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SAMSON, Andrea Christiane, et al.

Abstract

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Perception of other people’s mental states affects humor in social anxiety

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ABSTRACT

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Limitations: A possible limitation is that the present study was conducted in individuals with social anxiety in the non-clinical range.

Conclusions: The findings suggest that highly socially anxious people do not have a general humor processing deficit, but may feel threatened by tasks involving the mental states of others. The negative affect evoked by TOM humor may hinder the experience of funniness in highly socially anxious individuals, and it may also make it more difficult for them to rate their own amusement.

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Social anxiety disorders are highly prevalent in the general population with a 7—13.3% lifetime prevalence (Kessler et al., 1994). These disorders are characterized by the experience of extensive fear in social interactions and overly negative evaluation of social situations (Schneier, 2006; Stein & Stein, 2008). Although a number of psychological correlates of social anxiety have been described, relatively little is known about the more elementary processes of social and emotional cognition that may predispose one toward developing social anxiety, and experiencing significant distress and functional impairment in work and social domains (Lochner et al., 2003; Schneier et al., 1994).

Previous research has proposed that high levels of social anxiety may partly be attributed to social cognition deficits, which are manifested as a tendency toward inaccurate and distorted appraisals of the beliefs and intentions of others during interpersonal interactions (Hirsch & Clark, 2004; Stopa & Clark, 2000). Given that individuals with social anxiety tend to form inaccurate impressions about others, “Theory of Mind” (TOM) tasks may serve as a potent probe of mentalizing abilities, because they require individuals to make inferences about beliefs, intentions, and behaviors of others.

Functional magnetic resonance (fMRI) studies have begun to characterize the neural correlates of “mentalizing” using TOM tasks, indicating that a network of cortical areas that includes the medial prefrontal cortex, the temporal-parietal junction, and the precuneus plays a key role in mentalizing and forming impressions of other people (Amadio & Frith, 2006; Frith & Frith, 2006; Gallagher & Frith, 2003; Rilling, Sanfey, Aronson, Nystrom, & Cohen, 2004; Van Overwalle, 2008). Sripada et al. (2009) showed that patients with clinically significant social anxiety exhibited less activation of parts of this network during mentalizing compared with the results of matched healthy controls.

Whereas Theory of Mind usually refers to inferences about the mental states of another person, some researchers include the understanding of one’s own mental states as a part of the concept. Brain-based studies show that certain brain regions respond both when individuals are asked to infer the mental state of another individual and when they are asked to reflect upon their own mental state. These findings suggest that there may be a common biological basis related to a more elementary process of
mentaling about internal states; that is, about those of another person as well as about those of oneself (Gentili et al., 2009; Oberman & Ramachandran, 2007; Ochsner et al., 2004; Saxe, Moran, Scholz, & Gabrieli, 2006). This is supported by evidence that social anxiety is linked to deficits in a brain circuit that is related both to social cognition and the evaluation of one’s own emotional state (Gentili et al., 2009).

Evidence also suggests that social anxiety is associated with an attentional bias to threat by preferentially allocating attention toward threatening social information and signs of disapproval from others (Alden & Taylor, 2004; Amin, Fo, & Coles, 1998; Bögel & Mansell, 2004; Pineles & Mineka, 2005; Taylor, Bomyea, & Amir, 2010). Individuals high in social anxiety exhibit a bias toward negative information processing that is similar to biases in all other anxiety disorders (e.g., Mathews & MacLeod, 2005). However, social anxiety may be specifically characterized by aberrant processing of positive social information. Social anxiety has been related to diminished attentional allocation for positive social cues (Perowne & Mansell, 2002; Silvia, Allen, Beauchamp, Maschauer, & Workman, 2006; Taylor et al., 2010) and negatively biased processing of positive social information (Alden, Taylor, Mellings, & Laposa, 2008; Laposa, Cassin, & Rector, 2010; Yoon & Zinbarg, 2007). It has also been proposed that social anxiety may be associated with a more general positive affect deficit, related to a tendency to suppress emotions (Kashdan & Collins, 2010; Watson & Naragon-Gainey, 2010).

