others.

Subjects who report to be negatively affected by learning their opponent's situation choose significantly more often to reduce their opponent's endowment than others (p < 0.01, two-sample test of proportions). Indeed 22 subjects out of 35 who decided to reduce their opponent's endowment reported that they were less satisfied (resp. more dissatisfied) when being informed of their opponent's situation.

Table 8: Number (and proportion of subjects) taking a negative action according to direction of changes in subjects' satisfaction.

Direction of changes	Subjects taking a negative action	Total number of subjects
Negative changes in satisfaction	22 (62.86%)	60
No changes in satisfaction	6 (17.14%)	22
Positive changes in satisfaction	7 (20.00%)	27
Total	35 (100%)	109

Result 5 corroborates H2b. Besides, if we refer to the time subjects took for evaluating their satisfaction (see Table 9), we find some evidence suggesting that dissatisfied subjects might be influenced by negative emotions (e.g. envy). Indeed subjects reporting to be dissatisfied took significantly less time for evaluating their satisfaction than satisfied or indifferent subjects (resp. p = 0.022 and p = 0.034, two sided Mann-Whitney U-Test). Negative emotions (e.g. anger, irritation and envy) are known for being experienced very intensively and arising quickly (Lazarus, 1991; Ben Ze'ev, 2000). The fact that dissatisfied subjects took significantly less time for evaluating their satisfaction might thus be considered as an additional evidence of the experience of negative emotions and of their influence on subjects' behaviour.

Table 9: Average time for evaluation according to direction of changes in subjects' satisfaction.

Direction of changes	Mean time for first evaluation (in seconds)	Mean time for second evaluation (in seconds)	Average time for evaluation (in seconds)
Negative changes in satisfaction	34.38	22.98	57.37
No changes in satisfaction	35.50	24.68	60.18
Positive changes in satisfaction	40.63	24.96	65.59
Average	36.16	23.82	59.97

Result 6: The probability for a subject to undertake a negative action is significantly and negatively correlated to the relative difference between players' endowments.

Support: We estimate a binary logit model in order to identify the parameters having an influence on the probability for a subject to reduce the opponent's endowment. Table 10 reports the results of the estimation.

As satisfaction is modulated by absolute difference and as dissatisfied subjects reduced more others' income, one would expect absolute difference and the intensity of dissatisfaction to affect individuals' behaviour. Nevertheless, except for relative difference, no variable has a significant impact on the probability for a subject to reduce others' situation. A subject is more likely to reduce his opponent's endowment when the relative difference between both endowments is low. In other words, a subject whose endowment is twice inferior to his opponent's one is more liable to take a negative action than a subject whose endowment is three times inferior. With regards to our results it seems that only relative difference exerts an impact on subjects' behaviour. Finally H3b is validated while H2c is refuted.

Table 10: Results on Logit regression (probability modelled is subject chooses to reduce others' payoff).

Logit Regression

Nb.Obs   109

Adj-R Squared: 0.0446

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

Independent variable	Coefficient (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.

6. Conclusion and discussion

In this paper, we implement a very simple experimental protocol in order to investigate the impact of social comparisons on individual behaviour. We aim at observing if subjects' satisfaction is affected by unflattering social comparisons and if changes in subjects' satisfaction can explain destructive behaviour. To fulfil that purpose we refer to the notion of interdependent preferences. This concept highlights that others' situations (and more precisely others' income) affect individual well-being. We identify and measure interdependent preferences by asking to the subject to report his satisfaction level after learning his own endowment and after being informed of his opponent's endowment. Then subjects have the possibility to reduce their opponent's endowment by incurring a personal

cost. We also aim at investigating if subjects' satisfaction and behaviour are the same when differences between subjects' situations are low and when these differences are high? In other words, will Joe the Plumber be more affected and more prone to engage a destructive action by learning his colleague's annual income or by learning Bill Gates' one?

