

BJPO/2015/001362

Data supplement

1. Fictitious Emotional Scenarios

1.1. Description

After the experiment we used six different fictitious scenarios to test whether the depressed patients' avoidance of competitive situations was influenced by the expected negative emotional response to loss or positive emotional response to winning (for the overview of the scenarios, see Table S1). The participants were asked to imagine themselves in each of these scenarios and indicate their experienced emotions on an adapted version of the Positive and Negative Affect Schedule (PANAS) from [1]. While doing so, the participants had to imagine themselves in the situation of either cooperating or competing with their opponent, with the outcome of showing either better or worse performance than their opponent.

Before comparing the negative effect in the fictitious scenarios, we had to ensure that the negative emotions indicated on the PANAS did not simply reflect the general low mood of the depressed participants (as indicated by the BDI scores) by showing that there is no correlation between PANAS and BDI.

1.2. Analysis

To calculate the absolute negative affect, we used the scores for winning in a competition as baseline and subtracted them from scores for losing. This difference was determined for pairing with the opponent with the same diagnosis (scenario6 – scenario4; neg_affect_loss_same) and the opponent with the unknown diagnosis (scenario5 – scenario3; neg_affect_loss_unknown).

Similarly, we calculated the absolute positive affect scores for cooperation by subtracting the positive affect scores for cooperation resulting in performance worse than the opponent (scenario2) from the positive affect scores for cooperation resulting in performance better

than the opponent (scenario1). The so calculated variable *pos_affect_win_unknown* was used to test whether positive affect for cooperation was different between the MDD and the healthy control group.

To test whether the competition avoidance behavior of the depressive individuals might result from the increased fear of negative emotions associated with losing the competition against the two opponent types, we conducted t-tests on the variables *neg_affect_loss_same* and *neg_affect_loss_unknown* between the healthy and MDD groups. Similarly, we tested whether the positive affect (*pos_affect_win*) associated with cooperation was different between the MDD and healthy group using a t-test.

Additionally, we tested whether the *cooperators*(individuals who chose cooperation) might have preferred cooperation to competition because they wanted to avoid experiencing negative emotions as the result of losing. Thus, we conducted a t-test on negative affect scores (*neg_affect_loss_same* or *neg_affect_loss_unknown*) between the *cooperators* and the *competitors* when matched with the same-diagnosis opponent or with an opponent with an unknown diagnosis, respectively.

1.3. Results

No correlation was found between the *neg_affect_loss_same* and the *neg_affect_loss_unknown* and BDI scores [($r = 0.03$; $p = 0.85$) and ($r = -0.004$; $p = 0.98$), respectively], indicating that the negative affect associated with losing did not reflect the general negative mood typical of depression.

As assessed by the analysis of the fictitious scenarios, even after controlling for the baseline depressive symptoms measured by the BDI (see above), the MDD patients reported significantly more negative emotional responses to the possibility of losing, compared to the healthy subjects. However, this was the case for losing against an opponent with the unknown diagnosis [$t(58) = -2.42$; $p < 0.05$], but not against an opponent with the same

diagnosis [$t(58) = -1.39$; $p = 0.17$]. It is also noteworthy that the MDD competitors reported more negative emotions in the case of losing against the unknown-diagnosis opponent compared to cooperators, suggesting that the expected negative emotions did not prevent them from competing. Again, this effect was absent when assessing the match with a same-diagnosis opponent, as shown in Table 2 of the main article.

Further, there was no difference in the amount of positive affect associated with cooperation between the MDD and the healthy groups [$t(58) = -0.24$; $p = 0.81$]. However, there was a trend toward experiencing fewer positive feelings in the MDD group in the case of winning against the opponent with the same diagnosis [$t(58) = 1.8$; $p = 0.08$].

2. Participants' Psychotropic Medication

We explored the influence of psychotropic medication on the choice of the payment scheme in participants with MDD. We calculated chlorpromazine equivalents for antipsychotics and imipramine equivalents for antidepressants and tested associations between these equivalents and participants' competitiveness by t-tests in the MDD group. In addition, we tested for associations between participants' decision and treatment with lithium or an antiepileptic (either present or not present) using chi-square tests.

