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Anxious ultimatums: How anxiety disorders affect socioeconomic behaviour

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Although the role of emotion in socioeconomic decision making is increasingly recognised, the impact of specific emotional disorders, such as anxiety disorders, on these decisions has been surprisingly neglected. Twenty anxious patients and twenty matched controls completed a commonly used socioeconomic task (the Ultimatum Game), in which they had to accept or reject monetary offers from other players. Anxious patients accepted significantly more unfair offers than controls. We discuss the implications of these findings in light of recent models of anxiety, in particular the importance of interpersonal factors and assertiveness in an integrated model of decision making. Finally, we were able to show that pharmacological serotonin used to treat anxious symptomatology tended to normalise decision making, further confirming and extending the role of serotonin in co-operation, prosocial behaviour, and social decision making. These results show, for the first time, a different pattern of socioeconomic behaviour in anxiety disordered patients, in addition to the known memory, attentional and emotional biases that are part of this pathological condition.

Keywords: Decision making; Anxiety; Emotions.

Social interactions are rarely guided by pure economic rationality. Instead, when it comes to decisions about co-operation or resource allocation, humans routinely violate principles espoused by standard economic theory, and instead tend to reciprocate good deeds and punish bad deeds, even when imparting this punishment may come at a personal cost (Wischniewski, Windmann,

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Juckel, & Brüne, 2009). A plethora of research using a variety of different approaches has examined these behaviours, pointing to the role of emotions in guiding decisions. Additionally, as the role of emotion in decision making is increasingly understood and incorporated into economic models of decision making (Loewenstein & Lerner, 2003), socioeconomic behaviour (i.e., the interaction of two or more interested parties) has been shown to engage an ensemble of neural systems relevant to emotion and reward valuation (Sanfey, 2007).

However, individuals differ strongly in their emotional reactivity. These differences may be reflected in variation across personality traits, including the extremes that are exhibited in psychiatric disorders (Mealey, 1995; Troisi, 2005; Wischniewski et al., 2009). For example, it might be that individuals who feel anxious and threatened have a different mode of interacting with others, especially strangers (Wischniewski et al., 2009). Factors such as psychiatric conditions, and in particular how these disorders are relevant in a social context, have been largely bypassed in experimental research to date, but an examination of how people with these conditions engage in social decision making can play a valuable role in both better specifying models of normal decision making, as well as gleaning insights into how decisions are made in these psychiatric populations.

Anxiety and decisions

An excellent example of a disorder that may lead to differences in socioeconomic behaviour is the family of anxiety disorders. This is a condition characterised by preconscious, automatic selective attentional and memory bias for emotionally threatening information (see Clark, 1989, for reviews). In the normal course of events, anxiety is an adaptive emotion, aimed at directing an individual's responses towards threatening stimuli in order to cope with possible dangers. Specifically, anxiety induces physiological responses, such as increased sweating, heart rate, and muscular tension, as well as characteristic behavioural and cognitive patterns (Ackerl, Atzmueller, & Grammer, 2002), such as an increase or decrease in caution, response times, and general adjustment to an environment (Koolhaas et al., 1999). In its exaggerated form, however, anxiety may lead to psychiatric disorders and pessimistic appraisal (de Visser et al., 2010). For example, using self-report measures of risk perception and a decision-making task explicitly involving risk evaluation, studies have found that trait anxiety was associated with increased avoidance of risky decisions and pessimistic risk appraisals (Maner & Schmidt, 2006). Therefore, anxiety appears to affect decision behaviour, which may in turn lead to difficulties in these patients' everyday lives. In particular, disruption of decision-making processes can lead to problems in many different areas, such as in social and financial affairs (Bechara, Damasio, Damasio, & Anderson, 1994). Notably, the same brain areas important for decision making (Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003) are also areas involved in abnormal reactivity in anxiety, for example the insula (Ernst et al., 2002; Paulus, Rogalsky, Simmons, Feinstein, & Stein, 2003), the amygdala (Etkin et al., 2004), and prefrontal cortex (Bishop, 2008; Paulus et al., 2003; Simpson, Drevets, Snyder, Gusnard, & Raichle, 2001).

Most of the empirical literature on anxiety disorders and decision making focuses on factors such as risk (de Visser et al., 2010; Wischniewski et al., 2009). To date no studies have attempted to look for differences in socioeconomic behaviour in which important factors such as co-operation, negotiation, and social beliefs are required for successful interaction. A recent view of anxiety suggests that the disorder is maintained by patients' biased evaluation of their own social abilities (Clark, 1989), or by underestimating their behavioural skills (Hirsch, Meynen, & Clark, 2004). More specifically, with regard to social contexts, anxious people perform worse in social interactions as compared to non-anxious controls (Baker & Edelmann, 2002; Hampel, Weis, Hiller, & Witthöft, 2011), and show low levels of assertiveness (Herzberger, Chan, & Katz, 1984).

Therefore, these social deficits underlying anxiety may be detrimental for daily interpersonal interactions.