We observe that social comparisons are of great importance in determining subjects' well-being. First the great majority of subjects report their satisfaction to be affected when learning the opponent's endowment. Then the majority of subjects (55.57%) indicate to be dissatisfied after receiving information on their opponent's higher endowment. Moreover subjects' well-being is connected to others' situations. Indeed we observe that the satisfaction subjects derive from unfavourable social comparisons is negatively modulated by the opponent's endowment, the absolute difference (i.e. difference between subjects' endowments measured in absolute terms) and by their own endowment. Hence as both the opponent's endowment and the absolute difference increase, more subjects report to be more dissatisfied. It seems that unflattering social comparisons have a negative impact on individual well-being as income and inequalities increase. In our experiment, although subjects are not in interaction with other players, one subject out of three announces that he is willing to reduce his opponent's endowment. Whereas this result seems at first sight surprising, it strengthens the importance of social comparisons. Indeed unfavourable social comparisons have enough impact on subjects' behaviour to induce one third of them to engage hostile actions against others. Besides subjects reporting negative changes in their satisfaction after unflattering social comparisons undertake significantly more negative actions than others. Finally, relative difference (difference captured by the ratio between subjects' endowments) modulates subjects' decisions to reduce others' endowment. Indeed the probability for a subject to reduce his opponent's endowment is significantly and negatively correlated to the relative difference. As relative difference increases, a subject is less prone to engage a hostile action toward his opponent. Then both absolute and relative differences affect subjects. On the one hand absolute difference has a negative impact on subjects' satisfaction. On the other hand relative difference modulates subjects' behaviour by influencing negatively subjects' probability to reduce others' income.

This study provides interesting results for happiness research. It supplies empirical results indicating that social comparisons are enough important for subjects to engage behaviour. This simple study helps in disentangling the effect of both absolute and relative difference on subjects' well-being and behaviour. This research can also be particularly relevant for human resources when designing new firms' structure. By implementing financial incentives, managers can generate economic inequalities within a firm. These inequalities can trigger unpleasant feelings within some employees and exert them to sabotage the work of their colleagues or superiors.

This experiment can also serve as a new design for testing the role of complex emotions on individual behaviour. Indeed whereas primary emotions (joy, disgust, anger, sadness, fear and surprise) are easily recognizable and well defined by subjects more complex ones (envy, indignation, shame …) are more difficult to recognize and to define. Several methods can be used to assess the implications of emotions in decision making. Bosman and van Winden (2002, 2005) used a self-report method which consisted in giving a list of emotions and asking to the subject to report the intensity of each emotion on a graduated scale ranging from 1 (the emotion is not present at all) to 7 (the emotion is highly present). This method suits particularly well to the study of primary emotions because it relies on the assumption that subjects have a common and correct definition on given emotions. When asking to a subject if he feels envious, it requires that a subject knows the definition of envy. It has been proved, concerning the emotion of envy, that people adopt a wrong definition of envy and confound envy with jealousy (Smith et al., 1988). Besides emotion theorists commonly agree that ordinary language is confusing and misappropriate to the study of complex emotions. To study complex emotions, psychologists tend to use more sophisticated self-report questionnaires (Smith et al., 1999) using a great number of items and asking to the subject to rate each item. This study relies on a simple method which consists in asking to the subject to report his satisfaction level at different moments. Although we restrict our study to partial aspects of the emotion of envy, this study strengthens the invasive and powerful character of envy on individuals' well-being and behaviour.

We observe that satisfaction decreases when the subject's endowment increases. At first sight, this result seems contradictory: people should be happier as receiving higher endowment. Nevertheless Hirsch (1976) argued that the portion of people's consumption devoted to positional goods would increase as wealth increases. Few quasi-experiments dealing with positional bias showed that people are more positional on attributes for which they enjoy higher absolute levels (Van Kempen, 2003; Grolleau and Said, 2009). This result might be considered as strengthening Hirsch's hypothesis. Furthermore some results from happiness studies lead to the same conclusion. Layard (2005) referred on international data and suggested that above a fairly basic level of income, the efficiency of income on happiness is decreasing. Thus above a certain level of income, any increase of income would give very little additional happiness.

