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« Will Joe the Plumber envy

Bill Gates?

The impact of both absolute and relative

difference on interdependent preferences »

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Will Joe the Plumber envy Bill Gates?

The impact of both absolute and relative difference on interdependent preferences

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. Then they 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) satisfaction is negatively affected by absolute difference (difference between subjects' endowments measured in absolute terms) and (4) relative difference between subjects' endowments modulates subjects' negative behaviour.

Key words: Subjective well-being, Interdependent preferences, Envy, 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 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. So a negative behaviour is not an isolated phenomenon, many recent experiments (Zizzo and Oswald, 2001; Beckman et al., 2002; Abbink et al., 2008) support this observation. Are social comparisons so important for subjects that they exert individuals to behave negatively albeit they incur a personal loss?

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 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[2]. The author observed that relative income (i.e. how much an agent earns in comparison to others) is more important than absolute income (i.e. 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

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[2] This paradox can be summarized by the following quotation: "*Raising the income of all does not increase the happiness of all*" (Easterlin, 1995, p. 44).

results suggest that job satisfaction is entirely relative[3]. In line with previous work, Ferrer-i-Carbonnell (2005), using German Panel, revealed that an agent's life satisfaction decreases with the income of the agent's reference group[4]. 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 condition and two-player condition. 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 choosing the other gamble. This one-player condition was implemented in order to identify the affective consequences of private emotions (regret and joy). 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 choosing a gamble. The two-player condition supplied information on the affective effects of social emotions (envy and gloating). The authors underlined the key role of social comparisons by observing that social emotions (i.e. subjective feelings experienced in the two-player condition) 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, has 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 are 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[5]. In another experiment, Beckman et al. (2002) provided experimental evidences that social emotions, more precisely envy and malice[6] 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[7]. The authors observed that "*burning"* is substantial: the majority of subjects (62.5%) chose to "*burn*" others' incomes. Nevertheless although this study provides interesting results it does not allow the authors to conclude about the impact of interdependent preferences (i.e. social comparisons) on subjects' behaviour. Indeed, as subjects were associated to other participants they had to face decisions stemming from them. As a consequence subjects could have adopted a strategic behaviour: they decided to reduce others' income in order to retaliate against others'

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[3] By aiming to investigate 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 flow. This result might be interpreted as an evidence that relative comparison does not dependent on the absolute level of payments but rather on relative payment.

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

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

[6] 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.

[7] The cost of "*burning*" (i.e. reducing others' income) varies among treatments from 0.02 to 0.25 experimental monetary units (i.e. for a price of 0.25 m. u the subject have to give up 25 cents in order to reduce 1 dollar of another money).

"*burning*" decisions they anticipated. Bosman and van Winden (2002) focused their attention on how emotions triggered by others' decisions can 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. More precisely, they observed that 1) others' decisions have a great and significant impact on a subject's probability to destroy income, 2) a subject's emotions are deeply affected by others' decisions, 3) negative emotions (in particular irritation and contempt) drive 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 recent experimental studies showed that individuals could behave negatively even by incurring a personal cost. Moreover these studies suggested that emotions, and more precisely social emotions (i.e. emotions triggered by social comparisons), might induce subjects' behaviour. Indeed some studies conveyed that specific emotions could exert subjects to engage specific actions. Nevertheless no study, to our knowledge, has investigated the relationship between social comparisons (i.e. interdependent preferences) and behaviour[8]. Relying on quoted studies, we know that others' situations affect individual satisfaction and we also know that emotions generate specific behaviour. Then it would be tempting to argue that social comparisons affect individuals' behaviour by influencing their satisfaction. Besides we still ignore if interdependent preferences (i.e. social comparisons) can exert individuals to engage specific behaviour such as reducing others' income or refusing Pareto improvements. 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 remaining question is now the following: Can social comparisons affect individuals' behaviour by inducing subjects to undertake specific actions?