Social decision making

In order to examine the impact of anxiety and its associated interpersonal deficits on socioeconomic behaviour, we employed a well-known economic task, the Ultimatum Game (UG; Guth, Schmittberger, & Schwarze, 1982). Here, one player (the "proposer") makes an offer to another player (the "responder") as to how an amount of money should be split between them, with this money provided by the experimenter. The responder can either accept the offer, in which case the money is split as proposed, or reject the offer, in which case neither player receives anything. Whereas standard game theoretic models would predict that responders should accept any offers on the reasonable grounds that even a small amount is preferable to nothing, non-anxious individuals typically reject more than 50% of unfair offers (Camerer, 2003), and experience a negative emotional response and increased arousal when receiving unfair offers (Sanfey et al., 2003; Van 't Wout, Kahn, Sanfey, & Aleman, 2006). The use of this task has been recently applied to schizophrenic patients (Agay, Kron, Carmel, Mendlovic, & Levkovitz, 2008), depressed patients (Harlé, Allen, & Sanfey, 2010) and individuals with schizotypal traits (van 't Wout & Sanfey, 2011), though not to date to anxiety patients.

With regard to anxiety patients, one prediction is that their avoidance of social confrontation (Baker & Edelmann, 2002; Hampel et al., 2011) may lead to lower rejection rates during a UG, that is, they will be less likely to turn down unfair offers as compared to controls. Rejecting an unfair proposal has been considered as a way to maintain respect across members of one's group, but involves social confrontation. Anxious patients may encode social confrontation as more negatively arousing than controls, and thus associated with the interpersonal issues that they would rather avoid (Mennin, Heimberg, Turk, & Fresco, 2002; Roemer, Salters, Raffa, & Orsillo, 2005).

However, an alternative hypothesis based on patients' level of negative affect is that we may observe increased rejection rates as compared to controls. Since anxiety subjects typically suffer from high negative affective traits, this could lead to the priming of a negative affect state, which in previous studies has been shown to result in higher rejection rates (Harlé, Allen, & Sanfey, 2010; Moretti & di Pellegrino, 2010).

To address these questions, and to more broadly examine the nature of socioeconomic behaviour in anxiety disorders, we conducted an experiment where patients and matched controls played several rounds of a standard UG. Additionally, to investigate the similarities (and potential differences) across different types of anxiety disorders, we tested patients with two different kinds of anxiety disorders: generalised anxiety disorder (GAD), and panic disorder (PAD). GAD is characterised by excessive, uncontrollable and often irrational worries about everyday things, disproportionate to the actual source of worry. This excessive worry often interferes with daily functioning, as individuals suffering GAD typically anticipate disaster, and are overly concerned about matters such as health issues, death, family problems, friendship problems, and relationship problems (American Psychiatric Association, 1994). PAD on the other hand is characterised by sudden or out-of-the-blue moments of panic attack that are shorter in duration but have more intense symptoms than anxiety attacks (American Psychiatric Association, 1994). As a consequence, GAD patients may be even more impaired in their social abilities as compared with PAD individuals, who are usually more situation focused. We expected that GAD patients in particular may have deficits in judging the equity of an unfair socioeconomic transaction and an inadequate emotional reaction to it. Moreover, as an exploratory analysis, we took into consideration differences between on- and off-drug patients to examine the effect of serotonin in decision making. Previous studies have demonstrated that optimal levels of serotonin are associated with prosocial, co-operational, behaviour and successful bargaining in interactive games in both animals (Higley & Linnoila. 1997) and humans

(Moskowitz, Pinard, Zuroff, Annable, & Young, 2001), while low levels led to the opposite behavioural pattern (Crockett, Clark, Tabibnia, Lieberman, & Robbins, 2008). Therefore, we might posit that normal controls and on-drug patients (with pharmacologically increased levels of serotonin) would behave by punishing unfair behaviour, while off-drug patients, known to suffer from low level of serotonin, might demonstrate different bargaining behaviour. In particular we predicted, that off-drug patients would show fewer rejections of unfair offers, or in other words, will be less prone to regulate others' behaviour (e.g., punish unfair players).

These results are of importance in order to assess to what degree people afflicted with anxiety disorders may be impaired on social decision tasks. In addition, characterising performance of these groups on these well-understood tasks can help in better evaluating factors such as prosocial behaviour, equity perception, mutual co-operation, all traits that are specifically involved in social decision making.

METHODS

Participants

Participants were recruited from Santa Maria Hospital in Udine, Italy, and were diagnosed during an intake interview using the Structured Clinical Interview (SCID) for the DSM-IV (First, Spitzer, Gibbon, & Williams, 1994) and with the Hamilton Rating Scale for Anxiety (HARS; Hamilton, 1967) conducted by trained psychiatrists. These patients were not hospitalised, but were in out-patient treatment. Specifically, 10 subjects were classified as having Generalised Anxiety Disorder (GAD), nine had Panic Disorder (PAD), and one was diagnosed with both disorders. Matched age and education participants recruited from the normal population without history of either psychiatric or neurological symptoms (as assessed by informal interview) were recruited to act as controls (see Table 1 for details). All procedures were approved by the local medical ethical committee.