Finally we implement an experiment protocol in order to observe the affective and behavioural consequences of undeserved but moral situations of inferiority. It would be interesting to disentangle the affective and behavioural consequences of envy from those of indignation (resentment). To fulfil that purpose, one could rule a new experimental design in which players A's endowments are attributed by players B.

References

Abbink, K., Masclet, D. and Mirza, D. (2008). Inequality and riots: an experimental evidence, *Working Paper*.

Alewell, D. and Nicklisch, A. (2009). Wage differentials and social comparison: an experimental study of interrelated ultimatum bargaining, *International Review of Law and Economics*, Vol. 29(3), pp. 210-220.

Bacon, F. (1601). On envy, in *Essays or Counsels, Civil and Moral.*

Bault, N., Coricelli, G. and Rustichini, A. (2008). Interdependent utilities: how social ranking affects choice behavior, *PLoS One*, Vol. 3 (10) e3477, Epub 2008, Oct 22.

Becker, G. (1991). *A Treatise on the Family*, Harvard: Harvard University Press (Expanded edition).

Beckman, S. R., Formby, J. P., Smith, W. J. and Zheng, B. (2002). Envy, malice and Pareto efficiency: an experimental investigation, *Social Choice and Welfare*, Vol. 19, pp. 349-367.

Ben-Shakhar, G., Bornstein, G., Hopfensitz, A. and van Winden, F. (2007). Reciprocity and emotions in bargaining using physiological and self-report measures, *Journal of Economic Psychology*, Vol. 28, pp. 314-323.

Ben-Ze'ev, A. (1992). Envy and Inequality, *The Journal of Philosophy*, Vol. 89, No. 11, pp. 551-581.

Ben Ze'ev, A. (2000). *The subtlety of emotions*. Cambridge, MA: MIT Press.

Bohnet, I. and Zeckhauser, R. (2004). Social comparisons in ultimatum bargaining, *Scandinavian Journal of Economics*, Vol. 106, pp. 684-708.

Bolton, G. and Ockenfels, A. (2000). ERC: a theory of equity, reciprocity and competition, *American Economic Review*, Vol. 90, pp. 166-193.

Bosman, R. and van Winden, F. (2002). Emotional hazard in a power-to-take experiment, *The Economic Journal*, Vol.112, pp. 147-169.

Bosman, R., Sutter, M., van Winden, F. (2005). The impact of real effort and emotions in the power-to-take game, *Journal of Economic Psychology*, Vol. 26, pp. 407-429.

Celse, J. (2010). Sketching envy: from Philosophy to experimental evidence, *Working Paper*.

Clark, A. (1996). L'utilité est-elle relative? Analyse à l'aide de données sur les ménages, *Economie et Prévision*, Vol. 121, pp. 151-164.

Clark, A. (2003). Inequality aversion and income mobility: a direct test, *Working Paper*.

Clark, A. and Oswald, A. (1996). Satisfaction and comparison income, *Journal of Public Economics*, Vol. 61, pp. 359-381.

D'Arms, J., and Duncan Kerr, A. (2008). Envy in the philosophical tradition. In R. Smith (Ed.). *Envy: Theory and Research* (pp.39-59). Series in Affective Sciences. Oxford University Press.

De Sousa, R., 1987, *The Rationality of Emotion*, Cambridge, Mass.: MIT Press.

Duesenberry, J. S. (1949). *Income, Savings and the Theory of Consumer Behavior*, Harvard, Harvard University Press.

Easterlin, R. (1995). Will raising the incomes of all improve the happiness of all?, *Journal of Economic Behaviour and Organizations*, Vol. 27, pp. 35-47.

Fëhr, E. and Schmidt, K. M. (1999). A theory of fairness, competition and cooperation, *Quaterly Journal of Economics*, Vol. 114, pp. 817-868.

Ferrer-i-Carbonell, A. (2005). Income and well-being: an empirical analysis of the comparison effect, *Journal of Public* Economics, Vol. 89 (5-6), pp. 997-1019.