Do social comparisons (and thus interdependent preferences) affect individual behaviour, i.e. induce individuals to adopt a specific behaviour? We implement an experimental protocol in order to investigate whether social comparisons change subjects' satisfaction and to determine if these changes can explain subjects' decisions to undertake a negative action, such as reducing others' income. We aim at revealing directly the existence and the nature 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 situation thus his satisfaction (resp. dissatisfaction) would not be affected after learning his opponent's allocation. By reporting changes in his satisfaction after learning the opponent's endowment, a subject is said to manifest interdependent preferences. A subject exhibits positive interdependent preferences if his satisfaction (resp. dissatisfaction) is larger (resp. smaller) after being informed of his opponent's payoff. On the contrary an agent exhibits negative interdependent preferences if he is less satisfied (resp. more dissatisfied) after knowing his opponent's payoff. In our paper, we are only interested in revealing interdependent preferences

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[8] More recently some experiments tried to investigate how social comparisons influence subjects' decisions in a Gift-Exchange game (Gächter et al, 2008; Thöni and Gächter, 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.

when the subject makes unflattering social comparisons, i.e. when the subject's endowment is inferior to his opponent's one[9]. Again we are exclusively interested in one type of behaviour: the negative behaviour resulting from reducing the opponent's endowment.

Additionally, we aim at studying the impact of absolute difference (i.e. difference between subjects' endowments measured in absolute terms) and relative difference (i.e. difference between subjects' endowments measured in relative terms) on both interdependent preferences and on decisions to undertake negative actions. We want to examine whether absolute and/or relative difference modulate interdependent preferences and subjects' decisions to reduce others' income. There seems to be, in happiness studies, a consensus whether subjects are sensitive to relative difference rather than absolute difference. Relying on happiness studies, one might consider that individual well-being is affected by relative difference. In 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. As we rely on experimental methods the next section provides a description of the experimental protocol. Section 3 will be devoted to introduce our results. Last section offers a discussion and concludes.

2. Experimental Protocol

Experimental sessions were conducted in spring 2009 at the LEEM[10]. 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 (a scale from 18 to 26 years old) and from different universities (scientific or not). We ruled 12 sessions and 218 subjects participated in our experiments.

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 were displayed during the experiment[11]. We chose to display instructions during the experiment for two main reasons: First because we did not want subjects 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).

Two roles were randomly distributed in the experiment: role of player A and player B. Each participant can be whether a player A or a player B. As each player A was randomly associated to a

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[9] We focus on unflattering social comparisons because we expect the emotion of envy to play a major role in destruction actions. First because envy is an omnipresent and invasive emotion triggered by unflattering social comparisons and can lead to hostile action (Heider, 1958; Ben Ze'ev, 1992; Smith and Kim, 2007; Celse, 2009). 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 in "*burning*" decisions.

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[11] 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.

player B, there were as many players A as there were players B. Each subject was informed about his role and about the role of the associated player (opponent afterwards) at the beginning of the experiment. Subjects were then told that the computer will randomly allocate an endowment for each player. All subjects knew that feasible endowments ranged from 4€ to 32€. Subjects were also informed that only players 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 procedure of the game). From now we will present the procedures players A had to fulfil.

The experiment is single shot and consisted in a succession of six steps (only players A are concerned with these steps):

1. Each player A was informed about his monetary endowment which was directly expressed in Euros and depended on the treatment (see Table 1).
2. The subject was invited to evaluate and to declare his satisfaction level[12]. The subject had to declare[13] on a graduated scale ranging from -50 to +50 how satisfied he was by choosing a position on a slider. At the left extreme of the scale, the slider indicated the state "Extremely Dissatisfied[14]" and at the other extreme the state "Extremely Satisfied". The middle position was valued by 0 and indicated "Neither satisfied nor dissatisfied"[15]. A table indicated the value of the slider and remained the subject's endowment.
3. Players A received information about their opponents' endowment and thus realized their inferior position.
4. Each player A had to evaluate and to declare how satisfied they were after knowing their opponent's endowment (same procedure as previously).
5. Each player A was informed that they could decide or not to reduce their opponent's endowment[16]. If a player A decided not to reduce his opponent's endowment then the experiment was finished and subjects were paid according to their endowments. If a subject decided to reduce his opponent's endowment, he passed to the next step.
6. The player has to indicate how much he wanted to reduce his opponent's endowment. The subject could invest any integer amount from 1 to 10 unities[17], each unity was costly[18] and

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[12] The subject had to confirm each decision he took.