Table 1. *Demographic and clinical assessment*

	Anxiety patients	*Normal controls*	*Significance*
Age	41.25 (14.07)	42.4 (8.12)	$p = .7$
Education	12.6 (3.87)	10.95 (2.42)	$p = .1$
Sex	16 F, 4 M	15 F, 5 M	$p = .7$
Ethnicity	All Caucasian	All Caucasian	—
Handedness	18 right, 1 left, 1 ambidextrous	19 right, 1 left	—
Diagnosis (DSM-IV)	10 GAD, 9 PAD, 1 GAD + PAD out-patients never hospitalised	Without history of neurological and psychiatric diagnosis	—
Hamilton Anxiety Inventory	15.33 (8.88)	—	—

Experimental procedures

1. Assessment. In addition to the SCID measure, participants also filled out a series of self-administered questionnaires in the assessment phase. These comprised the Positive and Negative Affective scales (PANAS, trait version; Watson, Clark, & Tellegen, 1988), to test for the level of negative affect and its influence on decision making; the behavioural inhibition and the behavioural activation scales (BIS/BAS; Carver & White, 1994), to test for participants' likelihood of approaching rewards or avoiding punishments; and the Interpersonal Reactivity Index (IRI; Davis, 1980), to test for social orientation attitudes and empathy. These questionnaires can guide the interpretation of results and connect any differential performance to relevant personality traits. In particular, the IRI can highlight potential social deficits underlying anxiety that can bias socioeconomic behaviour, as suggested by the first hypothesis stressed in the introduction, whereas the PANAS can reveal how anxiety and associated negative affect can bias decision making according to the second hypothesis.

2. Ultimatum Game. After the assessment, participants were instructed as to the nature of the

Ultimatum Game. They were told they would play only in the role of responder, and receive one-time offers from various proposers. They completed two practice trials, and after demonstrating that they fully understood the game, then played the UG, receiving 30 different offers (one from each of 30 purported partners) presented in a randomised order. Each offer involved a €10 split, and participants were informed they would be playing for real money and would be paid a percentage of their earnings in the game in cash afterwards. A computerised version of the UG was used, and participants were told that they would be playing the game over a computer network with partners located at other institutions. The pictures that participants saw were selected from a pool of actual UG players' photographs with equal proportion of males and females. These pictures were extensively used in previous studies and controlled for the level of fairness and pleasantness and all had emotionally neutral expressions (Harlé & Sanfey, 2007).

On each trial, after a fixation point lasting for 500 ms, participants saw a picture of their proposer partner for four seconds. They then saw the proposer's offer, at which point they were instructed to choose from two options (accept or reject) by way of a button press. They had unlimited time to decide to either accept or reject this offer. Next, the decision made and the financial outcome (e.g., how much each player received) were presented for two and three seconds respectively (see Figure 1A for details). Based on the assumption that proposers would be expected to behave sensibly (i.e., not offer more than half of the pot), proposer offers ranged from €1 to €5 and included both fair offers (six offers of €5 and six offers of €4) and unfair offers (six offers each of €3, €2 and €1).

3. Debriefing. At the end of the task, participants completed a brief questionnaire asking them to rate the extent to which they felt basic emotions such as anger, sadness, disgust and happiness as well as their perceptions of equity when receiving both an unfair offer (e.g., €1 out of €10) and a fair offer (e.g., €5 out of €10), all rated using a 7-point Likert scale.

RESULTS

1. Assessment

Patients and controls significantly differed in terms of negative affect as detected by the PANAS, trait version (Watson et al., 1988): anxious: 23.3, controls: 17.9, $t(38) = 2.63$, $p < .05$. However, these differences disappeared when taking into account the subclinical types, with the PANAS not differing between diagnostic subtypes ($p > .05$). Importantly, patients were above the mean of the population (20.9 for the Italian population; see Terracciano, McCrae, & Costa, 2003), and controls were below. This measure strongly correlates with anxiety (Clark & Watson, 1991; Terracciano et al., 2003), further confirming the presence of anxiety symptoms in patients and their absence in controls. The positive affect scale did not differ between groups.

The behavioural inhibition and the behavioural activation scales (BIS/BAS; Carver & White, 1994) did not differ between the populations ($p > .05$). Even though BIS is generally associated with anxiety, it captures only some features of anxiety that may not be the most salient in our patients, thus leading to a non-significant difference with controls. The Interpersonal Reactivity Index (IRI; Davis, 1980), differed in the subscale "empathic concern" (anxious: 21.5, controls: 29.1), $t(38) = -6.87$, $p < .0001$, measuring sympathy and concern for others, linked to emotional empathy, and in the "fantasy" subscale (anxious: 19.05, controls: 23.6), $t(38) = -3.54$, $p < .005$, measuring the tendency to get caught up in fictional stories and imagine oneself in the same situations as fictional characters. The other subscales (perspective taking and personal distress) did not differ between groups ($p > .05$; see Figure 1B).

Again, these differences disappeared when taking into account the subclinical types. BIS/BAS and the Domain Specific Risk Taking test