Festinger, L. A. (1954). A theory of social comparison processes, *Human Relations*, Vol. 7, pp. 117-140.

Fliessbach. K., Weber, B., Trautner, P., Dohmen, T., Sunde, U. , Elger, C. E. and Falk, A. (2007). Social comparison affects reward-related brain activity in the human ventral striatum, *Science*, Vol. 318 (Nov).

Frank, R. H. (1997). The frame of reference as a public good, *The Economic Journal*, Vol. 107, pp. 1832-1847.

Frank, R. H. and Sunstein, C. R. (2001). Cost-Benefit analysis and relative position, *University of Chicago Law Review*, 68 (2), pp. 323-75.

Gächter, S., Nosenzo, D. and Sefton, M. (2008). The impact of social comparisons on reciprocity, CeDEx Discussion paper, N° 2008-09.

Gächter, S. and Thöni, C. (2009). Social comparison and performance: experimental evidence on the fair wage-effort hypothesis, *Discussion Paper*, N°2009-29.

Grolleau, G,. Lakhal, T. and Mzoughi, N. (2008). Consommer plus ou consommer plus que les autres? Une analyse empirique des biens de position, *Revue Economique*, Vol. 59 (4), pp. 701-717.

Grolleau, G. and Said, S. (2009). Do you prefer having more or more than others? Survey evidence on positional concerns in France, *Journal of Economic Issues*, Vol. 42 (4), pp. 1145-1159.

Heider, F. (1958). *The Psychology of interpersonal relations*, New York : Wiley.

Hirsch, F. (1976). *Social limits to growth*, Harvard University Press: Cambridge.

Kahneman, D. and Tversky, A. (1979). Prospect theory: an analysis of decisions under risk, *Econometrica,* Vol. 47, pp. 263-291.

Knez, M. and Camerer, C. (1995). Outside options and social comparison in 3-player ultimatum game experiments, *Games and Economic Behavior*, Vol. 10, pp. 175-178.

Layard, R. (2005). *Happiness: Lessons from a New Science*, London: Allen Lane.

Lazarus, R. S. (1991). *Emotion and Adaptation*, New York: Oxford University Press.

Lehmann, D. R. (2001). The Impact of Altruism and envy on competitive behaviour and satisfaction, *International Journal of Research in Marketing*, Vol.18, pp. 5-17.

Luttmer, E. F. P. (2005). Neighbors as negatives: relative earnings and well-being, *Quaterly Journal of Economics*, Vol. 120 (3), pp. 963-1002.

Michalos, A. (1985). Multiple Discrepancies Theory, *Social Indicators Research*, Vol. 16, pp. 347-413.

Miles, D. and Rossi, M. (2007). Learning about one's relative position and subjective well-being", Applied Economics, Vol. 39, No. 13, pp. 1711-1718.

Mittone, L. and Ploner, M. (2009). Social effects in a multi-agent investment game: an experimental analysis, *CEEL Working Paper*.

Montalvo, J. G. and Reynal-Quenol, M. (2005). Ethnic polarization, potential conflict and civil wars, *American Economic Review*, Vol. 95, No. 3, pp. 796-816.

Neumark, D. and Postlewaite, A. (1998). Relative income concerns and the rise in married women's employment, *Journal of Public Economics*, Vol. 70, pp. 157-193.

Ostby, G. (2008). Polarization, horizontal inequalities and violent civil conflicts, *Journal of Peace Research*, Vol. 45, No. 2, pp. 143-162.

Rawls, J. 1971. (1999). *A Theory of Justice*, revised edition, Cambridge, Mass., The Belknap Press of Harvard University Press.

Schoeck, H. (1995). *L'envie, une histoire du mal,* traduction française. Paris, Les Belles Lettres.

Senik, C. (2005). Income distribution and well-being: what can we learn from subjective data?, *Journal of Economic Surveys*, Vol.19, No. 1, pp. 43-63.

