



Emotion based learning under competitive conditions: The effect of schadenfreude

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ABSTRACT

It has previously been found that competition and feelings of inferiority can independently produce schadenfreude (pleasure at other's misfortune) and that schadenfreude has a negative influence on emotion based learning during the Iowa Gambling Task (IGT), when a participant (the Observer), who had watched a same-sex friend (the Player) perform the IGT in the absence of any interaction between the two, has to subsequently play the IGT. The present study investigates the effect of schadenfreude on learning during competitive situations. A sample of 90 university students completed the IGT in two competitive conditions with and without feelings of inferiority (participants were told that the Player had higher academic results than the Observer, and that this was the criteria for allocating them to the two roles). Contrary to our predictions, the results showed that schadenfreude did not influence the Observer's emotional learning in the two competitive scenarios, and revealed an unexpected impaired performance for the Player. These findings expand the conclusion of previous studies that any form of emotional investment during vicarious learning opportunities can negate the disruptive effect of schadenfreude on emotional learning and we propose a novel factor (perceived task difficulty) that might impair the naïve player's IGT performance.

KEY WORDS:	SCHADENFREUDE	EMOTIONAL LEARNING	IOWA GAMBLING TASK (IGT)	COMPETITION	FEELINGS OF INFERIORITY
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Misfortunes of another person can cause observers to have different emotional reactions. People can have feelings of concern (Eisenber, 2000), pity and sorrow (Batson, Duncan, Ackerman, Buckley, & Birch, 1981; Weiner, 1980, 1986), but they can also experience *schadenfreude* – a German word denoting the pleasure at another's misfortune (Heider, 1958; Nietzsche, 1887/1967). This later emotion has been linked with feelings of envy (Brigham, Kelso, Jackson, & Smith, 1997; Smith, Turner, Leach, Garonzik, & Urch-Druskat, 1996) and inferiority (Leach & Spears, 2008). *Schadenfreude* was also shown to pervade same-sex friendships of undergraduate students (Colyn, 2007) and to be strongly associated with situations in which people feel in competition with each other (Hareli & Weiner, 2002).

The Antecedents of Schadenfreude

Smith et al. (1996) showed participants a videotaped interview of a student who was intending to apply to medical school. Details about his academic achievements and activities that emerged in the interview were manipulated to suggest someone with either enviable superiority or average qualities. At the end of the tape, an epilogue informed participants that the student had been arrested for stealing amphetamines from the lab where he was working, and, as a result, he had to delay plans for medical school. Envy created by the manipulation of invidious superiority (measured while the tape was paused toward the end of the interview) mediated *schadenfreude* (measured comparing the ratings on a mood scale before and after the epilogue). Brigham et al. (1997) also used a procedure involving a videotaped interview and reported that envy mediated *schadenfreude* even when the advantaged person was not to blame for the misfortune and thus had suffered undeservedly. However, the two studies measured envy using multiple items that covered the range of affects theoretically associated with envy, such as feelings of inferiority, hostility, and invidious resentment (Smith & Kim, 2007), without making any distinction between the contribution of each of these components to *schadenfreude*.

A more in-depth analysis (to component level) of the envy – *schadenfreude* relationship was carried out by Leach and Spears (2008) who created a fictitious competition between two universities in the Netherlands to investigate the causal antecedents of *schadenfreude*. They considered inferiority to be a painful emotional experience that poses a serious threat to the self-concept. The results showed that the pain of domain inferiority was the strongest explanation of *schadenfreude*, when compared with emotional reactions to the other party's success, such as envy, illegitimacy, and illegitimacy-based anger. In accordance with previous work (i.e., Feather & Sherman, 2002; Hareli & Weiner, 2002), envy offered no explanation for *schadenfreude*. This was explained as a result of independently establishing in-group domain inferiority and out-group success. Thus, *schadenfreude* was shown to be determined to a greater extent by the inferiority of the self than the success of others. Furthermore, the authors argued that the distinction between constructs that have previously been considered together (e.g., envy, the pain of implied inferiority, and anger at another party's success) and their integration into a comprehensive model, are not specific to the intergroup level. Therefore, the constructs used and the measures developed in this study can also be considered at an interpersonal level of analysis.

Colyn (2007) examined the existence of schadenfreude within same-sex friendships of undergraduates from an American university and concluded that schadenfreude is omnipresent in these relationships with the most common themes in participants' own narrative accounts being competition within work, sports, and academic contexts. Competition occurs in a situation when two people are trying to obtain a certain outcome, and the success of one person requires the failure of another (Salovey, 1991). Hareli and Weiner (2002) reported that competition is a predictor of schadenfreude. They asked participants to recall and describe a situation in which they felt pleasure at another's misfortune. Subsequently, participants rated questions measuring emotions and attitudes toward the victim of misfortune, and towards the misfortune itself. The two researchers assessed the degree to which participants felt in competition with the victim. Although envy was acknowledged to be related to competitive concerns, Hareli and Weiner assumed that competition does not always lead to envy and measured these two factors separately. The results showed that competition was an antecedent of schadenfreude, independently of the other emotions studied. The link between schadenfreude and envy could not be documented, but this was attributed in part to the fact that people often hesitate to admit enviousness.

Emotion Based Learning and the IGT

The hypothesis that emotions can affect higher cognition and overt behaviour has received extensive attention and experimental confirmation (Damasio, 1994; Dolan, 2002; Rolls, 2000). Particularly in the field of decision-making, emotion and intuition have been reported to play a significant role (Kahneman, 2003) and the relationship between emotional disorders and decision-making impairments has been recognised (Bechara, Damasio, & Damasio, 2003).

