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Avoidance of emotional facial expressions in social anxiety: The Approach–Avoidance Task

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Abstract

The Approach–Avoidance Task (AAT) was employed to indirectly investigate avoidance reactions to stimuli of potential social threat. Forty-three highly socially anxious individuals (HSAs) and 43 non-anxious controls (NACs) reacted to pictures of emotional facial expressions (angry, neutral, or smiling) or to control pictures (puzzles) by pulling a joystick towards themselves (approach) versus pushing it away from themselves (avoidance). HSAs showed stronger avoidance tendencies than NACs for smiling as well as angry faces, whereas no group differences were found for neutral faces and puzzles. In contrast, valence ratings of the emotional facial expressions did not differ between groups. A critical discrepancy between direct and indirect measures was observed for smiling faces: HSAs evaluated them positively, but reacted to them with avoidance.

Keywords: Avoidance; Threat; Social anxiety; Emotional facial expressions

Introduction

Social phobia (social anxiety disorder, SAD) is a common and debilitating disorder, characterized by marked and persistent fear of one or more social and performance situations in which the person is exposed to unfamiliar people or to possible scrutiny by others (American Psychiatric Association, 1994). Psychological models of social phobia emphasize the importance of cognitive factors for the etiology and maintenance of the disorder (Beck & Emery, 1985; Clark & Wells, 1995; Foa & Kozak, 1986; Rapee & Heimberg, 1997). Several authors have argued that social phobia is maintained by highly specific dysfunctional beliefs (e.g., Beck & Emery, 1985), which refer to negative self-evaluation (Stopa & Clark, 1993). Beliefs that facilitate the interpretation of social situations as threatening may lead to the extensive fear of being negatively evaluated. Consequently, social situations are avoided, or are endured with intense anxiety or distress (American Psychiatric Association, 1994).

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Rapee and Heimberg (1997) integrated avoidance into their cognitive–behavioral model of the maintenance of social anxiety. They assume that confronted with a situation of possible threat, socially anxious individuals' dysfunctional beliefs activate cognitive (dysfunctional thoughts), physical (physiological arousal), and behavioral (overt avoidance) symptoms of anxiety. Anxious individuals continually scan the environment for signs of impending negative evaluation. If escape is impossible, they endure the situation, and they may engage in more subtle behavioral strategies with the intention to prevent possible negative evaluation from others (Wells et al., 1995). These strategies may become manifest in reduction of conversational participation and eye contact, aimed at drawing attention away from oneself and decreasing the risk of criticism. Avoidance of or within social situations acts as an important maintaining factor of social phobia, because it prevents effective processing of the situation and disconfirmation of negative beliefs (Turk, Lerner, Heimberg, & Rapee, 2001).

However, it is difficult for therapists and researchers to sufficiently inquire about avoidance strategies by directly asking anxious individuals, because not all elements of fear are accessible to introspection (Foa & Kozak, 1986). In some cases, in-situation safety behavior cannot easily be observed because it appears habitually and fast. Nevertheless, these behavioral aspects of social anxiety are a central component of cognitive–behavioral therapy (CBT), which is the most efficient psychological intervention for SAD (Hofmann & Barlow, 2002). For the effectiveness of exposure training, it is important that patients pay full attention to the feared situation, including non-verbal social references (Foa & Kozak, 1986). For example, Wells and Papageorgiou (1998) could show that instructions to maintain the focus of attention on the feared situation increased the efficacy of exposure techniques.

Avoidance behaviors have been studied in several different ways. The most straightforward way is to ask highly socially anxious individuals (HSAs) about their reaction, as in the avoidance scale of the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987; Mennin et al., 2002; Oakman, Van Ameringen, Mancini, & Farvolden, 2003). Questionnaires, however, are prone to self-presentation strategies, demand characteristics, and distortions based on social desirability. Moreover, they tend to address many different social situations without focusing on the processing of facial expressions, which are especially relevant to the socially anxious, because they are a major source of information in social interactions, conveying feedback about other people's reactions (Planalp, DeFrancisco, & Rutherford, 1996).