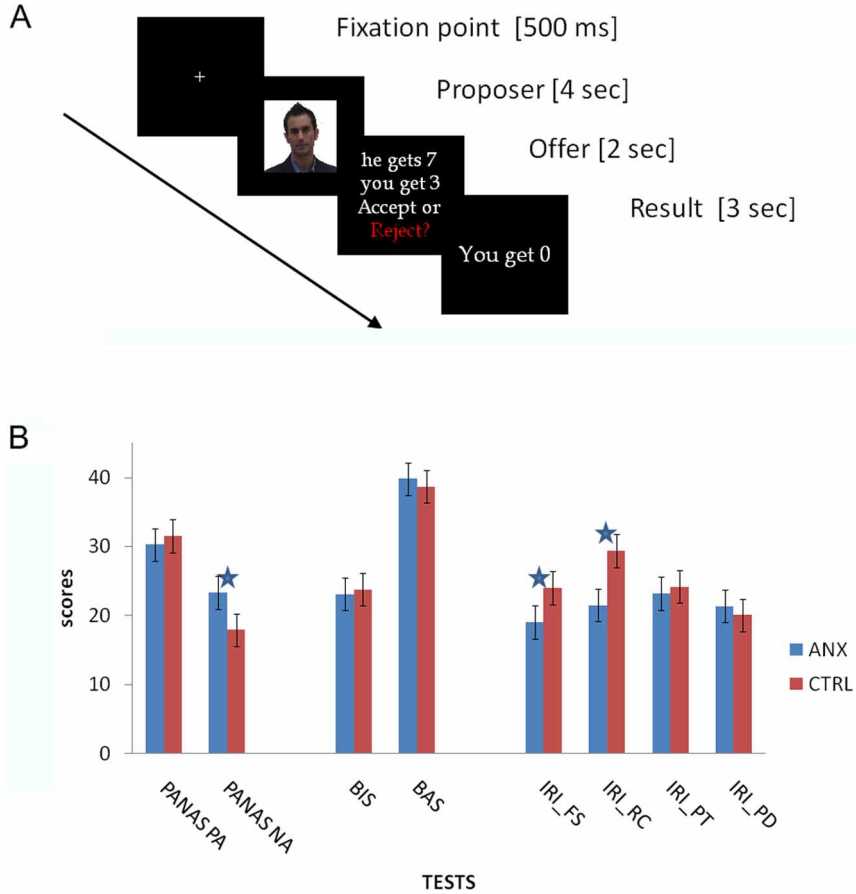

Figure 1. *Experimental design and questionnaires. (A) A trial timeline of the Ultimatum Game is presented, see the text for details. (B) Subjects were tested for relevant personality dimensions (PANAS, BIS-BAS and IRI). The only difference came from the level of negative affect (PANAS NA subscale) stronger in anxious patients, and from the level of social orientation (IRI FS and EC subscales), in which patients scored less than controls.*

(DOSPERT; Blais & Weber, 1996) did not differ between diagnostic subtypes (all $ps > .5$).

2. Choices

To examine the differences between patients and controls in terms of their decision making, a linear mixed model (LMM) was fitted to the data using offer acceptance rate as the dependent variable, Offer Amount (€5, €4, €3, €2, €1) as a within-subject (level 1) factor, and Clinical Status (GAD vs. PAD vs. controls) as a between-subject factor (level 2). Subject was modelled as a random factor and a diagonal matrix structure was specified to model residual variance across offer amounts (allowing the model to fit a different variance component at each level). Significant main effects of Offer Amount, $F(1, 70) = 461.038$, $p < .0001$, and Clinical Status, $F(2, 69) = 19.408$, $p < .0001$, as well as a significant Offer Amount by Clinical Status interaction, $F(2, 70) = 18.952$, $p < .0001$, were obtained. More specifically, the GAD group rejected significantly less €1, €2 and €3 offers than PAD and controls ($p < .05$, with Bonferroni corrections). The €4 offer showed a trend ($p = .055$), whereas no difference was found for €5 offers. PAD rejection rates did not differ from controls for any offer amount (all $ps > .05$).

Therefore, it appears that the GAD patients were primarily responsible for the overall patient effect described above (see Figure 2A).

Notably, the rejection rates showed a strong trend for correlating with the subscale of negative affect (PANAS NA) in anxiety patients ($\rho = -.45$, $p = .058$), that is, the greater the negative affectivity reported, the lower the rejection rate, with this correlation absent in controls ($\rho = -.28$, $p = .22$). Note, that Fisher's Z transformed correlation coefficients did not statistically differ from each other ($Z = 0.574$, $p > .05$, see Figure 2B). When considering GAD/DAP relationships, no significant correlation emerged ($p > .05$).

Moreover, there was a correlation between rejection rates of unfair offers and the level of anger for controls ($\rho = .54$, $p < .01$), whereas for patients this correlation simply failed to reach the significance ($\rho = .42$, $p = .07$).

Further analyses: Differences in pharmacological treatment

Regarding the medications used by patients, 10 out of 12 patients were treated with antidepressants (serotonin reuptake inhibitors), and the remaining patients with anxiolitic or with SSRI (see Table 2). To examine for the effect of serotonin on decision making, a linear mixed model (LMM) was fitted to the data from the 10 serotonin medicated patients, using offer acceptance rate as the dependent variable, Offer Amount (€5, €4, €3, €2, €1) as a within-subject (level 1) factor, and Drug Medication (on vs. off vs. controls) as a between-subject factor (level 2). Significant main effects of Offer Amount, $F(1, 79) = 365.910$, $p < .0001$, and Medication, $F(2, 81) = 5.99$, $p < .005$, as well as a significant Offer Amount by Medication interaction, $F(2, 79) = 6.985$, $p < .005$, were obtained. More specifically, off-drug patients rejected significantly less €1 and €2 offers than controls ($p < .05$, with Bonferroni corrections), and showed a trend for €3 offers ($p = .065$), whereas no difference was found when rejecting the €4 and €5 offers. Rejection rates for the on-drug group did not differ from both off-drug and controls for any offer amount (all ps $> .05$). Moreover, no differences were found in equity perception and level of anger between on-, off-drugs and controls (all ps $> .05$). Importantly, this experiment was not designed to specifically address this issue. Future studies will investigate this important point.