Humor is an important component of social interaction, generating laughter, amusement, exhilaration, mirth, and other positive emotions (Martin, 2007; Ruch, 2007). Interestingly, humor processing has not yet been used to study more elementary cognitive or emotional characteristics in social anxiety. Previous research on general anxiety and humor shows that anxiety is negatively correlated to the self-reported use of more adaptive humor styles (affiliative and self-enhancing humor), but positively related to self-defeating humor, a maladaptive humor style (e.g., Martin, Puhl-Doris, Larsen, Gray, & Weir, 2003). Although some studies show that humor reduces anxiety (e.g., Martin et al., 2003), only people with low or normal anxiety levels seem to benefit from the use of humor. In highly anxious individuals, humor may even have a detrimental effect. For instance, highly anxious students scored lower on a humorous test than on a non-humorous test, suggesting that anxious people may react negatively to humor (Townsend & Mahoney, 1981).

In the present study, an experimental paradigm in the context of positive emotions was used to test inferences about individual differences in social cognition and the perception of one’s own emotions. Participants with varying degrees of social anxiety were presented with humorous stimuli that varied in the social cognition requirements to understand the joke, and rated the cartoons for comprehensibility and positive emotions (i.e., funniness). By these means we aimed at using humor to probe some of the cognitive mechanisms of social anxiety.

The degree to which someone is able to experience amusement evoked by a joke or funny event depends on multiple factors. On the one hand, different people perceive humorous stimuli differently, and this depends on a variety of personality characteristics. Examples include 1) experience seeking (e.g., Forabosco & Ruch, 1994; Ruch & Hehl, 2007), 2) sense of humor (e.g., Martin et al., 2003; see also Martin, 2007), 3) emotional responsiveness (Herzog & Anderson, 2000), or 4) temperamental mood states such as cheerfulness, seriousness and bad mood (Ruch, Köhler, & van Thriel, 1996, 1997). Furthermore, cognitive skills such as cognitive flexibility (Shamm & Stuss, 2003) or the ability to ascribe mental states to other people (Theory of Mind; Samson & Hegenloh, 2010) seem to influence humor processing.

On the other hand, stimuli characteristics also seem to play an important role: content-related characteristics such as joke cruelty, hostility or aggression, and the joke target were addressed in several studies (Ferguson & Ford, 2008; Herzog, Harris, Kroppcott, & Fuller, 2006; Samson & Meyer, 2010; Zillmann & Cantor, 1976). The formal or structural aspects of jokes and cartoons, such as the resolvability of the incongruity (incongruity-resolution and nonsense humor, e.g., Ruch, 2007) and the cognitive rule upon which the punch line is based (Attardo, Hemplemann, & DiMaio, 2002; Attardo & Raskin, 1991), seem to be relevant as well. It is assumed that in order to understand a punch line, one has to bring two initially incongruent scripts into congruence. This is possible by recognizing the cognitive rule (also called logical mechanism) that describes how to resolve the incongruity.

Recently, several studies addressed the impact of different cognitive rules on the humor response: it was shown that the neural activation patterns during processing of cartoons differed according to the cognitive rules specifying how the incongruity was to be resolved: visual puns (PUN) are based on visual ambiguity (one visual element represents two meanings simultaneously), semantic cartoons (SEM) include several cognitive rules (exaggeration, analogy, etc.), whereas Theory of Mind (TOM) cartoons are based on the false beliefs of one of the characters portrayed in the cartoon (Samson, Zysset, & Huber, 2008). One can argue that social cognition is increasingly required on a continuum from visual puns (not at all), to semantic cartoons (sometimes, mental states of others play a role, but are not in the main focus of the joke), to TOM cartoons. In TOM cartoons, it is crucial to take into account the (false) mental states of the characters in the cartoon in order to understand the punch line. Usually, normal healthy participants rate visual puns to be the least funny, whereas TOM cartoons are perceived to be the funniest jokes. This pattern in the funniness response cannot be found in individuals with Asperger’s syndrome who are known to have social cognition difficulties (Samson & Hegenloh, 2010).

Consequently, participants in the present study were exposed to PUN, SEM, and TOM cartoons, as well as to cartoon-like pictures (control condition; see methods section and Fig. 1). The comprehensibility rating refers to the cognitive process of detecting and resolving the incongruity in the cartoons (i.e., detecting the punch line). The funniness rating is related to the perception and appreciation of humor and enjoyment. As it implicates the participants’ reflection on their own emotional state, the response latencies to the funniness rating may reflect how difficult it is to perceive and judge one’s own mental state.