An influential account of the relationship between emotions and cognition is given by the Somatic Marker Hypothesis (SMH; Damasio, 1994, 1996). According to the SMH, emotions originate from the subjective perception of the complex range of homeostatic changes that occur in given situations, or from their representation in the brain. For example, in the case of decision-making, for every option that is being contemplated, a somatic state is generated, which acts as an indicator (somatic marker) of the value attached to the option that is considered. These somatic representations in the brain are continuously updated. In addition, the SMH claims that somatic memories may be associated with the stimuli that caused the somatic change. These learned somatic reactions may be activated when re-experiencing similar stimuli, causing an anticipated perception of these emotions. Particularly in situations of complexity and uncertainty, these marker signals help to reduce the problem to a manageable size by marking the available choices with an 'emotional' signal. However, this theory was not received without criticism by some researchers (see, for a review, Dunn, Dalgleish, & Lawrence, 2006).

The Iowa Gambling Task (IGT; Bechara, Damasio, Damasion, & Anderson, 1994) is an important measure of emotion-based learning (Damasio, 1994). It was developed as a tool to measure neurological patients' deficit with regards to decision-making and to investigate the SMH (Bechara, Damasio, Tranel, & Damasio, 2005). Despite alternative explanations proposing that the performance on the IGT might show factors other than somatic markers influencing decision-making (see Tomb, Hauser,

Deldin, & Caramaza, 2002), the IGT has been used extensively in a wide range of formats (Bowman, Evans, & Turnbull, 2005). The task requires participants to make 100 selections from four decks of cards. Each card turn has either a positive outcome (winning the participant money), or a negative consequence (losing money). Two of the four decks are considered advantageous in the game (repeated selection from these decks leading to financial gain), and two are regarded as disadvantageous (leading in the long run to a financial loss). The amounts won or lost with every selection are different between the two types of decks. The good decks provide small gains but even smaller losses, while the bad decks give higher wins, but even higher losses. Emphasis has been placed on the complexity of the task (due to the varying contingency pattern of each of the four decks) with the suggestion that the participant must use emotion-based learning to deal with a complex decision-making process (Damasio, 1994).

Extensive research has associated impaired performance on the IGT (i.e., showing a preference for the bad decks or failing to develop a preference for the good decks) with numerous clinical and nonclinical factors (e.g., neurological deficits, psychiatric conditions, affect, personality types, age, instructional cues, etc.). As well as offering an insight into the mechanisms underlying emotion based decision-making, these studies help to better control for possible confounding variables in any investigation employing the IGT. Initially, poor performance on the IGT was shown in participants with lesions to the ventromedial prefrontal (VMF) cortex (Bechara et al., 1994; Bechara, Tranel, Damasio, Damasio, 1996; Bechara, Damasio, Damasio, Lee, 1999), and the amygdala (Bechara et al., 1999, 2003). Dunn et al. (2006) presented a review of studies, showing impaired decision-making on the IGT in a variety of neurological and psychiatric conditions (e.g., anorexia nervosa, attention-deficit-hyperactivity, obsessive compulsive disorder, pathological gambling, schizophrenia, etc.). Oldershaw et al. (2009) reported that adolescents who currently self-harm showed poor decision-making. Suhr and Tsanadis (2007) examined a nonclinical sample and found that participants showing a negative affect exhibit risky performance on the IGT (see also De Vries, Holland, & Witteman, 2008). Decision-making ability on the IGT of healthy adults was found to decline with age (Denburg, Tranel, Bechara, 2005; Fein, McGillivray, & Finn, 2007; Isella et al., 2008). Miu, Heilman, and Houser (2008) reported that trait anxiety was linked with poor results on the IGT (see also, Werner, Duschek, & Schandry, 2009; De Visser, van der Knaap, van de Loo, van der Weerd, Ohl, & van den Bos, in press). Sleep deprivation was also associated with impaired performance on the IGT (Killgore, Balkin, & Wesensten, 2006; Killgore, Lipizzi, Kamimori, & Balkin, 2007). Balodis, MacDonald, and Olmstead (2006) found that instructional cues can have a strong influence on how nonclinical participants play the IGT. The group that was told the IGT was used as a distraction task performed similarly to VMF patients (i.e., played predominantly from the disadvantageous decks, and showed no improvement over the 100 trials). The group that was correctly informed about the aim of the study (i.e., to measure decision-making) showed normal learning of the IGT. The results of the study support the conclusion that complete instructional cues are necessary for optimal performance on the IGT. Another instructional cue (i.e., time available to complete the task) was found to influence decision-making on the IGT. DeDonno and Demaree (2008) told one group of participants that the time available for completing the IGT was typically insufficient to learn and successfully complete the task, and told another group that the time was normally sufficient. Participants in both

conditions were given the same amount of time. Results showed that learning occurred in both situations during the IGT, but the group that played under the pressure of time, performed significantly worse than the control group. These findings regarding the clinical and nonclinical factors affecting the IGT performance collectively suggest that investigations using this task to measure emotion based learning should include a screening for neurological and psychiatric history and should also consider the possible effects of the nonclinical factors.

The classical finding for neurologically unimpaired individuals is to display a preference toward the positive decks, as the game progresses and they learn to play the task (Bechara et al., 1994). However, participants are usually not aware of the reasons behind their increased preference for the good decks (Bechara et al., 1997). This finding was used to support the idea that emotional based learning takes place during the IGT (i.e., participants learn to play the task by assigning an emotional value to each deck of cards, as they experience the positive and negative consequences, and they guide their decisions based on these emotional considerations).