3. Debriefing

Following the UG, participants provided subjective emotional ratings for the unfair offer (€1). Four basic emotions were rated using a 9-point Likert scale: anger, sadness, disgust, and happiness.

To begin with, we computed a grand analysis of variance (ANOVA) with Fairness (fair vs. unfair), Emotion (anger, disgust, happiness, sadness, surprise) as within factors, and Groups as a between factor. The main effect of Fairness was not significant, $F(1, 35) = 1.430$, $p = .24$, however its interaction with Group was significant, $F(2, 35) = 3.821$, $p < .05$. Emotions were significant, $F(4, 140) = 5.432$, $p < .001$, however the interaction with Group was not, $F(8, 140) = 1.217$, $p = .294$. The interaction Fairness × Emotion and the triple interaction Fairness × Emotion × Groups were both significant, $F(4, 140) = 5.260$, $p < .05$ and $F(8, 140) = 15.987$, $p < .001$, respectively.

To better understand why patients and controls differ in their choices, we tested for differences in the equity perception and emotions elicited by unfair offers, observing significant differences in the level of equity ($p < .05$, with GAD perceiving the unfair offers as less unequal than PAD and controls) and a strong trend for the level of anger ($p = .055$, with GAD scoring less than PAD and controls). These differences were even stronger when comparing GAD with controls (all ps $< .05$), but no difference was detected when comparing PAD with controls (all ps $> .05$). No group differences emerged for the other emotions, or for the fair offers (all ps $> .05$). Moreover, while controls differed in their emotions when responding to the fair and the unfair offers (all ps $> .05$), clearly discriminating their affective responses as a function of fairness from case to case, patients did not, except

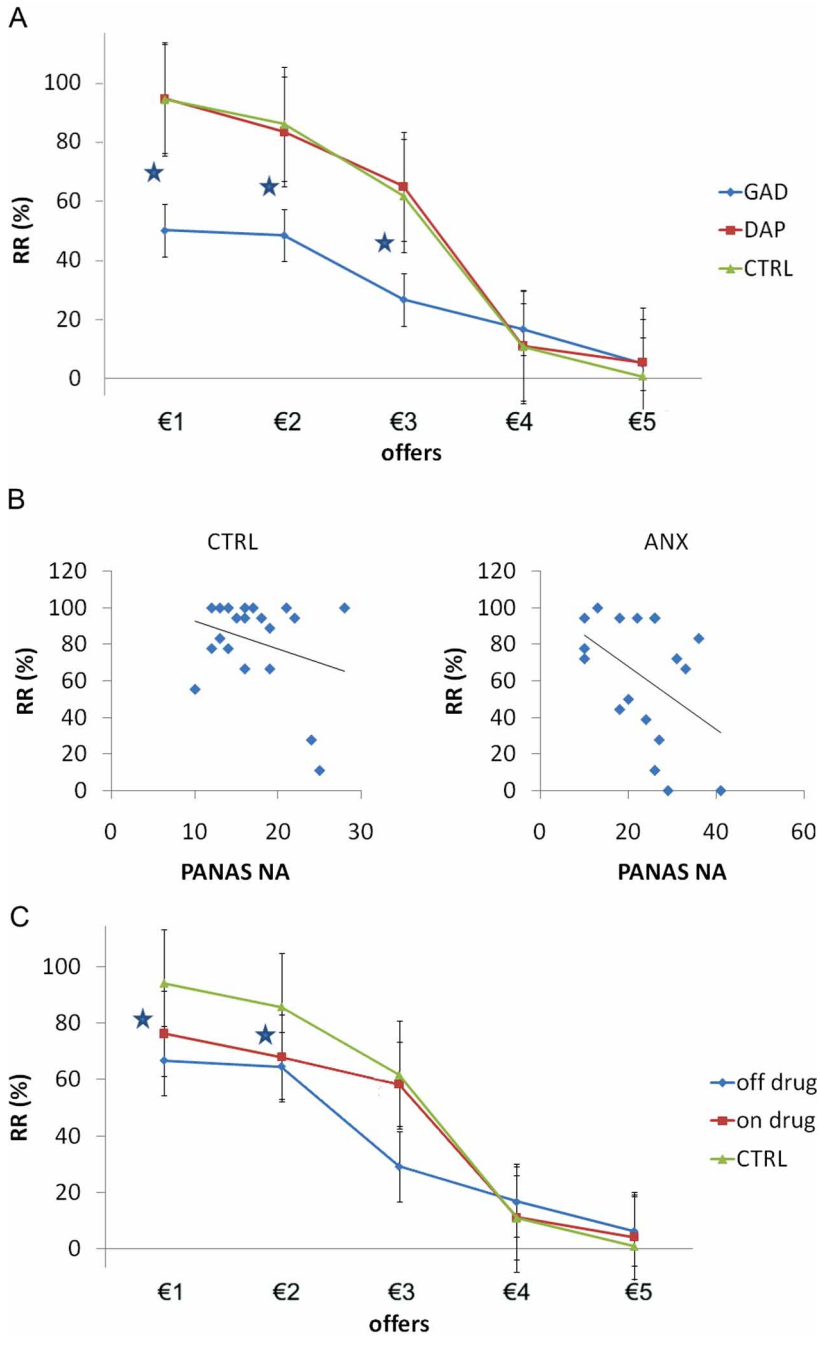

Figure 2. *Results and correlations. (A) Choices from the Ultimatum Game revealed significant differences between groups, with GAD patients rejecting fewer unfair offers than controls and PAD. (B) Importantly, patients' performance correlated with the level of negative affect: the more negative affect they scored, the less they rejected. (C) When split according to their use of psychotropic drugs (SSRI), effects of treatment can be observed, with subjects off-drug different from controls, while on-drug were not.*