The imipramine and chlorpromazine equivalents dosages of antidepressant and antipsychotics were not associated with choice of the payment scheme when MDD participants were paired with the opponent with the same diagnosis ([$t(22) = 0.64$; $p = 0.53$] and [$t(22) = -0.48$; $p = 0.64$] respectively). In case of pairing with the opponent with the unknown diagnosis, the antipsychotics also had no influence on the decision of the subject [$t(22) = 0.21$; $p = 0.84$]. However, specifically in MDD patients paired with an unknown opponent (where we found important avoidance of competition), decisions favoring competition vs. cooperation were associated with high imipramine equivalents (average dosage 225 mg vs. 108 mg, [$t(22) = -$

2.29; $p < 0.05$). Treatment with an antiepileptic had no effect on competitive behavior, neither when being paired with the opponent having the same [$\chi^2 (1,24) = 0.43$; $p = 0.51$] nor the unknown [$\chi^2 (1,24) = 0.15$; $p = 0.69$] diagnosis. Also treatment with lithium was not associated with competition decisions, neither when being paired with the opponent having the same [$\chi^2 (1,24) = 1.41$; $p = 0.23$] nor the unknown diagnosis [$\chi^2 (1,24) = 0.49$; $p = 0.48$].

3. Influence of Self-esteem, Non-social Risk and Trust on Competitive Behavior

To control for self-esteem in MDD participants, we analyzed participants' self-rated feelings of "worthlessness" (indicating low self-esteem) using data from the SKID interview on concerning the most current major depressive episode [2]. However, there was no association between "worthlessness" and payment scheme choice in either the condition in which the patients with MDD were matched with the opponent with the same diagnosis [$\chi^2 (1,24) = 1.62$; $p = 0.2$] or the condition in which the opponent had an unknown diagnosis [$\chi^2 (1,24) = 0.03$; $p = 0.87$].

We further conducted another experiment with the identical participant samples showing that the MDD participants did not differ from the healthy participants or BPD patients in the amount of trust they showed toward their fellow participants [$F(2,74) = 0.55$; $p = 0.58$]. There was also no significant difference in the behavior related to taking a non-social risk [$F(2,74) = 0.1$; $p = 0.91$].

4. Analysis of power

Given recent concerns about adequate sample sizes and their effects on interpreting experimental results [3], we have performed the analysis of power for the comparison of results considering payment scheme choice (cooperation vs. competition) of healthy and MDD participants using G Power [4]. A generally accepted minimum level of power is 0.80 [5]. Applying the traditional .05 criterion of statistical significance, the analysis indicated the

power of 0.89 for the chi-squared test in case of matching with the opponent with an unknown diagnosis. For the matching with the opponent with the same diagnosis the power analysis showed 82% power for detecting a medium sized effect.

- 1 Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. *J Pers Soc Psychol* 1988; **54**: 1063–1070.
- 2 Wittchen H-U, Fydrich T, Zaudig M. *SKID: Strukturiertes Klinisches Interview für DSM-IV; Achse I und II. Achse II: Persönlichkeitstörungen. SKID-II*. Hogrefe, Verlag für Psychologie, 1997.
- 3 Button KS, Ioannidis JPA, Mokrysz C, Nosek BA, Flint J, Robinson ESJ *et al.* Power failure: why small sample size undermines the reliability of neuroscience. *Nat Rev Neurosci* 2013; **14**: 365–376.
- 4 Faul F, Erdfelder E, Lang A-G, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods* 2007; **39**: 175–191.
- 5 Cohen J. *Statistical Power Analysis for the Behavioral Sciences, Second Edition*. Auflage: Revised. Lawrence Erlbaum Assoc Inc: Hillsdale, N.J, 1988.

Table DS1: Descriptions of the six fictitious scenarios used for the debriefing after the experiments

	scenario 1	scenario 2	scenario 3	scenario 4	scenario 5	scenario 6
payment scheme	cooperation	cooperation	competition	competition	competition	competition
Opponent	unknown	unknown	unknown	same	unknown	same
task performance	s>o	s<o	s>o, win	s>o, win	s<o, loss	s<o, loss

Table DS1: The table summarizes the six fictitious scenarios used for the debriefing after the experiment. In the first scenario, the participants were to cooperate with an unknown opponent, resulting in larger numbers of packed envelopes. In the second scenario, the participants were supposed to cooperate with an unknown opponent, delivering a poorer performance. The third scenario described a competitive situation against an opponent with an unknown diagnosis, resulting in the participants' improved performance. In the fourth scenario, the subjects competed against the same-diagnosis opponent, delivering a better performance. In the fifth scenario, the subjects competed with an opponent with an unknown diagnosis, having packed fewer envelopes than the opponent. In the sixth scenario, the subjects were supposed to compete with the opponent with the same diagnosis, and this was expected to result in poorer performance. Task performance reflects the number of packaged envelopes for the subjects and their opponents. Abbreviations: s:subject, o:opponent