[13] We trust that asking subjects to report their satisfaction is a reliable method. First, methods based on self-report measures are recurrent in psychology and often used by emotion theorists. Kahneman and Tversky (1979) argued that "*subjects have no special reason to disguise their true preferences*" (quoted from Bosman and van Winden, 2002). 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).

[14] All instructions were written in French. An English version of the instructions is supplied in appendix.

[15] See Appendix.

[16] 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 have chosen to do so in order to differentiate subjects who were willing to reduce others income from those who were not.

[17] 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.

[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.

reduced the opponent's endowment by a certain amount[19]. The player A could simulate the impact of his decision on both endowments. If a player A invested 10 unities (maximum allowed) to reduce his opponent's endowment then both players were on the same level, i.e. they had the same payoff[20].

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

As we aim at investigating the impact of both absolute and relative difference on individuals' satisfaction and behaviour, we conducted three different treatments. In one treatment entitled *Low Endowments and Low absolute Difference* (treatment LL afterwards), both subjects received low payoffs: 4€ for players A and 8€ for players B. Thus, in that treatment, the absolute gap between players A and B's endowments was low (gap equals 4€). In another one, *High Endowments and High absolute Difference* (treatment HH afterwards), subjects were better endowed: players A received 16€ and players B 32€. So in that latter treatment both subjects' endowments and the absolute difference between players' endowments has increased (gap equals 16€). Although relative difference was kept constant in LL and HH[21], we cannot rely on these two treatments to conclude about the impact of absolute nor relative difference on individuals' behaviour. Indeed two parameters were changed: the absolute gap between players and their endowments. Hence we conducted another treatment, entitled *High Endowments and Low absolute Difference* (treatment HL afterwards), in which players A received 16€ and players B 20€. In the latter treatment, only one parameter varied from treatment LL: the endowments attributed to players. The absolute difference is kept constant between LL and HL. Introduction of that latter treatment allows us to disentangle the effect of both absolute and relative difference on subjects' satisfaction and behaviour. Then it helps in drawing conclusions.

Table 1: Treatments and parameters used in the experiment.

Treatments	Subject's endowment	Opponent's endowment	Absolute difference	Relative difference	Cost for each unity invested in negative action	Reduction for each unity invested in negative action
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, $e \in [1; 10]$.

3. Results

Saying it differently, in order to reduce his opponent's endowment by one unity each player A had to sacrifice 2.5% of his initial endowment.

[19] 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%.

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

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

Result 1: The majority of subjects exhibits interdependent preferences.

Support: As Table 2 shows, 87 out of 109 players A report to be affected by learning their opponent's situation.

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 ($p < 0.01$, two-sample test of proportions). Whatever the inequality subjects are placed in, the great majority of them report to be affected, whether positively or negatively, when hearing their opponent's higher endowment. Indeed, there are no significant differences among subjects reporting changes in their satisfaction between treatments LL and HL, LL and HH and between HL and HH ($p > 0.1$, two-sample test of proportions). 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[22]. We measure time subjects took for evaluating their satisfaction and introduce it to our analysis. The binary logit model shows no significant results (see Table 3).

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

Table 3: Binary logit model results (probability to exhibit interdependent preferences).

Binary logit model
Nb. Obs : 109
Dependent Variable: Subject exhibits interdependent preferences ($Eval2 - Eval1 \neq 0$)

Independent variable	Coefficient (Std. errors)
Constant	1.9881 (1.4155)
D_R (Relative difference)	-0.5263 (0.7803)
D_A (Absolute difference)	0.0460 (0.0481)
$TpEval1$ (Time for first evaluation)	0.0048 (0.0132)
$TpEval2$ (Time for second evaluation)	-0.0085 (0.0180)

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

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[22] 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, while the graduated scale was displayed.