Turnbull, Worsey, and Bowman (2007) reported that emotion based learning took place not only in the case of the participant completing the IGT (the Player), but also for a participant watching the IGT being played (the Observer), and that *schadenfreude* could have a significant impact on the Observer's subsequent performance on the task. Vicarious learning was measured by comparing the Observer's performance on the IGT after having previously watched the Player completing the task, with the Player's performance (the naïve player). When the interaction between participants was manipulated, Turnbull et al. reported different levels of vicarious learning. More specifically, when Observer-Player communication was allowed, the Observer showed 100% vicarious learning (i.e., displayed the same level of performance at the beginning of the task as the Player did at the end). However, in two experiments in which interaction between the Observer and the Player was not allowed, vicarious learning did not take place. In one condition (when the financial gains or losses were incurred by both Observer and Player, but only the Player had an input in the game), the Observer later performed on the task similarly to the naïve player (0% vicarious learning). In the other condition, when the wins and losses would only apply to the Player, the Observer later performed worse than the naïve player (i.e., below 0% vicarious learning) and the selection of cards from the good and bad decks was almost at chance level. The researchers presented evidence supporting the idea that *schadenfreude* influenced the performance in the no-interaction conditions. Subsequently, they argued that the results in the dual-reward condition suggested that any form of emotional investment by the Observer seems to cancel the negative effects of *schadenfreude* on emotional learning. These findings revealed how different types of interactions between the Observer and Player influence emotion based learning, and the role that *schadenfreude* can take in this process. More specifically, they showed that when human beings work together towards a common goal (i.e., that they both benefit from), the emotional investment that they have in this process cancels the negative effects of *schadenfreude* on emotion-based learning. However, the study by Turnbull et al. does not address the case of competitive situations – in which the Observer has a direct gain when the Player suffers a loss. The relationship between such competitive situations and learning has been documented by Navaro and Schwartzberg (2007). These reports

together with the findings of Turnbull et al. invite the question of whether competition can increase the negative influence of schadenfreude on vicarious learning or whether the emotional investment in mutually exclusive goals (as in the case of competitive scenarios) cancels the negative effect of schadenfreude.

The aim of the present study was to examine the extent to which schadenfreude can affect emotion based vicarious learning under competitive conditions. This experiment investigated the effect of competition (see Navaro & Schwartzberg, 2007) together with, and in the absence of, feelings of inferiority (see Leech & Spears, 2008) on the emotional learning of the IGT, when no interaction took place between the participant playing the task and the observer. Based on previous findings (Hareli & Weiner, 2007; Turnbull et al., 2007), we expected schadenfreude to cause the observer to perform worse than the player on the IGT in the competitive condition (without feelings of inferiority) and we anticipated an even more impaired performance from the observer when competition and feelings of inferiority act together.

Method

Participants

Participants in the study were 90 university undergraduate students, 18 male and 72 female, with ages between 19 and 41 ($M=21.77$, $SD=4.53$), screened for neurological and psychiatric history (see Appendix A). Participants were recruited through the Bangor University SONA system, in pairs of same-sex friends. In exchange for their participation the students received the usual amount of course and printer credits and they were allowed to keep the amount of real money they won during the experiment, which was up to a maximum of £5.00.

Measures and Apparatus

A computerised version of the IGT was used. It was programmed and administered as in Turnbull et al. (2007). The IGT was based on four decks of cards – two disadvantageous (A & B), and two advantageous (C & D). Participants were not informed about the nature of the decks and were required to select cards from the four decks. The aim of the task was to win as much money as possible. For decks A and B, participants could win 10p for every card selection, but the total amount they lost for 10 selections from these decks was £1.25, thus sustaining a 25p net loss. Every selection from decks C and D could win the participants 5p, while for every 10 selections they would only lose 25p, producing a net gain of 25p. The task required participants to make a total of 100 card selections in five blocks of 20 selections. Each deck had 60 cards.

Subjective experience ratings were measured after each block of 20 card selections as in Bowman et al. (2005). Participants were asked to rate their perception of each deck on a scale from 0 (very bad) to 10 (very good).

Design

The experiment employed a 2 x 2 x 5 mixed factorial design. Conditions (Competitive and Competitive+Academic) and role (Player and Observer) were the between-subjects variables and time (blocks 1-5) was the within-subjects factor. The measures used in the study were the behavioural performance on the IGT and the subjective ratings for each of the four decks of cards.

The behavioural measure was taken after each of the five blocks of 20 card selections and it referred to the total number of card selections from the advantageous decks (C & D) minus the total number of card selections from the disadvantageous decks (A & B). The comparison between the behavioural score of the two participants in each pair was used to analyse vicarious learning for each of the two experimental groups. The subjective experience measure was also taken after each of the five blocks of 20 selections and it consisted in the ratings for the good decks (C+D) minus the ratings for the bad decks (A+B).

Procedure

The participants completed the experiment in same-sex pairs. They were randomly assigned to one of the two groups: competitive without feelings of inferiority (Competitive) and competitive with feelings of inferiority (Competitive+Academic). Both groups had to complete the study in two phases. Participants in every dyad were presented with a general overview of the study (see Appendix B) and then gave their written consent (see Appendix C). Next, they were told the role they were about to have in the study (Player or Observer).