Table 2. *Psychotropic drug treatment*

Patient #	*Diagnosis*	*Type*	*Drugs*	*Dosage*
1	GAD	SSRI	Cipralex	20 mg/die
2	PAD	SSRI	Zoloft	25 mg/die
3	GAD	SNRI	Efexor	75 mg/die
4	GAD	SNRI	Efexor	37.5 mg/die
5	GAD	SSRI	Elopram	10 mg/die
6	PAD	SSRI	Zoloft	50 mg/die
7	PAD	SNRI	Duloxetina	120 mg/die
8	GAD	SSRI	Zoloft	100 mg/die
9	PAD/GAD	SSRI/anxiolitic	Cymbalta + Xanax	20 mg/die + 0.5 mg/die
10	PAD	SSRI	Citalopram	24 mg/die
11	PAD	Anxiolitic	Alprazolam	0.2mg/1–2/die
12	PAD	SSRI	Zoloft	50 mg/die

for the level of happiness ($p < .05$). This implies selectivity for negative emotions in the patient group, with the happiness discrimination demonstrating that the patient group was not merely apathetic about the task in general (see Figure 3A).

To examine the effects of the two subjective measures (equity perception and the level of anger), we conducted a two factor general linear model separately for the three groups (GAD, PAD and controls) using Equity Perception and Anger as the two factors, and rejection rates of unfair offers as the dependent variables. Analyses showed a significant effect of Equity, Wald $\chi^2(3) = 17.568$, $p < .001$, and of Anger, $\chi^2(3) = 36.578$, $p < .0001$, as well as their interaction, $\chi^2(1) = 3.916$, $p < .05$, for GAD, no significant effects for PAD, and a significant effect of Equity only, Wald $\chi^2(3) = 84{,}326$, $p < .0001$, for controls (see Figure 3B).

Following the above results, one can argue that the effect observed in the Ultimatum Game can come from a mixed contribution of a certain diagnostic criteria and being under psychotropic treatment. To examine the effects of both drug and diagnosis, and to disentangle them, we conducted a two-factor general linear model using Diagnosis (GAD vs. PAD) and Drug Treatment (on vs. off) as the two factors, and rejection rates to both fair and unfair offers separately as the dependent variables. Notably, the distribution of on–off patients across diagnoses was balanced (see Table 2). Analyses showed a significant effect of Diagnosis, Wald $\chi^2(1) = 7.213$, $p < .01$, but not an effect of Treatment, $\chi^2(1) = 0.374$, $p = .541$, nor their interaction, $\chi^2(1) = 2.363$, $p = .124$, for the unfair offers, confirming the role of having a GAD diagnosis when making a socioeconomic decision.

However, when taking into consideration the fair offers, we found a significant interaction, $\chi^2(1) = 3.790$, $p < .05$, but no main effects, diagnosis: $\chi^2(1) = 1.452$, $p = .228$; treatment: $\chi^2(1) = 0.077$, $p = .781$. This demonstrates a role for both diagnosis and treatment in the observed results. Additionally, a covariance analysis confirmed that the two coefficients did not covary (Fisher's correlation, cov: 13.78, $p < .05$), further confirming the role of both factors in affecting the socioeconomic decisions.

DISCUSSION

Individuals with a clinical diagnosis of anxiety disorder demonstrated significantly altered socioeconomic behaviour, accepting more unfair monetary offers than control participants in a well-studied socioeconomic task. This supports the hypothesis that certain social deficits underlying anxiety disorders may affect socioeconomic behaviour. Critically, anxiety did not alter the tendency to accept fair offers, further supporting the idea that there was a specificity for offers that elicited negative emotions, and ruling out