Our result underlines the importance and omnipresence of social comparisons. The great majority of subjects report their satisfaction to be affected when they learned their opponent's payoff. By doing so, people seem to attach much importance to income comparisons. Our result is consistent to prior findings on happiness studies (Clark and Oswald, 1996; Neumark and Postlewaite, 1998) as well as on positional studies (Frank, 1997; Solnick and Hemenway, 1998, 2005; Frank and Sunstein, 2001) which tend to corroborate the invasive character of interdependent preferences. Scholars argue that social comparisons are inherent to human beings: they have a huge impact on one's self-evaluation. Ben Ze'ev (1992) emphasizes on the key role of 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. Social comparisons lead to a diagnostic: being superior/inferior or on success/failure. Hence social comparisons are important because they give information about which ingredients are required to perform better or to acquire success. In line with quoted authors, Michalos (1985) argue that satisfaction judgements are strongly linked to the existing differences between one's situation and the situation of one's reference (which can consist of a solely individual, a group of persons, aspirations, needs…).

Result 2: The majority of subjects exhibits negative interdependent preferences.

Support: As Table 4 shows, 60 out of 109 players A report to be negatively affected by learning their opponent's endowment.

After being informed of their opponent's better situation, 55.05% of subjects report to be less satisfied (or more dissatisfied). The majority of subjects express negative interdependent preferences. Indeed, significantly most people exhibit negative interdependent preferences than positive interdependent preferences and than indifference (resp. $p < 0.01$ and $p < 0.01$, two-sample test of proportions). This result holds for treatments HL and HH but not for treatment LL. In treatment LL, whereas both differences and endowments are low there as many subjects reporting to exhibit negative and positive interdependent preferences ($p > 0.1$, two-sample test of proportions).

Table 4: Number of subjects reporting changes or not in their satisfaction.

	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

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, i.e. their inferiority in one or more than one specific areas. These comparisons are to be held responsible for generating feelings of ill-will and displeasure (Smith et al., 1994; Smith and Kim, 2007). Such negative feelings are prone to damage one self-image and self-esteem. Hence the negative affective consequences of feelings of inferiority might explain why so

many subjects declare to be dissatisfied (resp. less satisfied) when learning their opponent's endowment. Our result is in line with those from Bault et al. (2008). In their experiment, subjects reported that situations in which they received a fewer payoff than their opponent were experienced as the worst situation. The authors conclude that envy (situations where the subject's payoff was inferior to another subject's payoff) was experienced as a very negative emotion. In our experiment, the majority of subjects consider situations of economic inferiority as very negative ones.

A remaining question would be the following: why are there no significant differences among interdependent preferences in treatment LL? Indeed when subjects receive low endowments (4€ and 8€) and, as a consequence, when absolute difference is low (4€) there are no significant differences among interdependent preferences. The reason might be found in positional studies. Hirsch (1976) argued that as subjects' wealth increase, subjects become more positional. This would suggest the existence of a threshold. Above that threshold, subjects would be more prone to use their income in positional goods (leisure, cars…) because they already are sure to satisfy their basic needs (housing, basic consumption level…). Hence according to the author, we would expect to observe more dissatisfied subjects in HL and HH than in LL. Indeed once entering in the laboratory subjects are willing to win a payoff large enough to reimburse travel costs and time spent in experiments. Once subjects have won a certain amount, they may consider income as more positional. Hence subjects would be more affected by others' situations when receiving higher endowments (i.e. in treatments HL and HH). We observe such a result. To our knowledge, there is little empirical evidence on such a relationship between income and interdependent preferences. Grolleau and Said (2008), in a positional study, implemented two different questions on income: a low income question and high income question. More positional answers were observed concerning the high income question than concerning the low income question.

Result 3: Subjects' interdependent preferences are negatively modulated by subjects' endowments and absolute difference. Then dissatisfaction increases with subjects' endowments and absolute difference.

Support: We observe that as subjects' endowments increase there are significantly more people reporting negative interdependent preferences (see Table 4). Spearman Rank Correlation tests and *Partial Least Square* (PLS) regressions reveal that absolute difference and subjects' endowments have a significant impact on interdependent preferences. Results from PLS regression are given in Table 6.

As players' endowments increase, more subjects report to be dissatisfied. Indeed there are significantly more subjects reporting to be negatively affected by their opponent's situation than subjects who report positive changes or no changes in their satisfaction (resp. $p < 0.01$ and $p < 0.01$, two-sample test of proportions) in treatment HL. We observe the same differences in treatment HH (resp. $p < 0.01$ and $p < 0.01$, two-sample test of proportions). Conversely in treatment LL, there are no significant differences in terms of interdependent preferences between subjects (resp. $p > 0.1$ and $p > 0.1$, two-sample test of proportions).