Experimental approaches to assess attentional biases for facial expressions in social anxiety support the occurrence of attentional avoidance to some extent. Using a visual probe task, Mansell, Clark, Ehlers, and Chen (1999) could demonstrate that socially anxious individuals showed avoidance of positive as well as negative emotional faces. Chen, Ehlers, Clark, and Mansell (2002), who used the same paradigm, found greater avoidance of negative, positive, and neutral faces than neutral household objects in patients with social phobia, compared with non-anxious controls (NACs). In contrast, using a modified dot probe task with facial stimuli, Mogg, Philippot, and Bradley (2004) failed to find avoidance of angry, happy, or neutral faces. Several methodological differences between the studies, such as different facial and control stimuli, may be responsible for the inconsistent results. Furthermore, to reconcile the discrepant findings, a limitation of the visual probe task has to be mentioned: Mogg and Bradley (1998) suggested that anxious individuals show an unstable attentional response pattern, which might be difficult to assess with this task, using only one or two different stimulus exposure durations. For this reason, monitoring of eye movements during attentional tasks seems to be a more appropriate measure (Rinck, Reinecke, Ellwart, Heuer, & Becker, 2005).

Since it is the eyes in particular that signal social threat in facial expressions (Öhman, 1986), in a feared social situation, SAs tend to avoid looking at other people, especially at their eyes. Empirical confirmation for this observation comes from a study by Horley, Williams, Gonsalvez, and Gordon (2004). Using an experimental approach, the authors recorded eye movements and fixations of HSAs while they looked at pictures of angry, sad, happy, and neutral faces. They found that compared with NACs, HSAs avoided salient facial features, particularly the eyes in angry faces, and fixated non-salient features instead. Results support the clinical view that HSAs avoid emotionally relevant facial features because of their potential threat value. The results argue against a general avoidance of non-verbal social stimuli in SAs; instead they support the view that SAs avoid facial expressions or facial features, because they fear the potential threat contained in faces. However, eye movements and fixations, as measured by Horley et al. (2004), are limited because to a large extent, they reflect controlled aspects of avoidance behavior.

Recent research has shown that additional information about the more automatic processing of threatening stimuli can be gained from using so-called indirect measures (see De Houwer, 2006). These tasks aim to infer the individuals' attitudes towards potentially threatening objects without asking them directly. Thus, indirect measures are expected to be less affected by distortions created by social desirability than direct self-report measures (De Houwer, 2006). Moreover, self-report measures depend on awareness of the processes reported; therefore they mainly assess beliefs and behaviors that are easily accessed. For the study of cognitive structures that are not sufficiently accessible to conscious self-report, indirect measures are needed. Finally, they have been found to predict more automatic aspects of behavior, while direct measures are better suited for the prediction of more controlled behavior (Huijding & de Jong, 2006).

Indirect measures have already been used successfully to study the cognitive aspects of anxiety and different anxiety disorders. The common principle of these reaction time tasks is that the participants' response speed in a categorization task is affected by the compatibility between the response and the valence of the stimuli (De Houwer, 2006). In clinical psychology, indirect reaction time tasks have been used most often to study fears and phobias (e.g. Ellwart, Becker, & Rinck, 2005; Ellwart, Rinck, & Becker, 2006; Huijding & de Jong, 2006). A limitation of these tasks is that by assessing automatic associations, they mainly tap onto the semantic aspect of emotional information processing (Rinck & Becker, 2007), while emotional reactions consist of a complex pattern of responses. This is particularly relevant in fear and anxiety (Lang, Bradley, & Cuthbert, 1997), because they activate cognitive representations, physiological reactions, and a behavioral tendency to avoid the threatening stimuli. The indirect tasks described above, however, tell us little about behavioral responses, namely whether HSAs differ from NACs in their avoidance reactions. Therefore, we employed a task recently introduced by Rinck and Becker (2007), the *Approach– Avoidance Task* (*AAT*).

The AAT is based on the finding that stimulus valence is linked to the psychological dimension of approach and avoidance. Approach and avoidance are basic responses associated with the primary motive systems of the brain that underlie every complex emotional responding (Lang et al., 1997). In particular, pleasant stimuli produce immediate approach tendencies, whereas negative stimuli produce immediate avoidance tendencies (e.g., Chen & Bargh, 1999). In fact, Darwin (1872) already suggested that our intentions and movements like pushing an object away or pulling it towards us are strongly associated with each other. He concluded that "if we eagerly wish an object to move in any direction, we can hardly avoid moving our bodies in the same direction, although we may be perfectly aware that this can have no influence" (Darwin, 1872, p. 64).

One way to observe these approach–avoidance reactions in overt behavior is by means of arm movements. Several studies (e.g., Chen & Bargh, 1999; Solarz, 1960) have shown that avoidance is associated with pushing objects away from oneself, and approach is associated with pulling the objects closer. Most relevant here, Marsh, Ambady, and Kleck (2005) used this relationship to study behavioral responses to facial expressions in an unselected sample of students. They found that angry facial expressions facilitated avoidance-related behavior in their participants, that is, they responded more quickly by pushing a joystick away from themselves than by pulling it closer.