The aim of the present study was to examine whether the impact of social anxiety on humor appreciation may depend on the degree of social cognition involved in assessing humorous stimuli. We assumed that the degree of social anxiety may selectively predict the appreciation of TOM humor, where it is essential to take into account other peoples thoughts and beliefs. These might be potentially threatening and negatively interpreted by socially anxious individuals. By contrast, we expected that humorous stimuli that do not require assessing the mental states of others, such as visual puns, may be equally enjoyed by individuals with low and high social anxiety. Referring to their possible deficit in the evaluation of their own emotions (Gentili et al., 2009), it was assumed that individuals high in social anxiety may take more time to perceive their own emotional states such as amusement and exhilaration. Finally, if social anxiety is related to more general positive emotional dysfunction, appreciation of all types of humor might be reduced.

1. Method

1.1. Participants

Fifty-six participants (28 men, 28 women) aged 18–53 years (M = 24.3, SD = 6.3) completed the experiment. They were
recruited by flyers posted on the university campus. No participant reported using psychoactive medication and none had participated in an experiment using cartoons before. The study was performed in accordance with ethical standards and was approved by the local ethics committee. Participants gave their informed consent to participate in the study.

1.2. Stimulus material

The stimulus material consisted of three groups of cartoons and one group of non-humorous pictures serving as a control condition. All pictures were used in previous studies (Samson & Hegenloh, 2010; Samson et al., 2008; Samson, in press). Theory of Mind (TOM) cartoons are characterized as those in which it is essential to take into account the (false) mental states of the characters in the cartoon to understand the punch line. Visuals puns (PUN) are cartoons where the punch line is based on the visual similarity or identity of two different objects that might partially overlap in their meaning or function (see Hempelmann & Samson, 2008). Semantic cartoons (SEM) are not based on visual similarities of two objects, but the punch line is based on the incongruity and (if resolved) the semantic relations between two scripts or meanings. The incongruity has to be resolved by recognizing the underlying cognitive rule of the cartoon (e.g., analogy) — to understand on which mechanism the joke is based. Cartoon-like pictures that contain an incongruity which cannot be resolved meaningfully were used as a control condition (irresolvable incongruities, INC); that is, INC pictures do not contain a punch line.

During the experiment a total of 96 cartoons were presented, divided into three blocks. Within each block, the cartoons (8 TOM, SEM, PUN, and INC each) were presented in pseudorandom order. In total, 24 TOM, 24 SEM, 24 PUN, and 24 INC cartoons were used. The order of blocks was counterbalanced.

1.3. Questionnaire data

1.3.1. Social anxiety data

For the assessment of individual differences in social anxiety, the German adaptation of the Social Phobia Inventory (SPIN, Connor et al., 2000; German version by Stangier & Steffens, 2002) was used, which has been extensively validated in clinical and non-clinical samples (Sosic, Gieler, & Stangier, 2008). It consists of 17 items referring to social anxiety symptoms experienced during the last week (5 point Likert scales, from 0 “not at all” to 4 “extremely”). In the present sample, the total score ranges from 0 to 62, $M = 16.0$, $SD = 11.1$, $a = .93$.

1.3.2. Depression

To be able to control for the potential impact of depressed mood on the results, the German version of the CES-D was applied, which is particularly suitable to measure depressive experiences in the general population (Hautzinger & Bailer, 1993; Radloff, 1977; Wood, Taylor, & Joseph, 2010). It is comprised of 20 items referring to mood and attributions over the past week. Scores have a potential range from 0 to 60. The mean score in the present sample was $M = 12.4$ ($SD = 8.4; a = .7$).

1.3.3. Retrospective rating scales

As an indicator of their motivation, the participants were asked to indicate how much effort they had made to accomplish the task after each block (17-point rating scale, from 1 “not at all” to 17 “extremely”; $M = 8.0$, $SD = 5.2$). They were also asked to indicate how difficult they had experienced the task in the previous block (17-point rating scale, from 1 “not at all” to 17 “extremely”; $M = 5.9$, $SD = 3.9$).