Smith, R.H., Kim. S.H., and Parrott. W.G. (1988). Envy and jealousy: semantic problems and experiential distinctions, *Personality and Social Psychology Bulletin*, Vol.14, pp. 401-409.

Smith, R. H., Parrott, W. G., Ozer, D. and Moniz, A. (1994). Subjective injustice and inferiority as predictors of hostile and depressive feelings in envy, *Personality and Social Psychology Bulletin*, Vol. 20 (6), pp. 705-711.

Smith, R. H., Parrott, W. G., Diener, E. F., Doyle, R. H., and Kim, S.H. (1999). Dispositional envy, *Personality and Social Psychology Bulletin*, Vol. 25 (8), pp. 1007-1020.

Smith, R.H., and Kim, S.H. (2007). Comprehending envy, *Psychological Bulletin*, Vol.133, No 1, pp. 46-64.

Solnick, S. J. and Hemenway, D. (1998). Is more always better?: A survey on positional concerns, *Journal of Economic Behavior & Organization*, Vol. 37, pp. 373-383.

Solnick, S. J. and Hemenway, D. (2005). Are Positional concerns stronger in some domains than in others?, *American Economic Review*, Vol. 95, pp. 147-151.

Tenenhaus, M. (1998). *La Regression PLS: Théorie et pratique*, Technip.

Van Kempen, L. (2003). Fooling the eye of the beholder: deceptive status signaling among the poor in developing countries, *Journal of International Development*, Vol. 15, pp. 157-177.

Veblen, T. (1909). The limitations of marginal utility, *Journal of Political Economy*, Vol. 17, pp. 620-636.

Zizzo, D. J. and Oswald, A. (2001). Are people willing to reduce others' incomes?, *Annales d'Economie et de Statistiques*, Vol. 63-64, pp. 39-62.

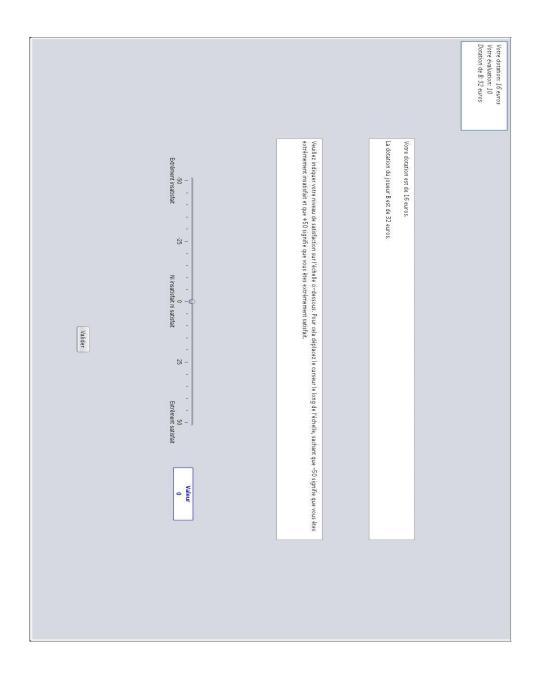# Appendix: Instructions (Translation from French)

Welcome,

We thank you for accepting to participate to this experiment. This experiment will be 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 is neither good nor bad answer. All amounts will be directly expressed in Euros. Your 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 will be randomly associated to a player B. Whatever your role you will always be 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 one 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: Computer screen for evaluation of satisfaction

Votre dotation: 16 euros
Votre évaluation: 10
Dotation de B: 32 euros

Votre dotation est de 16 euros.

La dotation du joueur B est de 32 euros.

Veuillez indiquer votre niveau de satisfaction sur l'échelle ci-dessous. Pour cela déplacez le curseur le long de l'échelle, sachant que −50 signifie que vous êtes extrêmement insatisfait et que +50 signifie que vous êtes extrêmement satisfait.

Extrêmement insatisfait

−50   −25   0   25   50

Ni insatisfait ni satisfait   Extrêmement satisfait

Valider

Valeur
0

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