Rinck and Becker (2007) adapted the AAT to the study of approach–avoidance responses in spider phobics in a series of experiments. An improvement of their AAT was the introduction of a "zooming" function: When participants push the joystick away from themselves in response to a picture presented on the computer screen, the picture shrinks. When the joystick is pulled, the picture grows until it almost fills the screen. This zooming effect creates the visual impression that the pictures are coming closer upon pulling of the joystick and that they move away upon pushing it. The zoom feature is particularly important because Experiment 2 by Rinck and Becker (2007) revealed that a fixed-size version of the AAT is open to cognitive re-interpretation of arm movements with reference to the stimuli versus to the body, which could lead to opposing effects. For this reason, the zoom feature was developed by the authors and tested in Experiments 3 and 4. Their results suggest that the zoom version of the AAT is resistant against cognitive re-interpretations of arm movements: pushing and pulling clearly mean avoidance and approach, respectively. Using this improved AAT, Rinck and Becker (2007) found a behavioral avoidance tendency in people afraid of spiders. Compared with NACs, they responded more quickly to spider pictures by pushing them away than by pulling them closer.

Following Rinck and Becker (2007) and Marsh et al. (2005), we chose to use the AAT in order to investigate HSAs' behavioral tendencies of approach and avoidance. In the experiment reported below, participants (HSAs and NACs) responded to pictures of emotional facial expressions (angry, neutral, or smiling) or to control pictures (puzzles) by pulling a joystick towards themselves (approach) or by pushing it away from themselves (avoidance). Upon pulling or pushing, the faces grew or shrank in size, respectively. When the joystick was moved all the way into one or the other direction, the picture disappeared from the screen, the response time was recorded, and the next picture was presented. In this task, the effects of facial expressions on approach and avoidance behavior were measured indirectly because the participants did not push or pull the joystick based on the depicted emotion. Instead, they responded to a different dimension by pulling all faces and pushing all puzzles (or vice versa), with no reference to emotional expressions at all. Because of this indirect measurement, the task should be more appropriate for measuring automatic behavioral responses than direct measures.

In order to assess whether the behavioral responses observed in the AAT were associated with explicit evaluations of the emotional faces, we also asked the participants to rate the emotional valence of each picture presented during the AAT. Studies that examined explicit evaluative biases in social anxiety indicate that social phobia is not characterized by such a bias for non-verbal social information, that is, facial expressions (Merckelbach, van den Hout, van den Hout, & Mersch, 1989). Consequently, we hypothesized that HSAs and NACs would not differ in their direct valence ratings: both groups should evaluate angry faces as unpleasant, neutral ones as neutral, and smiling ones as pleasant.

Regarding the response times in the AAT, however, the two groups were expected to differ. Following Marsh et al. (2005), we predicted an evolutionary-based avoidance tendency for angry faces in both groups, reflected by faster pushing than pulling by HSAs and NACs. Presumably, this RT difference should be stronger in HSAs, given that angry faces are more threatening to them. For smiling faces, there are two conceivable results. First, one might expect an approach tendency in both groups, because smiling faces are a signal of social acceptance and successful interaction. Contradictory to this expectation, however, smiling faces usually announce the initiation of an interaction, which is a threatening situation that socially anxious individuals try to avoid (Rapee & Heimberg, 1997). Consequently, it might be easier for them to push smiling faces away than to pull them closer.

The latter prediction implies a discrepancy between direct and indirect measures: HSAs should give positive ratings of smiling faces, whereas their AAT effects should be negative (i.e., faster pushing than pulling). In clinical populations such as HSAs, previous research has not yet addressed the possible discrepancy of more controlled versus more automatic aspects of behavior. Finally, neutral faces and control stimuli should be of no affective valence for NACs, reflected by pull–push differences close to zero. As these stimuli contain no emotionally relevant information, the same expectation holds for HSAs.