The experiment required the Player to perform the IGT, while the Observer watched the computer monitor without taking any part in the game. Participants were told that a target win had been set and if the Player reached or exceeded the target win, then he/she would keep the money made on the IGT and the Observer would not win anything. However, if the Player failed to reach the target win, then he/she would not win anything, and the Observer would receive the target win. The amount that had to be reached by the Player was not disclosed to either participants in order to control for participant expectation effect (i.e., if the target win was known to participants, both performance and learning could have been affected when the target was reached during the IGT) and to avoid the situation in which participants would not reach the target. No interaction between the two participants was allowed. Since there were 60 cards in each deck and the IGT required 100 card selections to be made, participants were told to continue choosing from the remaining decks, in case one of the decks ran out of cards (see Bechara et al., 1994). After each block of 20 selections, three sets of subjective experience ratings were taken. The Player provided own subjective ratings for the four decks. The Observer rated the decks according to his/her own perception and then rated the same decks based on his/her impression on how the Player would rate each deck. At the end of Phase 1 (after finishing the 100 card selections), irrespective of the amounts won by the Player on the IGT, participants were told that the target win was exceeded, and thus, the Player got to keep the money made on the gambling game. The Observer was told that he/she had won nothing as a result.

For Phase 2 of the study, the Player was invited to leave the experimental room and the Observer was asked to play the same version of the IGT, being told that whatever the amount won on the IGT, he/she will get to keep it. After each block of 20 selections, subjective ratings were provided by the Observer, regarding his/her own impressions about the decks.

Phase 1 and Phase 2 were identical for both competitive conditions. What was manipulated between the two scenarios was the information given to participants about the way they were allocated to the two roles. In the Competitive condition (i.e., without feelings of inferiority), participants were told that they were randomly assigned to the role of Player or Observer. In the Competitive+Academic condition (i.e., when feelings of inferiority were induced in the Observer) participants were told that their academic results in key areas for the study had been used to determine which of them will play the IGT and who will observe the game. As a result, the participant with the higher academic score in every dyad was allocated to the Player role and the other participant was asked to watch the game (the Observer). However, in both conditions, participants were randomly allocated to one of the two roles.

In order to insure that no communication took place between the two participants during the IGT the researcher remained in the experimental room during both Phase 1 and Phase 2. A debriefing sheet was provided at the end of the study (see Appendix D).

Results

As in Bechara et al. (1994), the 100 card selections of the IGT were divided into five blocks of 20 selections. Performance on the gambling game for each participant was scored as the total number of card selections from the good decks (C & D) minus the total number of selections from the bad decks (A & B). Thus, scores above zero indicate that the participant played the IGT advantageously (more selections from the good decks than from the bad decks), and scores below zero indicate an impaired performance (see the summarised raw data in Appendix E). In order to test the effect of schadenfreude on IGT learning during the two competitive conditions, the behavioural score for each of the five blocks of card selections was analysed for both participants in the dyad (Player – during Phase 1 and Observer – during Phase 2), separately for the two experimental conditions (Competitive and Competitive+Academic). Subsequently, we looked at the difference between the Player's performance across the five blocks in the Competitive condition versus the Competitive+Academic condition and similarly we analysed the Observer's performance in the two conditions.

The subjective evaluation was calculated, after each block of 20 card selections, in a similar way: the mean ratings of the disadvantageous decks (A & B) were deducted from the mean ratings of the advantageous decks (C & D). A positive subjective score attested that the good decks were rated as better than the bad decks and a negative score indicated that the bad decks were rated more favourably. The subjective evaluations of the decks were firstly analysed separately for each condition (Competitive and Competitive+Academic) and for each role (Player and Observer) across the five blocks of 20 card selections. Secondly, the Player's and the Observer's ratings across the five blocks were compared for each condition.

Behavioural Performance in the Competitive Condition

The results for the Competitive condition, as illustrated in Figure 1, show an unexpected performance on the IGT for both Player and Observer. In Phase 1 of the IGT, participants in the P1 role ($n=22$) began by selecting more cards from the bad decks ($M = -3.36$, $SD = 4.55$) and their performance only increased to chance level (i.e., made almost as many bad card selections as good card selections) by the end of the IGT (e.g., Block 5; $M = .00$, $SD = 5.62$). A within-subjects ANOVA revealed a main effect of Block ($F(4,84) = 2.55$, $p = .045$).