Are subjects' interdependent preferences modulated by some parameters? We investigate whether there is correlation between the intensity and nature of interdependent preferences subjects exhibit and other parameters such as the subject's endowment, the opponent's one, the absolute difference… The intensity and nature of interdependent preferences subjects express are captured

by the variable $Diffeval$[23]. 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). The subject is thus said to exhibit positive interdependent preferences. Results on Spearman Rank Correlation tests are given in Table 5. We observe that four variables have a significant correlation with the intensity and nature of interdependent preferences. The subject's own endowment, the opponent's endowment and absolute difference are negatively and significantly correlated to subjects' interdependent preferences. In other words, as the subject's endowment, the opponent's endowment and thus absolute difference increase, subjects' satisfaction decrease and more subjects exhibit negative interdependent preferences. Besides time subjects took for evaluating their satisfaction at first evaluation is significantly and positively correlated to subjects' interdependent preferences. If we consider time subjects took for evaluating their satisfaction (see Table 12), we observe that dissatisfied subjects took significantly less time than others. This last point might be interpreted as an evidence of the presence of negative emotions such as envy and anger (see above).

Table 5: Results on Spearman Rank Correlation test made on the nature and intensity of interdependent preferences.

Spearman Rank Correlation Test
Nb. Obs   109
Dependent Variable: $Diffeval = Eval2 - Eval1$

Independent variable	Spearman Correlation
X_A (Player A's endowment)	-0.2922***
X_B (Player B's endowment)	-0.3307***
D_R (Relative difference)	0.0084
D_A (Absolute difference)	-0.2893***
$TpEval1$ (Time for first evaluation)	0.2385**
$TpEval2$ (Time for second evaluation)	0.1251

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

We have also ordered *Partial Least Square* (PLS) regressions in order to investigate which parameters have more influence on the nature and intensity of interdependent preferences. 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. The consequences of the use of the MLR are: the variances of the estimators are not minimal, then the t-statistics tends towards zero (the probability to accept H0 increases) and the R-squared tends towards 1. However if any of these three conditions breaks down, *Multiple Linear Regression* 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[24]. 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

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[23] $Diffeval = Satisfaction\ reported\ at\ second\ evaluation - Satisfaction\ reported\ at\ first\ evaluation.$
[24] See Tenenhaus (1998).

collinearity. For example absolute difference is equal to the difference between subjects' endowments and relative difference corresponds to the opponent's endowment divided by 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 subjects' satisfaction (resp. dissatisfaction). We also measure time subjects took for evaluating their satisfaction and introduce it in our analysis. Again we refer to the variable labeled $Diffeval$ to capture the nature and intensity of interdependent preferences. Three parameters have a significant and negative impact on subjects' interdependent preferences: the opponent's endowment, absolute difference and the subject's endowment (see Table 6). In other words, as absolute inequalities increase 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.

Table 6: Results from PLS regression (variable of importance, weight and direction of the relation).

PLS regression				
Nb. Obs : 109				
Dependent Variable: $Diffeval = Eval2 - Eval1$				
Independent variable	Model effect weights (vector Wh*)	Model effect loadings (Vector Ph)	Variable Importance	Unstandardised regression parameters
X_A (Player A's endowment)	-0.5386	-0.5479	1.3194*	
X_B (Player B's endowment)	-0.6220	-0.6254	1.5236*	
D_R (Relative difference)	-0.0072	0.0063	0.0177	
D_A (Absolute difference)	-0.5552	-0.5517	1.3599*	
$TpEval1$ (Time for first evaluation)	0.1144	0.0694	0.2802	
$TpEval2$ (Time for second evaluation)	0.0405	0.0417	0.0992	

Note: *Statistically significant (VIP > 1). Vectors Wh* (also referred as 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. Vectors Ph indicate the direction of the connection. Vectors Ph are statistically significant when Ph > 0.4.