1.4. Procedure

Participants were tested one by one in a sound-attenuated examination room. After the questionnaires were administered, the participants received instructions for the task and were given sample cartoons and the required responses. The experiment was run using a Matlab (MathWorks Inc.) script designed for this study. Each cartoon was presented for 6 s, along with two buttons at the bottom of the screen (“not understood”, “understood”). Participants were required to indicate via mouse click, whether or not they had understood the punch line of the cartoon. After presentation of each cartoon, a scale appeared for 4 s on which the participants rated via mouse click the funniness of each cartoon, from 1 (not funny) to 6 (very funny). The computer program also calculated the response latencies to the comprehensibility and funniness ratings. After each block (32 trials), the participants were given 10 min to relax and fill in the rating scales, which were also presented on the screen. The experimenter remained outside the examination room during the whole experiment; the participants were monitored through a one-way mirror and an intercom.1

1.5. Data analysis

Data from “not understood” TOM, SEM, and PUN cartoons and “understood” INC pictures, and trials in which participants failed to

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1 Additional data were obtained for purposes not related to the present research question.
answer the funniness rating were excluded from further analysis. On average, $M = 19.5$ ($SD = 3.9$), $M = 20.2$ ($SD = 3.2$), $M = 19.3$ ($SD = 3.6$) trials were valid for TOM, SEM, and PUN, respectively. For each type of cartoon, the funniness ratings and response latencies to the funniness and the comprehensibility ratings were averaged across all items of all blocks. As there was very little variance in the answers to the comprehensibility questions, they were not further analyzed.

In order to control whether the cartoons were perceived as funny in contrast to the control condition (INC) and to check whether TOM, SEM, and PUN cartoons differed from each other in the responses or response latencies to the funniness ratings, a one-way multivariate analysis of variance was performed, with type (TOM, SEM, PUN, INC) as the independent variable, and perceived funniness and latencies as the dependent variables. The multivariate approach to repeated measures analyses was used, which allows valid tests under nonsphericity conditions (Vasey & Thayer, 1987). Estimates of effect size are reported using partial eta-squared ($\eta_p^2$), which gives the proportion of variance a factor or error variance. Tukey’s HSD was used for a posteriori comparisons.

For the evaluation of the main research question, residualized scores ensured that the analyzed residual variability was specific to the participants’ evaluation of the experience of humor and accompanying feelings of amusement and exhilaration, as opposed to the evaluation of any pictures or recognition of any incongruence. Nine standard multiple regression analyses were performed with social anxiety as predictor and residualized scores of perceived funniness, response latencies to the funniness rating, and response latencies to the “understood” question for the different types of cartoons (TOM, SEM, PUN) as outcome variables. As there is evidence that women may be more emotionally responsive in general and more susceptible to humor in particular (Kring & Gordon, 1998; Ruch & Carrell, 1998), and tend to have higher social anxiety scores (Sosic et al., 2008), sex was entered as a control variable. To evaluate the possibility that effects of social anxiety may be due to a more depressed mood in more socially anxious participants, depression was entered as a further control variable. Finally, effort (motivation), showing relatively high variability among participants, was entered to control for its potential impact on the behavioral data. All predictors were entered simultaneously.

### Table 1

Mean funniness ratings (from 1 to 6) and response latencies (in seconds) to the funniness ratings.

<table>
<thead>
<tr>
<th></th>
<th>TOM</th>
<th>SEM</th>
<th>PUN</th>
<th>INC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funniness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1–6)</td>
<td>3.89 (.67)</td>
<td>3.71 (.63)</td>
<td>3.47 (.77)</td>
<td>3.28 (.36)</td>
</tr>
<tr>
<td>Residuals</td>
<td>1.21 (.26)</td>
<td>1.21 (.25)</td>
<td>1.15 (.27)</td>
<td>1.32 (.37)</td>
</tr>
</tbody>
</table>

Note: TOM – Theory of Mind cartoons; SEM – semantic cartoons; PUN – visual puns; INC – pictures with irresolvable incongruities (control condition). Standard deviations are given in parentheses.

### Table 2

Effects of social anxiety on responses and response latencies to the funniness ratings.