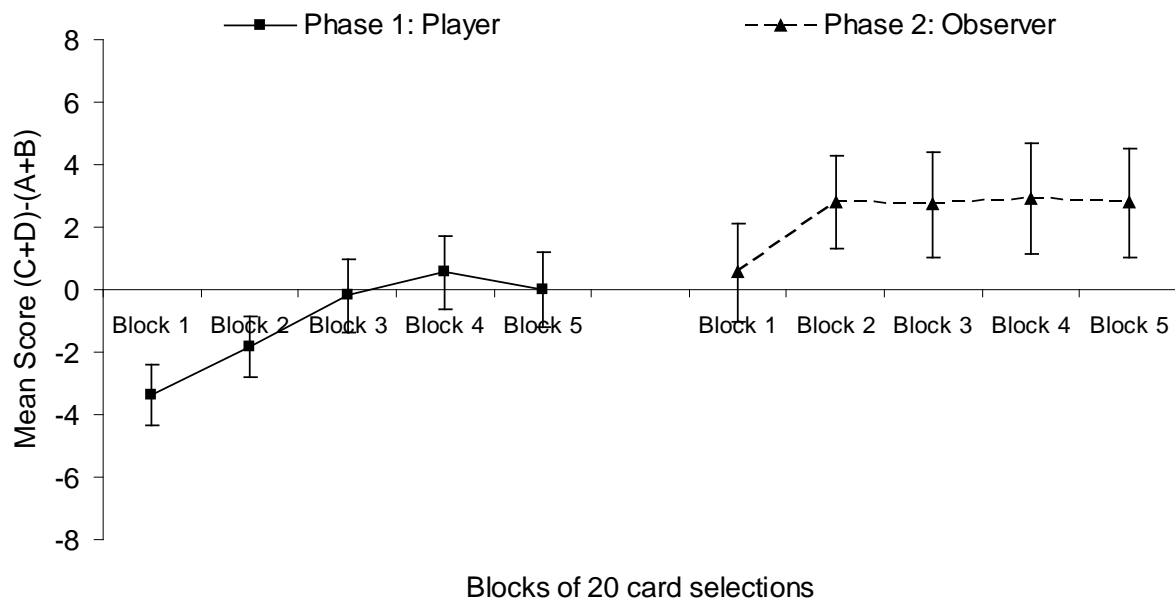


Figure 1: Mean number of card selections from the good decks minus the selections from the bad decks (C+D)-(A+B), across each of the five blocks for both the Player and the Observer, in the Competitive condition.

In Phase 1, the Player begins by selecting more cards from the bad decks and performance only improves up to chance level. In Phase 2, the Observer shows a preference for the good decks starting with Block 2, and maintains the high level of performance throughout the game. The error bars represent \pm SE of the mean.

In Phase 2, participants playing the role of the Observer ($n=22$) showed a clear preference for the advantageous decks throughout the game (e.g., Block 2; $M=2.82$, $SD=7.00$). A within-subjects ANOVA failed to reveal a main effect of Block. This revealed that the Observer did not learn the IGT during Phase 2, but showed evidence of an unimpaired vicarious learning of the IGT during Phase 1, when the Player was playing the game.

Comparison of the Behavioural Performance during Phase 1 and 2 in the Competitive Condition.

A 2x5 mixed-factor ANOVA performed between Phase 1 and 2 and across all five blocks found a main effect of Block ($F(3.24,136.11)=3.16, p=.024$) and a main effect of Phase ($F(1,42)=4.7, p=.036$). An independent-samples t-test confirmed that the Observer's overall performance in Phase 2 ($M=2.35, SD=7.66$) was significantly higher than the Player's performance in Phase 1 ($M=-0.96, SD=5.29; t(218)=3.71, p<.001$). This finding is in total contradiction with our expectations and showed that the Competitive condition had no effect on the Observer's behaviour, but it impaired the Player's decision-making on the IGT.

Behavioural Performance in the Competitive+Academic Condition

The Competitive+Academic group of participants were told that the allocation to the two roles (Player and Observer) was made based on their academic performance in key areas (the Player having a higher academic performance than the Observer). The introduction of this variable influenced the performance of the Player, and contrary to expectation did not influence negatively the learning of the Observer.

The results of the behaviour analysis showed that the Players ($n=23$) learned to avoid the disadvantageous decks across time. The performance increased from Block 1 ($M=-3.65, SD=6.43$) and showed a preference for the advantageous decks (e.g., Block 4; $M=5.39, SD=9.50$). A within-subjects ANOVA revealed a main effect of Block ($F(3.01,66.25)=6.99, p<.001$) which supports the idea that the Player learned to avoid the bad decks and selected more cards from the good decks as the game progressed.

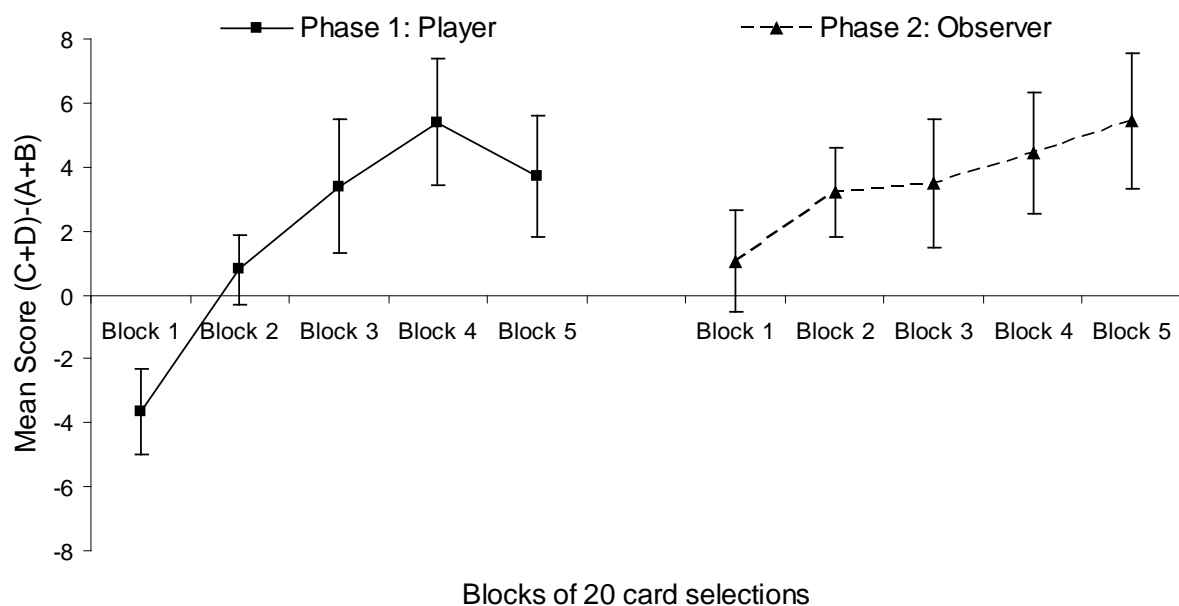


Figure 2: Mean number of card selections from the good decks minus the selections from the bad decks (C+D)-(A+B), across each of the five blocks for both the Player and the Observer, in the Competitive+Academic condition.