At first sight, this result seems contradictory: people should be happier as receiving higher endowments. Nevertheless this result is observed in positional studies. Hirsch (1976) argued that the portion of people's consumption devoted to positional goods would increase as wealth increases. Several quasi-experiments dealing with position   al bias are in line with Hirsch showing that people are more positional on attributes for which they enjoy higher absolute levels (Van Kempen,

2003; Grolleau and Said, 2008). This result strengthens Hirsch's hypothesis by showing that others' situations have a stronger negative effect on subjects' satisfaction as wealth and inequalities increase. Furthermore researches on happiness studies lead to the same conclusion: when others' income and inequalities increase, individual well-being decreases. Ferrer-i-Carbonnell (2005) found that a person's satisfaction with life decreases with the income of his reference group. Luttmer (2005) showed that when the income of the reference group increases, subjects report lower levels of happiness. Finally Layard (2005) drew the same conclusion. He 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.

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

Support: As Table 7 shows, on aggregate, 32.11% of subjects choose to undertake a negative action aiming at reducing the opponent's situation.

In absence of interactions (and thus in absence of any strategic behaviour), only 35 subjects on 109 indicate that they were willing to reduce their opponent's endowment. Unflattering social comparisons have enough effect on subjects' behaviour to exert almost a third of them to reduce others' income whereas others cannot retaliate. We previously observed that social comparisons are of great importance to subjects' satisfaction (see result 1). This result strengthens the key role of social comparisons on subjects' satisfaction and behaviour. This result is also far from corresponding to the observation of Zizzo and Oswald (2001) who observed that more than half of subjects reduced others' income even by incurring a heavy personal cost. But that result fits with observations from Beckman et al. (2002) as well as Bosman and van Winden (2002). Beckman et al. (2002) revealed that up to 34% of subjects placed in situations of inferiority opposed to Pareto improvements. Bosman and van Winden (2002) observed that only 21% of subjects, participating in a power-to-take game, decided to destroy income. There are no significant differences in terms of negative actions undertaken between treatments (p > 0.1, two-sample test of proportions).

Table 7: Number (and proportions) and intensity of negative actions undertaken by treatment.

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

Negative actions are not very intense (see Table 7). Whereas subjects could invest up to 10 unities, they invest, on average, 3.34 unities. If we compare the amount invested between treatments, we do not find significant differences (see Table 8) except between treatments HL and HH (p = 0.061, two sided Mann-Whitney U-Test). Whereas the amount invested in HH is slightly higher than in HL, 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. This observation

tends to support the polarization theory which postulates that conflicts and aggressive acts are more likely to emerge when differences between subjects (or groups) are low[25].

Table 8: Two-tailed Mann-Whitney test on the intensity of negative actions.

Treatments	HL	HH
LL	0.276	0.234
HL	X	0.061*

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

Another result strengthens this explanation. We investigate whether the intensity of negative actions was correlated to other parameters. We observe (see Table 9) that the intensity of negative actions is significantly and negatively correlated to the relative difference between subjects' endowments. Then as relative difference decreases, negative actions are more intense. Again we observe results in accordance with the polarization theory.

Table 9: Results on Spearman correlation test made on the intensity of negative actions undertaken.

Spearman Rank Correlation Test
Nb.Obs   109
Dependent Variable: Intensity of negative actions

Independent variable	Spearman Correlation
X_A (Player A's endowment)	0.1152
X_B (Player B's endowment)	0.0279
D_R (Relative difference)	-0.1967**
D_A (Absolute difference)	-0.0719
$Diffeval$ ($= Eval2 - Eval1$)	-0.0695
$Diffevalabs$ ($= |Eval2 - Eval1|$)	0.0244
$TpEval1$ (Time for first evaluation)	-0.0111
$TpEval2$ (Time for second evaluation)	0.0727

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

We also compare the average amount invested according to the interdependent preferences subjects' reported (see Table 10). Subjects who report negative interdependent preferences did not invest more in negative actions than others and conversely subjects who report positive or no interdependent preferences did not invest more than others. There are no significant differences.

Table 10: Two-tailed Mann-Whitney test on the intensity of negative actions according to reported interdependent preferences.