Methods

Participants

Forty-three HSAs and 43 NACs were tested, all of them psychology students at Dresden University of Technology. First, potential participants were selected on the basis of their anxiety scores on the Liebowitz Social Anxiety Scale, German version (LSAS-A; Liebowitz, 1987; Stangier & Heidenreich, in press) from a sample of altogether 350 students. The LSAS was found to be to be a reliable, valid measure of SAD (Heimberg et al., 1999). Cut-off scores were chosen such that potential participants belonged to the highest or lowest 10% of the distribution (LSAS-A >27 for HSAs and LSAS-A <13 for NACs). Mean LSAS-A scores were 37.8 ($SD = 8.3$) for HSAs and 5.8 (SD 3.7) for NACs. Total LSAS scores (LSAS-T) for HSAs averaged 69.3 ($SD = 16.7$). Subsequently, 44 potential NACs and 48 potential HSAs were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994) by trained, experienced interviewers using the "International Diagnosis-Checklists for DSM-IV", German version (IDCL, Hiller, Zaudig, & Mombour, 1997). The IDCL for DSM-IV has demonstrated good reliability for the majority of the disorders covered by the checklists (Hiller et al., 1997). Participants were included in the HSA group if they met the DSM-IV criteria for SAD, except that they did not have to suffer from significant impairment. This was true for 33 individuals of the HSA group, while 10 members of the HSA group met all criteria of SAD. Exclusion criteria were affective disorders, posttraumatic stress disorder, generalized anxiety disorder, psychotic symptoms, and substance-related disorders. Three potential participants were excluded

Table 1
Mean questionnaire scores of the participant groups (means, standard deviations, and *t*-tests)

	HSAs	NACs	Significance of *t*-test (df = 84)
LSAS	33.8 (8.7)	7.1 (4.6)	$p<.001$
FDD	9.4 (6.1)	3.5 (3.4)	$p<.001$
STAI-T	44.4 (10.3)	31.6 (6.5)	$p<.001$
STAI-S pre	39.7 (8.5)	33.7 (5.0)	$p<.001$
STAI-S post	39.5 (7.0)	37.0 (7.5)	n.s.

because they did not fully meet the criteria for the HAS group. Additionally, we had to exclude two high socially anxious students because of a current major depression. The NAC group consisted of individuals without diagnosis of SAD or any of the exclusion diagnoses. We had to exclude one potential participant from the NAC group because of continuous substance abuse. At the time of the interview, none of the participants had sought treatment. The two experimental groups were comparable with regard to gender (HSAs: 7 male, 36 female; NACs: 13 male, 30 female) and age (HSAs: mean 22.6, SD 2.1; NACs: mean 22.4, SD 3.7). Participants were informed of their rights as experimental participants and gave their consent. They received course credit or a modest fee for participating.

Participants completed the German FDD-DSM-IV inventory (Kühner, 1997), which is a translation of the "Inventory to Diagnose Depression" (Zimmerman, Coryell, Wilson, & Corenthal, 1986), an 18-item, self-report measure of the severity of depressive symptoms. The acceptable reliability and validity of the FDD have been well documented (Kühner & Viel, 1993). Finally, participants completed the German STAI-Trait questionnaire before the AAT (Laux, Glanzmann, Schaffner, & Spielberger, 1981), and the STAI-State questionnaire (Laux et al., 1981) both before and after the AAT (measures STAI-S pre and post in Table 1).

Table 1 shows the groups' mean questionnaire scores. The HSAs scored significantly higher than the NACs not only on the LSAS but also on the STAI-Trait and on the pre-AAT measures of the STAI-State, indicating social anxiety and a higher level of state and trait anxiety in the socially anxious participants. No post-AAT differences in the STAI-S were found. The difference in FDD was also statistically significant, but of little practical relevance because for both groups, the mean scores were in the low-to-normal range.

Materials and apparatus

Twenty-seven pictures showing angry, smiling, and neutral facial expressions were selected after extensive pre-testing. All pictures were judged to be easily perceivable (mean ratings of at least 3 on a 5-point rating scale ranging from 1 to 5) by a sample of 37 different participants. Moreover, on a scale ranging from -2 to $+2$, the angry facial pictures were rated to be clearly unpleasant (mean = -1.18, SD = .65), the neutral faces were judged to appear neutral (mean = .01, SD = .72), and the smiling facial pictures were rated to be clearly pleasant (mean = 1.92, SD = .34). Photographs had been taken of 9 different professional drama students (4 men and 5 women, aged 23–28), with each individual expressing each facial affect. Additionally, 9 puzzle pictures of neutral valence, which were of the same gray-scale and size as the face pictures, were used as control stimuli. Pictures were black-and-white photographs, sized 8.4×13.5 cm.