In Phase 1, the Player shows substantial learning across time. In Phase 2, the Observer shows a preference for the good decks starting with Block 2, and maintains the high level of performance throughout the game. The error bars represent \pm SE of the mean.

In Phase 2, the participants playing the role of the Observer showed a preference for the good decks starting with Block 1 ($M=1.04$, $SD=7.62$), which increased as the game progressed (e.g., Block 5; $M=5.43$, $SD=10.27$). However, a within-subjects ANOVA failed to reveal a main effect of Block, which showed that the Observer's preference for the good decks did not develop during Phase 2, and that the learning of the IGT took place during Phase 1, when the Observer was watching the Player.

Comparison of the Behavioural Performance during Phase 1 and 2 in the Competitive+Academic Condition

A 2x5 mixed-factor ANOVA performed between Phase 1 and 2 and across all of the five blocks found a main effect of Block ($F(3.15,138.5)=8.74$, $p<.001$) but no main effect of Phase. This supports the idea that schadenfreude in competitive scenarios paired with feelings of inferiority (for the Observer) does not have a negative impact on emotional learning during the IGT for either the Player or the Observer.

Comparison of the Behavioural Performance between the Competitive and the Competitive+Academic Condition

A mixed-factor ANOVA comparing the performance of the Player in the Competitive condition and the performance of the Player in the Competitive+Academic condition for all the five blocks revealed a main effect of Block ($F(3.24,139.40)=9.29$, $p<.001$), and a main effect of Condition ($F(1,43)=4.09$, $p=.049$), but no interaction between block and condition. An independent-samples t-test showed the Player's performance in the Competitive+Academic condition ($M=1.92$, $SD=8.74$) was significantly higher than the Player's performance in the Competitive condition ($M=-.96$, $SD=5.29$; $t(223)=2.98$, $p=.003$). These results showed that the Player's performance on the IGT was impaired in the Competitive condition, but not in the Competitive+Academic condition.

A mixed-factor ANOVA ran between the performance of the Observer in the Competitive and Competitive+Academic conditions revealed a main effect of Block ($F(3.17,136.42)=3.04$, $p=.029$) but no main effect of Condition. The Observer thus, showed an unimpaired emotional learning during the IGT under competitive conditions irrespective of the presence of feelings of inferiority.

Subjective Experience Ratings in the Competitive Condition

In the Competitive condition, as shown in Figure 3, the Player's subjective experience ratings in Phase 1 favoured the good decks (e.g., Block 3; $M=4.41$, $SD=3.38$). A within-subjects ANOVA found a main effect of Block ($F(2.79,58.58)=4.39$, $p=.009$) which showed that the preference for the good decks formed as the game progressed. The Observer's ratings in Phase 1 followed a similar pattern to the Player's both when they referred to own impressions and to the Player's perceived impressions. A between-subjects ANOVA found no main effect of

Rating (Player's own ratings, Observer's own rating, and Observer's rating about Player's perception) for any of the five blocks.

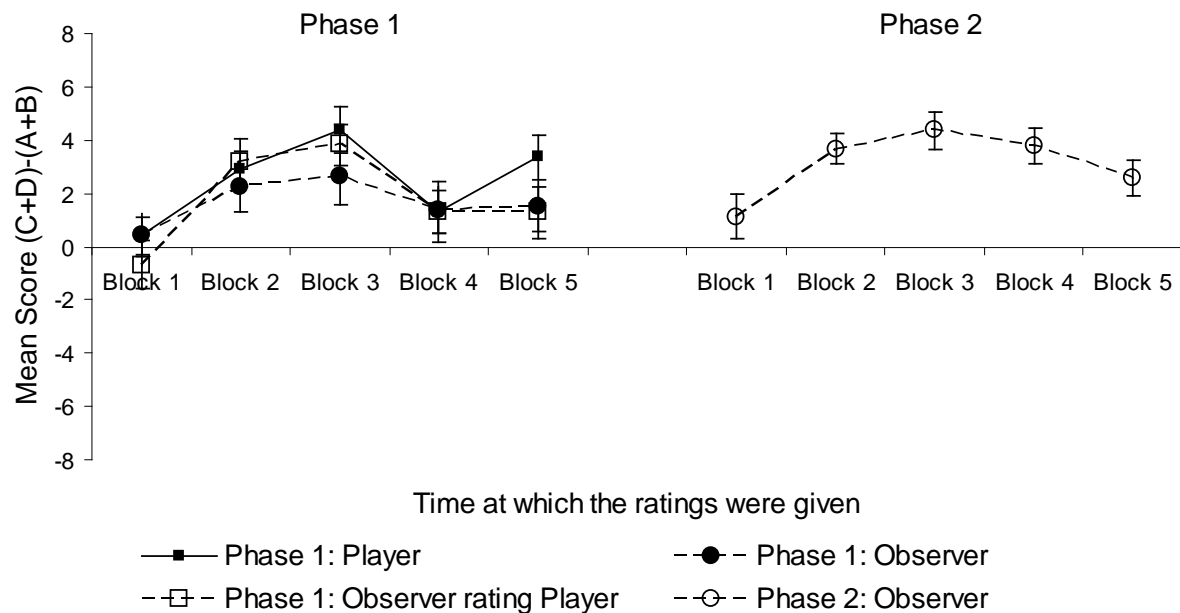


Figure 3: Mean score of the subjective experience ratings of the good decks minus the ratings of the bad decks (C+D)-(A+B), across each of the five blocks for both the Player and the Observer, in the Competitive condition.