Interdependent preferences	Positive interdependent preferences	Neutral
Negative interdependent	0.347	0.675

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[25] See also Abbink et al. (2008) who observed that riots are more likely to emerge when opposing two similar groups. They also found that as differences between groups increase, less riots are observed.

preferences		
Neutral	0.825	X

Result 5: Negative actions are mostly undertaken by subjects reporting negative interdependent preferences.

Support: As Table 11 shows there are significantly more subjects exhibiting negative interdependent preferences who decided to undertake a destructive action.

Subjects who report to be negatively affected by learning their opponent's situation choose significantly more 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 11: Number and proportion of subjects taking a negative action by interdependent preferences.

Interdependent preferences	Subjects taking negative action	Total number of subjects
Negative	22 (62.86%)	60
Indifference	6 (17.14%)	22
Positive	7 (20.00%)	27
Total	35 (100%)	109

Bosman and van Winden (2002, 2005) observed that negative emotions, such as irritation and contempt, drove to destruction. In their experiment subjects who report to experience high levels of negative emotions were likely to destroy their endowment. In our experiment we observe a similar result. Negative actions are mostly undertaken by subjects who reported to be negatively affected by learning their opponent's endowment. A decrease in one's satisfaction can be explained by the experience of negative emotions such as envy or irritation. This result reveals a relationship between individuals' well-being and their behaviour. Time subjects took for evaluating their satisfaction tends to corroborate this point (see Table 12). Indeed subjects reporting to be dissatisfied took significantly less time for evaluating their satisfaction than satisfied subjects ($p = 0.022$, two sided Mann-Whitney U-Test). There are no significant differences in time for evaluation between subjects exhibiting negative interdependent preferences and subjects reporting not to be affected by their opponent's situation ($p = 0.630$, two sided Mann-Whitney U-Test). There are neither significant differences between subjects exhibiting positive interdependent preferences and indifference ($p = 0.247$, two sided Mann-Whitney U-Test). Dissatisfied subjects might be influenced by negative emotions (e.g. irritation, envy) which are known for being experienced very intensively and arising quickly (Smith et al, 1988, 1999). The fact that dissatisfied subjects took less time for evaluating their satisfaction might thus be considered as an evidence of the experience of negative emotions.

Table 12: Average time for evaluation by interdependent preferences.

Interdependent	Mean time for first	Mean time for second	Average time for

preferences	evaluation (in seconds)	evaluation (in seconds)	evaluation (in seconds)
Negative	34.38	22.98	57.37
Indifference	35.50	24.68	60.18
Positive	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 determine which parameters have an influence on subjects' negative decisions. Table 13 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 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.

Table 13: Results on Logit regression (probability modelled is subject chooses to reduce others' payoff).

Logit Regression
Nb.Obs 109
Dependent Variable: $Action = 1$

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)

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

Again this result is in line with the polarization theory. We observe that as relative differences between subjects are low subjects are more prone to undertake negative actions. Whereas economic models focus on absolute differences (Fëhr and Schmidt, 1999) we observe that absolute difference only modulates individual satisfaction. Individual behaviour seems to be impacted by relative difference. Researches on happiness reveal that relative difference has more influence on individual well-being than absolute difference (Clark, 1996; 2003). Their results are obtained by analysing

subjective data. But the data they used cannot allow them to disentangle the direct effect of relative inequalities on their satisfaction and the effect of their decisions on their satisfaction. Luttmer (2005) concludes by saying that "*the negative effect of neighbours' earnings is real and that it is most likely caused by a psychological externality, that is, people having utility functions that depend on relative consumption in addition to absolute consumption*" (p. 990).

4. Conclusion and discussion

In this paper, we implement an experimental protocol in order to investigate the impact of social comparisons, through measuring subjects' interdependent preferences, 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 fulfill that purpose we refer to the notion of interdependent preferences. This concept highlights that others' situations (and more precisely others' income) affect largely 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 observe that social comparisons are of great importance in determining subjects' well-being. The great majority of subjects (79.82%) report their satisfaction to be affected when learning the opponent's endowment. More precisely the majority of subjects (55.57%) indicate to be dissatisfied after receiving information on their opponent's higher endowment.