Procedure

Participants were informed that single pictures of faces or puzzles would be presented to them on the computer screen in random order. Their task was to respond to every picture by moving a joystick attached to the computer, either by pushing it away from themselves or by pulling it towards themselves with their dominant hand. The joystick was positioned between the participant and the screen, and the participant was seated in front of the joystick at a distance which ensured that the joystick motions were indeed directed towards the body or away from it. For each participant, the AAT consisted of 2 conditions, presented in 2 separate blocks of the experiment. In the Approach condition, participants pulled the joystick towards themselves as quickly as possible whenever a picture of a face appeared on the screen, independently of the expression shown. For all puzzle pictures, participants pushed the joystick away from themselves as quickly as possible. In the Avoidance condition, instructions were reversed: participants pushed in response to all facial pictures and pulled in response to the puzzles. The order of blocks was counterbalanced across participants, and they received a short break between blocks. In total, each participant completed 144 trials (18 practice trials and 54 experimental trials per block). Facial expressions and puzzles were presented in the same pseudo-random order to all participants, with the restriction that no more than 3 pictures of the same type were presented successively.

Each trial was initiated by the participant: as soon as the joystick was positioned in the central upright position and the participant pressed the start key located near the top of the joystick, a picture of medium size appeared on the screen. The participant then had to decide whether the picture showed a face or a puzzle, and then pull or push the joystick accordingly. Upon movement of the joystick, the picture changed in size, such that it grew upon pulling and shrank upon pushing, creating the visual impression that the picture itself is being pulled closer (approach) or pushed away (avoidance). The picture disappeared as soon as the joystick was moved by approximately 30° in one or the other direction. This was close to the maximum possible movement that the joystick allowed (approx. 32°). The picture disappeared irrespective of whether the joystick was moved in the correct or wrong direction. Joystick motions to the left or right did not cause the pictures to disappear. The computer automatically recorded the time from appearance of the picture to its disappearance. The AAT lasted for approximately 10 min. After the AAT, participants evaluated every facial picture by rating its emotional valence on a 5-point scale ranging from 'very unpleasant' (−2) to 'very pleasant' (+2). Finally, participants were debriefed and reimbursed for their participation.

Design

A full combination of the between-subjects factor 'participant group' (HSAs, NACs) with the two within-subject factors 'picture type' (angry, neutral, smiling, puzzle) and response direction (pull, push) resulted in a $2 \times 4 \times 2$ factorial design. Please note that emotional valence of the facial expressions is critical in this analysis, but irrelevant to the participants' response. According to the instructions, they should ignore facial expressions and react to all faces in the same way. Thus, differences between expressions were measured indirectly. Reaction times (RTs) of correct responses were used as the dependent variable. Median RTs were determined for each participant for each of the 8 combinations of picture type and response direction. In addition, AAT effect scores were computed from these RTs by subtracting each participant's median RT in the pull condition from the median RT in the corresponding push condition (angry-push minus angry-pull, neutral-push minus neutral-pull, smiling-push minus smiling-pull, puzzle-push minus puzzle-pull). The resulting AAT scores reflect the relative direction of the response tendency: negative values indicate stronger avoidance than approach, and positive values vice versa.

Results

Approach– Avoidance Task

Due to the ease of the task, the error rates were uniformly low, averaging less than 2%. No differences between groups or conditions were observed for error rates. Therefore, only RTs of correct responses are reported here (see Table 2 for mean RTs). The median RTs were normally distributed (Kolmogorov–Smirnov $Z = 1.19$, $p = .12$). The $2 \times 4 \times 2$ ANOVA of these RTs revealed a marginally significant main effect of picture type ($F(3,252) = 2.52$; $p = .06$; $\eta^2 = .029$), resulting from participants' faster responses to the emotional faces (angry and smiling) compared with neutral faces. The overall difference in response speed between HSAs and NACs was marginally significant ($F(1,84) = 3.77$; $p = .06$; $\eta^2 = .04$), resulting from generally slower response times in HSAs compared with NACs. There was a highly significant effect of response direction ($F(1,84) = 6.84$; $p = .01$; $\eta^2 = .08$), because participants responded more quickly by pushing than by pulling.