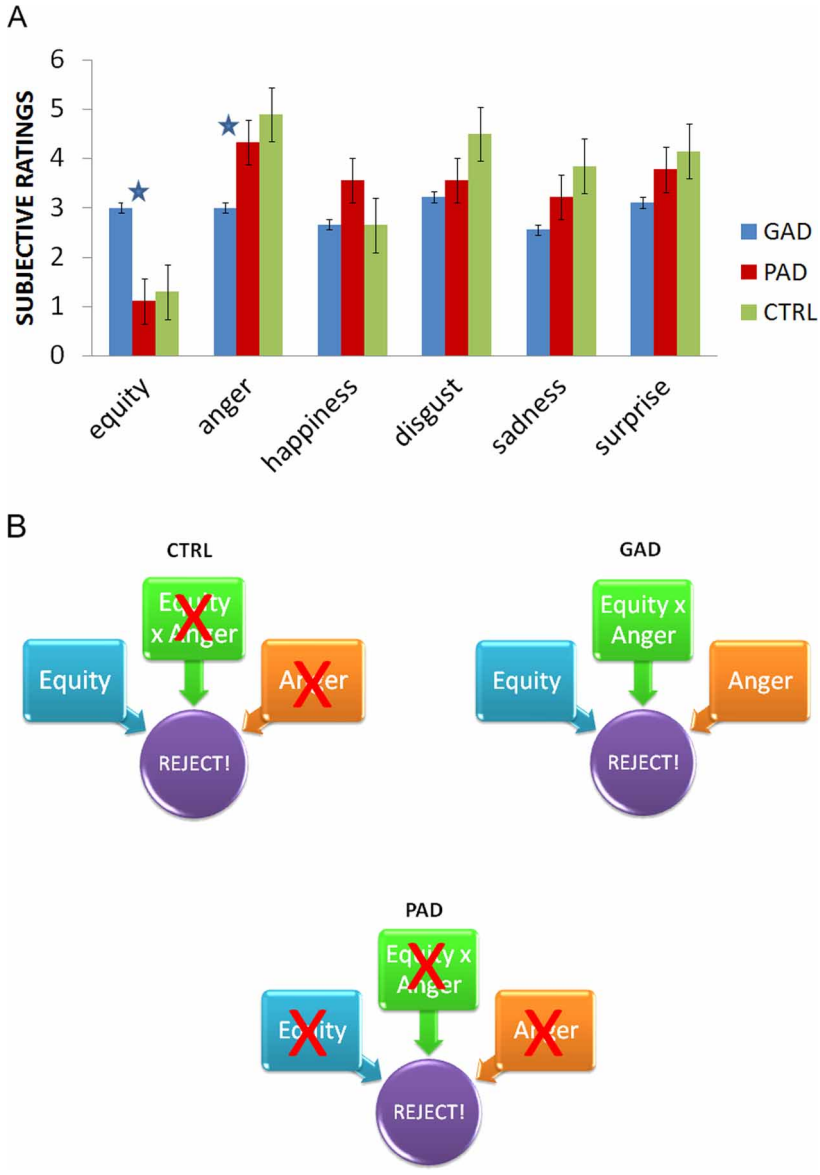

Figure 3. *Debriefing and modelling. (A) Debriefing on equity perception and emotional rating revealed that GAD were considering the unfair offers as less unequal than controls and PAD, and reacted with less anger. (B) Mathematical models showed that equity and anger were explaining the decision to reject the unfair offers for GAD, while for controls only equity seemed to explain their decisions.*

the hypothesis of broadly compromised reward processes in patients. In particular, GAD patients were significantly different from controls, while PAD more closely resembled control behaviour. Notably, it has been argued that GAD individuals suffer from fear of social confrontation and interpersonal situations (Baker & Edelmann, 2002; Hampel et al., 2011). In contrast, PAD individuals are less sensitive to social dimensions, and more concerned with avoiding specific contexts that elicited the initial panic attacks. Indeed, experimentally recorded pathological

thoughts of GAD concern categories such as interpersonal conflict, competence, acceptance, and worry about others, while PAD thinking concerns only physical and mental catastrophe (Breitholtz, Johansson, & Ost, 1999). Interestingly, pure GAD patients have shown more interpersonal and competence worries than GAD with social phobia (Breitholtz et al., 1999). Therefore, differences between the two populations may become apparent when playing an interactive socioeconomic task. This hypothesis is in line with the so called "experiential avoidance model" of anxiety (Mennin et al., 2002; Roemer et al., 2005), which posits that GAD patients in particular actively avoid confrontation and interpersonal emotionally eliciting situations, and instead are constantly worried about things to come. Indeed, these patients have been reported as having low level of assertiveness (Colter & Guerra, 1976; Herzberger et al., 1984), and of expressing and reacting to negative emotions (Gladding, 1988). The interpersonal confrontation and assertiveness deficits of GAD seem supported by the fact that GAD patients evaluate the fairness of the opponent's behaviour differently, reporting that they found unfair offers less unequal than did controls, and responded to "selfish proposers" with less anger than PAD and normal controls. Previous research has demonstrated that feelings of anger experienced by responders predict the rejections of unfair offers (Pillutla & Murnighan, 1996), presumably because the unpleasant emotional state led them to "punish" selfish proposers by rejecting the offer (Nowak, Page, & Sigmund, 2000). It is well known that people with traits of anxiety are typically less assertive, as they are afraid of rejection and as such find social interaction often difficult (Wolpe, 1958). Similarly, in our study GAD patients may have been less able to react with normal levels of anger when treated unfairly. This result supports the idea that rejections of unfair UG offers are guided by emotions (e.g., anger), leading participants to explicitly violate principles espoused by standard economic theory (punishing bad deeds even at a personal cost; Wischniewski et al., 2009).

In sum, anxious patients are likely to accept more unfair offers than controls and this effect seems to be driven mostly by GAD. However, because of the small sample size of the two clinical groups, the last consideration should be taken with caution. Whether there are systematic differences between the two clinical groups is a matter of future research, as it was not the primary aim of the present study.

The alternative hypothesis that anxious patients might reject unfair offers at a higher rate due to a negative emotion bias was not supported. Contrary to this hypothesis we found a negative correlation between rejection rates and negative affective scores (PANAS). However, previous studies (Harlé & Sanfey, 2007; Moretti & di Pellegrino, 2010) showed that induced incidental negative mood was associated with greater rejection of unfair monetary offers. Our results seem in contradiction with the previous findings. However, it must be noted that mood-induction studies were artificially eliciting incidental moods in normal-mood subjects, whereas in the present experiment, no external induction was used, but rather we tested more stable personality-related pathological mood. One possibility is that externally induced mood and pathological stable mood affect our decision making in different directions.