Moreover subjects' interdependent preferences are connected to others' situations. Indeed we observe that subjects' satisfaction is negatively modulated by their own endowment, the opponent's endowment, the absolute difference (i.e. difference between subjects' endowments measured in absolute terms) and by subjects' own endowment. Hence as both the opponent's endowment and the absolute difference increase, more subjects exhibit negative interdependent preferences. It seems that social comparisons have a negative impact on individual well-being as income and inequalities increase.

In our experiment, one subject out of three announces that he is willing to reduce his opponent's endowment. Although subjects are not in interaction with other players (and then not facing others' decisions), one third of them choose to undertake a negative action aiming at reducing their opponent's endowment. Whereas this result seems at first sight surprising, it strengthens the importance of social comparisons. Indeed the latter have enough impact on subjects' behaviour to induce them to engage hostile actions against others. Besides subjects reporting to be dissatisfied (or less satisfied) after unflattering social comparisons undertake significantly more negative actions than others.

Finally, relative difference (i.e. how much the opponent's endowment is larger than the subject one) modulates subjects' decisions to reduce others' endowment. Indeed relative difference is significantly and negatively correlated to the probability for a subject to reduce his opponent's endowment. 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' preferences. On

the one hand absolute difference has an impact on subjects' well-being. Indeed subjects' satisfaction is significantly and negatively correlated to absolute difference. On the other hand relative difference modulates subjects' behaviour by influencing subjects' probability to reduce others' income.

This study provides interesting results for happiness research. It corroborates previous results and indicates that social comparisons are enough important for subjects to engage behaviour. The study helps in disentangling the effect of both absolute and relative difference on subjects' well-being and behaviour. This study 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 their superior's work. More interestingly, this study can be relevant for policymakers. It supplies precious information on the negative consequences of unequal situations on subjects' attitude. Results of this study can be used to explain severe conflicts observed in developed countries (e.g. riots observed in France and in Greece). People may consider their economically inferior situation as undeserved and, after observing the success of different classes, might riot in order to signal the unequal situation.

This experiment can also serve as a new design for testing the role of complex emotions on individual behaviour. Indeed whereas primary emotions (joy, surprise, anger, sadness, fear) are easily recognizable and well defined by subjects more complex ones (envy, jealousy, 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.

This experiment reveals that dissatisfied subjects reduce more others' income than others. The underlying cause for such behaviour could be a desire for equality or envy. On the one hand, subjects by reporting how dissatisfied they are, might indicate that they do not accept an unequal situation and that they are willing to restore equality. On the other hand, subjects report to be dissatisfied because they may feel envy toward their opponent and would appreciate to be in the latter's shoes. In that case, subjects would engage negative actions in order to satisfy their envious feeling. Our protocol cannot disentangle both types of subjects. Nevertheless it supplies information on that point. If subjects were animated by equalitarian principles they would have invested the maximum allowed when reducing their opponent's endowment so as to restore equality. We do not observe such behaviour in our experiment. Indeed only 5 subjects out of 35 (14.28%) have invested the maximum allowed in negative actions.

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.

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.

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. (2009). 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.

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.

Fehr, 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, *IZA Discussion Paper*, N° 2006-16.

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. (2008). 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.

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.

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

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.

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 first 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 a decision. Players B are invited to remain silent during the experiment.

After each participant has finished reading instructions, the computer will 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

Ni insatisfait ni satisfait
0

25

50
Extrêmement satisfait

Valider

Valeur
0

Appendix: Computer screen for decision to reduce opponent's payoff.

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

Vous pouvez réduire la dotation du joueur B avec lequel vous êtes en interaction, sans que celui-ci en soit informé (le joueur B ne pourra donc entreprendre aucune action contre vous).

Souhaitez vous réduire la dotation du joueur B?

◉ oui ○ non

Valider

Vous pouvez investir entre 1 et 10 unités pour réduire la dotation du joueur B.
Chaque unité investie diminue de 2 euros la dotation du joueur B et vous coûte 0,4 euros.

Veuillez indiquer dans la zone de texte ci-contre le nombre d'unités que vous souhaitez investir.

Une simulation de votre gain final et de celui du joueur B s'affiche ci-dessous.

Veuillez saisir un nombre d'unités d'investissement

Valider

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[1] La liste intégrale des Documents de Travail du LAMETA parus depuis 1997 est disponible sur le site internet :
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