<table>
<thead>
<tr>
<th></th>
<th>TOM</th>
<th>SEM</th>
<th>PUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funniness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>$sr$</td>
<td>$r$</td>
</tr>
<tr>
<td>Social anxiety</td>
<td>-.20</td>
<td>-.29*</td>
<td>-.11</td>
</tr>
<tr>
<td>Sex</td>
<td>-.36*</td>
<td>-.38**</td>
<td>-.22</td>
</tr>
<tr>
<td>Depression</td>
<td>-.01</td>
<td>.02</td>
<td>-.01</td>
</tr>
<tr>
<td>Effort</td>
<td>.24</td>
<td>.24</td>
<td>.23</td>
</tr>
<tr>
<td>Latencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social anxiety</td>
<td>.35**</td>
<td>.38**</td>
<td>.30*</td>
</tr>
<tr>
<td>Sex</td>
<td>.14</td>
<td>.20</td>
<td>-.10</td>
</tr>
<tr>
<td>Depression</td>
<td>.09</td>
<td>.13</td>
<td>.10</td>
</tr>
<tr>
<td>Effort</td>
<td>-.11</td>
<td>.03</td>
<td>-.04</td>
</tr>
</tbody>
</table>

Note: TOM Theory of Mind cartoons; SEM semantic cartoons; PUN visual puns. Sex is coded 1 for women and 2 for men. $r$ ... zero-order correlation; $sr$ ... semi-partial correlation; *$p < .05$, **$p < .01$.}

2. Results

Responses to the funniness ratings differed between types of cartoons ($F_{6,50} = 153.3, p < .001$). Subsequently performed univariate tests showed that this held both for perceived funniness ($F_{1,65} = 515.6, p < .001, \eta_p^2 = .90$) and the response latencies to the funniness ratings ($F_{3,65} = 7.5, p < .001, \eta_p^2 = .12$). Means and standard deviations are shown in Table 1. In both variables, INC markedly differed from TOM, SEM, and PUN (lower funniness ratings, longer response latencies). Additionally, puns were rated somewhat less funny than TOM and SEM cartoons ($HSD = .194, .092$).

The regression analyses with perceived funniness as the dependent variable revealed that social anxiety predicted how funny TOM cartoons were perceived ($F_{4,55} = 4.6, p < .005; \beta = -.33, p < .05$). Higher social anxiety scores were associated with lower funniness ratings. In addition, women rated the TOM cartoons to be more funny than men ($\beta = -.40, p < .005$). The predictors did not significantly contribute to the variance of perceived funniness of SEM ($F_{5,65} = 1.8, n.s.$), only sex and effort were significant predictors of perceived funniness of PUN cartoons ($F_{4,55} = 3.0, p < .05$; sex $\beta = -.30, p < .05$; effort $\beta = .27, p < .05$). Higher funniness ratings were observed in women and in participants having expended more effort. Table 2 shows zero-order and semi-partial correlations for all experimental variables. The semi-partial correlations indicate the unique contribution of a predictor variable to explaining the variance of the dependent variable (i.e., the relationship between one particular predictor and the dependent variable with the effects of all other predictors removed). The analyses of the response latencies showed that participants with higher social anxiety scores took more time to respond to the funniness ratings of TOM cartoons ($F_{4,55} = 2.9, p < .05; \beta = .43, p < .005$). This association also holds true in the case of SEM cartoons ($\beta = .33, p < .05$; see Table 2 for zero-order and semi-partial correlations), although the overall result of the regression model failed to be
significant ($F_{4,55} = 1.43$, ns.). None of the predictors explained a significant amount of variance of response latencies to PUN cartoons ($F_{4,55} = .8$, ns.; see Table 2). Perceived funniness and response latencies of the funniness ratings were not correlated (TOM: $r = -.20$, ns.; SEM: $r = -.09$, ns.; PUN: $r = -.18$, ns.). The analyses with response latencies to the comprehensibility ratings as the dependent variable revealed no significant effects ($F_{4,55} = 42$, ns.; $F_{4,55} = .57$, ns.; $F_{4,55} = .65$, ns.; all zero-order and semi-partial correlations ns.).

The correlation between social anxiety and depression was $r = .43$ ($p < .005$). Participants with high social anxiety scores rated the task as more difficult ($r = .30$, $p < .05$). Sex differences in social anxiety scores were not statistically significant ($t_{54} = 1.6$, ns.; men $M = 13.6$, women $M = 18.3$).