The intriguing finding that anxiety reduces rejections in UG is something to be explained. Based on the subjective ratings collected at debriefing, one possible reason for this effect is that anxious patients are less angry at unfair treatment. A common suggestion is that rejections in the UG are driven by angry reactions (Pillutla & Murnighan, 1996). We find some support for this theory here in that the regression analyses (Wald tests) indicate that anger reactions can explain the decision to reject an offer. Of course, why anxiety patients react with less anger to unfair offers can have different explanations. One hypothesis is that because of their social confrontation deficits and low assertiveness, they judge an unfair division as less unequal (as demonstrated by the subjective ratings). Another possibility is that these patients have lower expectations in advance, perhaps because of their

pessimistic appraisal of future events (e.g., Gilboa-Schechtman, Franklin, & Foa, 2000), and are therefore not surprised by the unfair behaviour shown by some participants, thus reacting with less anger. Previous research has shown that expectations are an important predictor of acceptance rates (Sanfey, 2009). Another possibility is that because anxiety patients experience higher levels of negative affect at baseline (as shown in the assessment by PANAS-NA scores), they do not experience as much of a "boost" in negative reactions as controls do when they receive unfair offers. However, unlike previous studies (Harlé & Sanfey, 2007) we found a negative correlation between negative affectivity and rejection behaviour. Finally, anxious patients showed a generally low level of empathic concern and social orientation (low scores in the IRI test, see the assessment). As the UG is a socioeconomic task, one possibility is that they tend to underestimate the interpretation of an unfair transaction. However, we did not find GAD/DAP differences between these factors and do not know if empathy affects fairness considerations. These hypotheses remain speculative for now, but future experiments could usefully disentangle these alternative explanations.

The present study also revealed suggestive differences when separating on- and off-psychotropic-drug treatment. Off-drug patients showed a significant difference compared with controls (fewer rejections), while the on-drug group exhibited a relatively normal pattern (more rejections). These patients were treated with selective serotonin reuptake inhibitors (SSRIs), a standard treatment for anxiety disorders (Baldwin, Ajel, & Garner, 2010; Bespalov, van Gaalen, & Gross, 2010). SSRI treatments increase the level of synaptic serotonin (5-HT) that is typically deficient in these patients (Coplan & Lydiard, 1998; Rush et al., 1998). Interestingly, low levels of 5-HT have been associated with social isolation and poor interpersonal functioning, while high or enhanced 5-HT function has been connected with affiliation and co-operation (Crockett, 2009). 5-HT has also been connected to measures of social competence. For example rhesus macaques with low levels of 5-HT have difficulty building and maintaining social relationships and have fewer social partners (Higley & Linnoila, 1997). Increasing 5-HT also influences co-operation and social dominance in humans as it decreases quarrelsome behaviours and enhance dominant behaviours (Moskowitz et al., 2001). Interestingly, Crockett and collaborators (Crockett et al., 2008; Crockett, Clark, Hauser, & Robbins, 2010) reported that individuals with pharmacologically depleted serotonin levels (via dietary tryptophan) showed a significant increase in UG rejection rates, results which are inconsistent with both models of serotonin in standard social dominance (Moskowitz et al., 2001) or social co-operation in co-ordination games (Knutson et al., 1998), as well as with the present finding. One possible explanation for this discrepancy is that tryptophan depletion has different basic effects than stable neurochemical imbalances, as found in our patients, or in heritable genetic phenotypes (Clarke et al., 1995; Higley & Linnoila 1997; Higley et al., 1996). In support of this notion, Crockett et al. (2008) did not report changes in mood associated with their manipulation, though chronically low levels of serotonin are associated with anxiety and depressive disorders. An alternative explanation might be that there is an inverted U-shape pattern between serotonin and rejection rates in socioeconomic tasks, for which low and high level of serotonin lead subjects to behave in the same way, whereas medium levels do not affect their decision making. However, it must be pointed out that the present study was not meant to test this hypothesis and results should be taken cautiously. Future experiments will test this specific hypothesis.

Overall, the findings of the present study should be of great interest for both clinicians and experimental psychologists. For clinicians, knowing that anxiety can disrupt decision making specifically in a social context can potentially lead to more focused therapeutic interventions that can include specific techniques to treat these category of decisions, and perhaps even influence judiciary decisions and forensic tests. Additionally, the knowledge that certain classes of psychotropic treatment (such as SSRI/SNRI) can directly affect high-level interactive decision making is a

valuable insight into treatment efficacy. Finally, models of normal decision making can benefit from knowing that abnormal personality traits (and potentially abnormal levels of serotonin) play an important role in social decision making.

Classical economic models of *Homo oeconomicus* suggest that human behaviour is based on deliberate and controlled thinking that is free from biases, and that strives to maximise personal benefit regardless of social and emotional context (Wischniewski et al., 2009). More recent evidence has clarified that humans appear to have developed emotional and motivational motives that guide behaviour towards co-operation and the sanctioning of unfair behaviours (Axelrod & Hamilton, 1981; Cosmides, 1989; Nowak et al., 2000). Here we show, for the first time, that pathological populations suffering from anxiety exhibit social and interpersonal problems that significantly impact decision making in a social context.

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