In Phase 1, starting with Block 2, the Player's own ratings and both the Observer's ratings indicate a correct discrimination between the good and the bad decks.

In Phase 2, the Observer continues to display a positive perception about which decks are good and which are bad, starting with Block 1. The error bars represent \pm SE of the mean.

The Observer's ratings in Phase 2 showed a similar preference for the advantageous decks (e.g., Block 1; $M=1.14$, $SD=.84$). A within-subjects ANOVA found a main effect of Block ($F(4, 84)=3.97$, $p=.005$), which revealed that the Observer's perception of the decks continued to change in Phase 2 (e.g., Block 3; $M=4.36$, $SD=3.36$).

Subjective Experience Ratings in the Competitive+Academic Condition

In the beginning of Phase 1 (see Figure 4), the Player rated the good and the bad decks approximately the same (Block 1; $M=-.65$, $SD=4.72$) and starting with Block 2 ($M=4.09$, $SD=2.81$) rated the advantageous decks more favourably than the disadvantageous decks. A within-subjects ANOVA reported a main effects of Block ($F(4, 88)=7.54$, $p<.001$) showing that the Player had correctly perceived the difference between the good and the bad decks. The Observer's subjective ratings showed a similar pattern to the Player's when both referring to own ratings and to the Player's perceived impressions. A between-subjects ANOVA found no main effect of

Rating (Player's own ratings, Observer's own rating, and Observer's rating about Player's perception) for any of the five blocks.

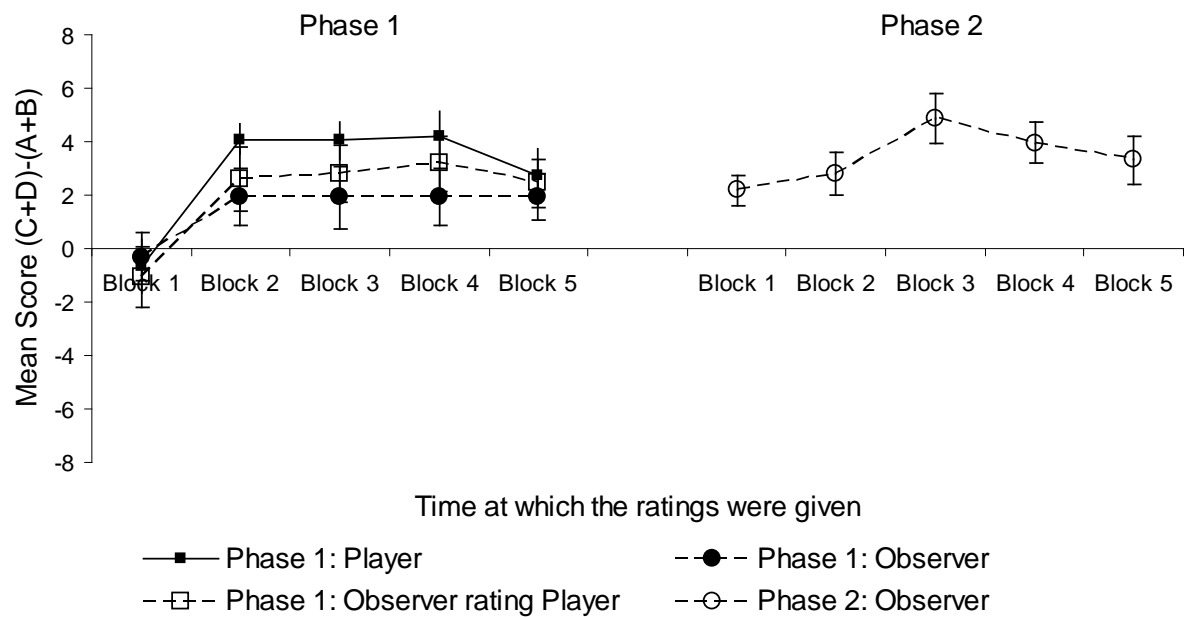


Figure 4: Mean score of the subjective experience ratings of the good decks minus the ratings of the bad decks (C+D)-(A+B), across each of the five blocks for both the Player and the Observer, in the Competitive+Academic condition.

In Phase 1, starting with Block 2, the Player's own ratings and both the Observer's ratings indicate a correct discrimination between the good and the bad decks.

In Phase 2, the Observer continues to display a positive perception about which decks are good and which are bad starting with Block 1. The error bars represent \pm SE of the mean.

In Phase 2, the Observer rated the advantageous deck higher than the disadvantageous decks starting with Block 1 ($M=2.17$, $SD=.55$). A within-subjects ANOVA revealed a main effect of Block ($F(4, 88)=3.85$, $p=.006$), which suggested that the perception about the decks continued to change (e.g., Block 3; $M=4.87$, $SD=.91$).

Discussion

The present study examined whether schadenfreude during competition with and without feelings of inferiority can have a negative effect on emotional learning. Firstly, the results deny our expectation about the negative effect of schadenfreude on the Observer's performance in both competitive scenarios and will be used as evidence to support the conclusion that the emotional investment during competitive situations serves as a powerful aid in successfully negotiating emotion based decision-making tasks. Secondly, an unexpected finding is reported about the performance of the Player, who in the Competitive condition failed to learn the IGT, but in the Competitive+Academic condition showed an unimpaired performance,

which revealed a novel nonclinical factor that seems to negatively affect participants' performance on the IGT.