Most importantly, the predicted 3-way interaction of group, picture type, and response direction was significant ($F(3,252) = 2.74$; $p = .04$; $\eta^2 = .03$). To explore this interaction in more detail, each facial

Table 2
Mean manual reaction times in ms (with standard deviations) depending on group, picture type, and response direction

Measure	Picture type			
	Angry	Neutral	Smiling	Puzzle
High socially anxious (HSAs)				
Push	598 (70)	621(95)	599 (84)	627 (75)
Pull	639 (98)	630 (83)	636 (86)	616 (74)
Non-anxious controls (NACs)				
Push	581 (72)	596 (80)	588 (75)	590 (83)
Pull	590 (82)	598 (96)	591 (93)	599 (66)

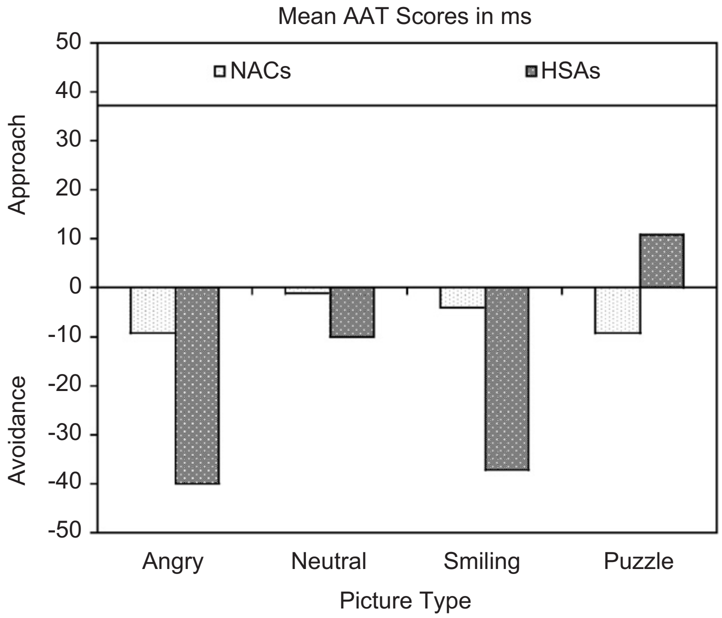


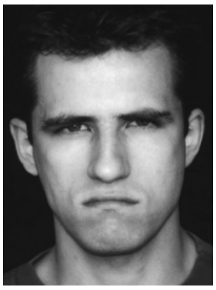
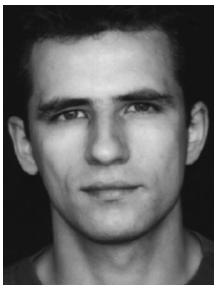
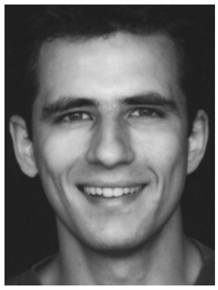
Fig. 1. Mean AAT effects depending on group and picture type.

expression was compared with the control pictures separately. For angry faces, the expected interaction of group, picture type, and response direction was observed ($F(1,84) = 5.4$; $p = .02$; $\eta^2 = .06$). As is apparent in Fig. 1, it was due to the fact that SAs responded more quickly to angry pictures by pushing than by pulling, yielding a significantly negative AAT score of -41 ms ($t(42) = 3.3$, $p = .002$), whereas NACs did not show a significant difference (–9 ms; n.s.). A similar 3-way interaction was found for smiling faces ($F(1,84) = 6.2$; $p = .02$; $\eta^2 = .07$), with a significantly negative AAT score for HSAs (-37 ms; $t(42) = 3.3$, $p = .002$), but not for NACs (–4 ms; n.s.). For neutral pictures and puzzles, the AAT scores of the two groups did not differ from each other, and neither score differed from zero. To summarize, HSAs showed avoidance tendencies in response to angry and smiling faces, and NACs did not show any tendencies.

Valence ratings

The participants' valence ratings of the facial expressions (see Table 3) were analyzed in the same way as the AAT scores. As expected, the main effect of facial expression was highly significant $F(2,164) = 713.3$; $p = .00$; $\eta^2 = .89$), indicating that smiling faces were evaluated more positively than neutral ones, which in turn were

Table 3
Picture materials: valence ratings

	Angry	Neutral	Smiling
			
Valence	High socially anxious (SAs)		
(−2 to +2) Mean SD	−1.16 (.28)	−0.17 (.29)	1.66 (.39)
	Non-anxious controls (NACs)		
(−2 to +2) Mean SD	−1.03 (.51)	−0.21 (.25)	1.57 (.69)

evaluated more positively than angry ones. In contrast to the AAT effects, neither an interaction of group and facial expression ($F(2,164) = 1.2$; $p = .51$) nor an overall difference between HSAs and NACs was observed ($F(1,82) < 1$): HSAs and NACs rated the facial expressions very similarly.