3. Discussion

The present study discovered a clear drop in humor appreciation when participants with high social anxiety scores were presented with humorous material that required making inferences about other people’s mental states for its comprehension. The decrease in the funniness response was specific to TOM cartoons and was not generalizable to the other types of cartoons. This result eliminates the possibility that humor appreciation might be generally impaired in social anxiety or that the findings might be related tohedonic deficits or a general positive emotional dysfunction in social anxiety (Watson & Naragon-Gainey, 2010). As the possible impact of depression was statistically controlled, the findings cannot be attributed to the association of social anxiety with negative affect, which may be related to impaired affection flexibility (Papousek et al., 2010). Both a cognitive component (more negative appraisal of social situations in which other people’s mental states have to be inferred) and an emotional component (associated higher levels of evoked negative emotions) may be involved in the impaired appreciation of TOM humor in social anxiety.

Social anxiety was specifically related to perceived funniness of TOM cartoons, but not of SEM cartoons, which also frequently portray social situations. Therefore, the previously shown tendency of socially anxious individuals to (mis)interpret social situations in a negative or threatening fashion (Alden & Taylor, 2004; Rapee & Heimberg, 1997) seems to be replicated in the humor domain, but only if the humorous stimulus required interpretations of other people’s thoughts and feelings. This is probably related to the greater ambiguity of the scenarios in which others’ mental states have to be inferred from the available information, whereas the content of the situations is more explicit in SEM cartoons (cf. Amin et al., 1998). The associated negative affect may hinder the processing of discordant positive information and, consequently, reduce the perceived funniness of jokes.

Moreover, participants with higher social anxiety scores not only perceived TOM cartoons as less funny, but also took more time to deliver the funniness ratings. Thus, the greater prevalence of negative affect in highly socially anxious individuals may also make it more difficult to rate their own level of amusement. Participants with high social anxiety scores took more time to respond to the ratings of TOM and SEM cartoons, but not of PUN cartoons. As both TOM and SEM (but not PUN) cartoons involve social situations, socially anxious participants may have needed more time to decide whether it was potentially threatening or safe to be amused by the joke, or they may have had to inhibit their nascent anxiety before they could perceive and judge their amusement (cf. Kashdan, 2007).

The impaired appreciation of TOM humor in more socially anxious participants seems to line up neatly with the cognitive features of social anxiety. Socially anxious individuals tend to transform vague or neutral social cues (e.g., facial expressions) into interpersonal threats (Alden & Taylor, 2004; Rapee & Heimberg, 1997) and interpret mildly negative social events in a catastrophic fashion, leading to inaccurate interpretations not only of others (e.g., as critical judges) but also of the mental representation of the self (e.g., as socially incompetent; Alden & Taylor, 2004; Hirsch & Clark, 2004; Hofmann, 2007). This may also be related to a greater tendency of socially anxious individuals to project negative aspects that occur in the cartoon scenarios to themselves. For instance, being generally more worried about being criticized, they may feel embarrassment for the character, who has a false belief. This is in accordance with a study by Moran (1996) in which the perceived funniness of cartoons was reduced when participants identified themselves with the protagonist, particularly when the protagonist was the target of the joke. However, it should be mentioned that all cartoons in the present study were low in aggressive, violent, and sexual content. They were carefully selected according to this criterion, because the appreciation of aggressive and sexual jokes strongly depends on personality traits and gender (see Ruch, 2007). Nevertheless, many jokes involve a victim, particularly those involving social situations.

In contrast to perceived funniness, recent anxieties do not seem to affect the detection of the cartoons’ punch lines. Thus, social anxiety was only associated with impaired affective humor appreciation and reduced positive emotional responsiveness, whereas the subjective cognitive comprehension of the incongruities and their resolution was not affected. This may distinguish social anxious individuals from individuals with general deficits in seeing things from another person’s perspective who showed lower responsiveness to all kinds of humor (Samson & Hegenlohe, 2010).