Our findings about the unimpaired performance of the Observer in both competitive conditions expand the work of Turnbull et al. (2007). The researchers reported that *schadenfreude's* negative affect on the Observer's performance on the IGT in Phase 2 is cancelled when the outcome of the Player's performance during Phase 1 also applied to the Observer. The explanation proposed was that any form of emotional investment in the IGT during Phase 1 cancels the effect of *schadenfreude*. Our study expanded these findings, supporting the conclusion that the negative effect of *schadenfreude* on emotional learning is cancelled not only when the Observer profits from the Player's unimpaired performance, but also when the Observer benefits only if the Player performs poorly. More notably, Turnbull and colleagues reported that during Phase 2, of the shared-rewards condition, the Observer started playing the IGT poorly but was then able to learn to select cards more advantageously. However, in our study, we found that the Observer's performance did not improve significantly during Phase 2 which suggests that a strong preference for the good decks was formed during Phase 1 (i.e., the Observer benefited from vicarious learning). Consequently, a negative emotional investment, such as in the competitive conditions tested in the present experiment (when the Observer won only if the Player did not win) enabled vicarious learning to take place during Phase 1, while a positive emotional investment, such as in the shared reward paradigm tested by Turnbull and colleagues, was reported not to do so. In the terms of the SMH proposed by Damasio (1994, 1996), these findings suggest that the somatic markers elicited by win/lose (i.e., I win if you lose) situations might be stronger than the somatic markers evoked in win/win (i.e., I win if you win) circumstances. As a final note, we reported evidence of vicarious learning in both competitive conditions, thus the presence or absence of feelings of inferiority experienced by the Observer did not affect the emotional learning (i.e., the strength of the somatic markers). This is further evidence about the strength of the win/lose somatic markers and their positive influence on emotional learning and more specifically vicarious learning. To conclude, our study expanded the evidence supporting the idea that *schadenfreude's* disruptive effect on emotional learning can be abolished by other forms of emotional investment. Further research can investigate directly the difference between the effects of cooperative and competitive scenarios on emotional learning and test our prediction that competitive (win/lose) situations elicit stronger somatic markers than cooperative (win/win) scenarios, and thus prove to be a more valuable aid for the learning and subsequent performance on emotion based decision-making tasks.

The second unexpected finding of our study, regarding the Player's poor performance on the IGT during the Competitive condition and the unimpaired performance in the Competitive+Academic condition, contributes to a better understanding of the factors influencing emotion based decision-making. The literature investigating the nonclinical conditions that impair the performance on the IGT reported that when participants were told that the time available to complete the IGT is normally insufficient, performance was impaired (DeDonno & Demaree, 2008). Our study uncovered a novel instructional cue: if participants are told that they can only keep the money they make on the IGT if they exceed an undisclosed target win (otherwise, the Observer receives the target win), despite being able to correctly

identify the good and the bad decks (as outlined by the subjective ratings) participants fail to make more advantageous cards selections. We reject the simple explanation that this poor decision-making behaviour was caused by the fact that the undisclosed target win forced participants to employ short term strategies (i.e., making a lot of money quickly) to make sure they exceeded the target win, thus disregarding the advantage of the small gains of the good decks (that levied even smaller punishments). We acknowledge that this conclusion could, at least in part, explain the results of DeDonno and Demaree (2008). However, we consider this interpretation to be invalid for our present findings for two reasons. Firstly, the subjective ratings show that the participants identified correctly which decks were good (i.e., winning the participants money) and which were bad. Therefore, since the aim of the IGT was unchanged (i.e., to make as much money as possible), and only the condition in which they would keep the money was different, one would expect the participants to make more selections from the good decks. Secondly, in the Competitive+Academic condition, when participants were under the same constraints (regarding the target win), but additionally they were told that their academic performance in key areas for the study was superior to the performance of the person next to them (the Observer), decision-making on the IGT was unimpaired, which meant that as well as identifying the good decks (through higher subjective ratings) they were able to make increasingly more advantageous card selections throughout the task, showing normal emotional learning. The possible explanation that we propose for the present findings involves the participants' anxiety level. In the Competitive condition, the target win requirement made the task more challenging (i.e., difficult), which, we argue, could have increased the participants' anxiety level and this in turn affected the performance on the IGT (see De Visser et al., in press; Miu et al., 2008; Werner et al., 2009). In the Competitive+Academic condition, when the Players were told that their academic performance was superior to that of the Observers, the Players felt more self-confident and the task seemed more achievable to them and thus participants' anxiety level was not significantly affected, and they showed normal emotional learning. Further research could investigate our claims by measuring the perceived difficulty of the task as well as the anxiety level of the participants after they are informed about the conditions of the experiment and before they begin the IGT.

In conclusion, the present study offered further evidence supporting the idea that schadenfreude's disruptive effect on emotional learning can be abolished by other forms of emotional investment and invited further research to investigate if the positive effect of competitive scenarios (i.e., involving mutually exclusive goals) on emotional learning is significantly greater than the effect of cooperative scenarios (i.e., in which participants have common goals). Furthermore, we proposed that perceived task difficulty might influence the IGT performance (i.e., the more difficult the IGT is regarded to be, the poorer is the decision-making on the task), and that this effect is possibly mediated by participants' anxiety level.

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