Discussion

The current study provided a first application of the Approach–Avoidance Task (AAT) to the measurement of avoidance tendencies in social anxiety. Socially anxious individuals have a strong wish to perform socially adequate and to convey a favorable impression to their conversational partner, but at the same time they are insecure of their ability to do so. Consequently, non-verbal feedback such as facial expressions is particularly important to them. Avoidance of the feared situation is a common coping strategy, as it reduces the threat for socially anxious individuals. Nevertheless, avoidance is highly problematic for social phobics, because complete avoidance of social situations is very difficult to realize. Thus, socially anxious individuals often do not completely avoid feared situations, but have to engage in social interactions that they find distressing. The critical question we investigated here is if and how this in-situation avoidance also takes place at a more automatic level of behavior. To measure HSAs' spontaneous avoidance tendencies in reaction to different facial expressions, we employed an AAT.

As expected from previous work on approach and avoidance of emotional faces (Marsh et al., 2005), socially anxious individuals pushed angry faces away more quickly than pulling them closer. This finding is consistent with the notion that angry faces signal potential threat and activate avoidance mechanisms (Lang et al., 1997), which should be particularly evident in HSAs because of their concern of being disliked and rejected. Evolutionary models of anxiety stress the importance of HSAs being especially vigilant for signals of dominance, and consequently reacting with submissive behavior, particularly gaze aversion (Öhman, 1986). Especially angry facial expressions (wide open, staring eyes) and rapid approach of the counterpart work as signs of social dominance, which control responses of sympathetic activation and avoidance in HSAs.

Furthermore, our results showed that in HSAs, a strong avoidance tendency was also evident for smiling faces, reflected by faster pushing than pulling of them. Interpreting this result from the viewpoint of the evolutionary model discussed above, socially anxious individuals may generally react submissively in social situations because of unconditional negative beliefs they hold about themselves, e.g., "I'm different" or "I'm unacceptable" (Clark & Wells, 1995). Assuming their own inferiority, they might also interpret smiling people who approach them as socially dominant.

Darwin (1872, p. 347) initially suggested that enhanced self-consciousness can trigger habitual avoidance in response to positive as well as negative social cues. This should especially be the case in socially anxious individuals who, confronted with a social situation, already shift their focus of attention to detailed monitoring and observation of themselves (Clark & Wells, 1995). Accordingly, Mansell et al. (1999) provided empirical evidence for attentional biases away from angry and smiling faces in HSAs. To a socially anxious individual, even a friendly smile, intended to convey acceptance and encouragement, may be associated with threat and will therefore be avoided, both at the spontaneous, automatic level studied here and at a more controlled level in everyday interactions.

For neutral faces and puzzles, we found neither approach nor avoidance tendencies in HSAs. This is in contrast to a study which suggests that neutral faces might be ambiguous stimuli for the socially anxious: Cooney, Atlas, Joormann, Eugène, and Gotlib (2006) investigated the neurobiological basis of the processing of social stimuli in SAD, and their results suggest that neutral faces may also elicit emotional processing reflected by amygdala activation. Nevertheless, in the present study, AAT response times clearly indicated that pulling faces closer was not generally aversive. Instead, this effect seems to be limited to smiling and angry faces. Future studies will have to show whether similar effects can be observed for other emotional facial expressions such as disgust or fear. In sum, the present results indicate that the emotional facial stimuli presented here are more threatening to HSAs than to NACs, regardless of the specific expression (angry or smiling).

Interestingly, we found neither approach nor avoidance tendencies in NACs, although one might have expected an evolutionary-based avoidance tendency for angry faces (Marsh et al., 2005), and possibly an approach tendency for smiling faces. However, two important methodological differences make it difficult to compare our AAT results with those of Marsh et al. (2005). First, Marsh et al. (2005) tested an unselected sample of students, whereas our group of NACs represents the lowest 10% of the social anxiety distribution, who do not seem to react easily to social cues. Second and most notably, in the experiment by Marsh et al. (2005), valence and task dimension were identical because participants pushed or pulled the joystick in response to facial affect. This way, behavioral tendencies were measured directly. In contrast, the aim of our study was to measure behavioral tendencies concerning emotional facial expressions in a completely indirect way to identify the more automatic aspects of safety behavior. The task was to ignore the valence and to respond to every face in the same way. Following the instructions perfectly, NACs were able to ignore the task-irrelevant dimension of face valence, and they easily responded to the task-relevant dimension, the decision whether a face or a puzzle was shown. Consequently, they did not show any push–pull differences for different types of faces. In contrast, the HSA group showed avoidance tendencies that were specific to emotional faces (angry and smiling) and did not occur for neutral faces. In contrast to NACs, HSAs were unable to ignore the valence of the facial expressions, even though it was absolutely irrelevant to the task. Consequently, they showed reaction time differences for pushing versus pulling of smiling and angry faces.