Our finding of unimpaired cognitive TOM capacities in socially anxious individuals corresponds to a recent study by Lysaker et al. (2010) who found that better TOM performance was associated with higher levels of social anxiety and paranoid features in schizophrenic patients. Perhaps social anxiety requires a certain level of cognitive TOM capacity allowing one to draw paranoid inferences about the mental states of others. There is emerging evidence of a close association between paranoid thoughts and social anxiety (Freeman, Garety, Bebbington, Slater, 2005; Freeman, Garety, Bebbington, Smith, 2005; Freeman et al., 2008). Thus, a more functional cognitive TOM capacity allows more socially anxious individuals to catch the punch lines and report an understanding the joke. But the more negative appraisal of the social situations in which the mental states of other have to be inferred (i.e., interpretation of the scenarios in a more negative or “paranoid” way, and projecting negative aspects that occur in the cartoon scenarios more to themselves) makes the more socially anxious people rate the jokes as less funny.

An alternative interpretation of the prolonged response latencies may be related to hypotheses that socially anxious individuals have deficits in properly accessing their own emotions (Gentili et al., 2009). The present study design does not allow us to make direct inferences about the ability of highly socially anxious people to evaluate their own emotional state. Therefore, these considerations remain speculative. The hypothesis may be supported by the finding that participants with high social anxiety scores retrospectively rated the task as more difficult. As they obviously had no difficulties detecting the punch lines, this presumably refers to the judgments of their amusement. Recently, findings with a self-report measure suggested that individuals high in gelotophobia (i.e., the fear of being laughed at; Ruch, 2009; Ruch & Proyer, 2009), which is conceptually very close to social anxiety (Carretero-Dios, Ruch, Agudelo, Platt, & Proyer, 2010; Edwards, Martin, & Dozois, 2010).
2010; Ruch, 2009) had general difficulties in perceiving and interpreting their own emotions (Papousek et al., 2009). Moreover, a neuroscientific study, in which participants were asked to infer the mental state of the individual in a picture and to evaluate their own emotional response to the picture, demonstrated that brain regions supporting judgments of one’s own mental state and inferences about another individual’s mental state considerably overlap (Ochsner et al., 2004). This was also shown on the behavioral level. Even if reading cognitive and emotional states might be different processes, there is evidence that the ability to read mental states correlates with reading one’s own emotions (Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007; Spreng & Grady, 2010; Subic-Wrana, Beutel, Knebel, & Lane, 2010). Thus, there is some indication that there may be a common basis underlying the reduced perceived funniness of the TOM cartoons and the prolonged response latencies to the ratings. However, perceived funniness and response latencies were not correlated.

The present findings also indicate that not all people are able to benefit from humor to the same extent. Humor is said to have many positive functions, for instance, to help cope with a difficult social situation (e.g., Martin, 2007). However, in socially anxious individuals, the use of humor may backfire, particularly if the joke is based on other people’s false mental states. Instead of having a relaxing and positive effect, the jokes might raise negative emotions and the suspicion that the joke is meant to put them down and encourages others to laugh at them instead of fostering camaraderie with them (see also Voorn & Zinbarg, 2007).

A well-controlled study design that ruled out the influence of any systematic bias or deliberate faking (especially as far the latencies are concerned) could allow for more valid conclusions. A possible limitation is that the present study was conducted in individuals with social anxiety in a non-clinical range. Although there is evidence that social anxiety disorder is a dimensional condition varying quantitatively rather than qualitatively from subclinical manifestations of social anxiety (Kollman, Brown, Liverant, & Hofmann, 2006), it will be necessary to replicate the findings in individuals diagnosed with social anxiety disorder. However, as associations tend to be more pronounced in clinical samples, it seems likely that the present results represent a conservative estimate of the strength of the relationship between social anxiety and humor appreciation. Taken together, the present study showed that specific differences in the processing of humor may provide some insights into the inner-workings of social anxiety. Our findings support indications that social anxiety may be related to aberrant social cognition and perhaps also difficulties in the perception of one’s own mental state. Negative affect evoked by humor that requires other people’s mental states to be understood may hinder the experience of funniness and may make it even more difficult to rate one’s own amusement. If social anxiety is a dimensional condition, research like the present one can provide insight into factors of the etiology and maintenance of social anxiety disorder, thereby facilitating the development of effective treatments. If social anxiety disorder can be qualitatively distinguished from subclinical manifestations of social anxiety, it allows similar conclusions about social anxiety in the non-clinical range that can also be a source of considerable burden.

Conflict of interest
There is no conflict of interest.

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