Because stimulus valence is supposed to underlie approach and avoidance behavior (Lang et al., 1997), we assessed valence ratings for all facial expressions subsequently to the AAT. Despite the differences found in reaction times, HSAs and NACs rated the facial expressions very similarly, in accord with former studies indicating that social phobia is not characterized by an explicit evaluative bias for non-verbal social information (Douilliez & Philippot, 2003; Merckelbach et al., 1989). In both studies, no differences between HSAs and NACs were observed for the evaluation of angry, neutral, and joyful faces. Philippot and Douilliez (2005) also failed to find an explicit bias for the decoding of emotional facial expressions in social phobia out-patients. The authors suggested that social phobia is not characterized by an explicit evaluative bias for non-verbal social information. Using a different procedure, however, Winton, Clark, and Edelmann (1995) could show that in socially anxious participants, a negative evaluation bias for negative and neutral facial expressions occurred when a short presentation time of 60 ms was used.

Philippot and Douilliez (2005) concluded that the inconsistent results are due to the nature of biases measured. They assume that automatic evaluative biases are more likely in social anxiety than explicit biases. This view corresponds with Mogg and Bradley (1998) who assume a valence evaluation system, which automatically assesses the threat value of stimuli on the basis of personal concerns (e.g., fear of negative evaluation), rather than based on explicit stimulus valence. Accordingly, the present study revealed a discrepancy between the HSAs' AAT effects for smiling faces on the one hand and the explicit evaluations of these faces on the other hand: Although the HSAs' valence ratings were positive and almost identical to those of the NACs, they showed a clear avoidance tendency rather than approach. This discrepancy may be attributed to differences in processing: reaction time paradigms like the AAT are considered to measure more automatic processes, whereas explicit evaluations are more strategic.

Thus, indirect measures such as the AAT might contribute to the distinction between more automatic versus more controlled processes, which is central to several different theories of anxiety (e.g., Drobes & Lang, 1995; Mathews & Mackintosh, 1998; Öhman, 1993; Williams, Watts, MacLeod, & Mathews, 1997). For this reason, indirect reaction time tasks such as the AAT may be valuable additions to direct measures like self-reports. Moreover, compared with other indirect measures, the AAT may have specific advantages because it measures behavioral avoidance tendencies caused by threat, rather than more semantic aspects of threat representations.

The implementation of indirect reaction time tasks like the AAT in future research may also contribute to the clarification of therapeutic issues concerning social phobia. In their review of the treatment of SAD, Rodebaugh, Holaway, and Heimberg (2004) assume that there is a lack of knowledge regarding effectiveness of different treatments. For instance, it is not fully understood which treatment works best for whom, and why. Therefore, the AAT may prove to be a valuable instrument to assess the nature of in-situational safety strategies in more detail to possibly identify subgroups of patients and improve the treatment focusing on in-situation avoidance behavior.

Given the promising results reported in the present study, it seems worthwhile to explore further extensions and applications of the AAT to avoidance tendencies of socially anxious individuals. First, it would be important to evaluate the specificity of the observed effects. Is avoidance of angry and smiling faces unique to the socially anxious, or can it be found in other groups of anxiety disorders as well? Is avoidance limited to angry and smiling faces, or does it extend to other emotional faces showing, for instance, disgust or fear? And is avoidance in social anxiety specific to emotional facial expressions? Or does it generalize to other kinds of potentially threatening stimuli? Second, further studies should examine whether socially anxious individuals show similar in-situation avoidance patterns while engaging in social interactions.

In sum, additional research is needed to establish the usefulness of the AAT as a measure of affective behavioral reactions to potential threat in social anxiety. At this point, it can be regarded as a promising task for the indirect measurement of in-situation avoidance tendencies. These cannot be assessed directly, but are supposed to affect the processing of potentially threatening information. In the future, the AAT may prove to be a valuable instrument not only to illuminate the maintenance of social anxiety disorder, but also to contribute directly to the development of effective treatments for this frequent and serious condition.

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