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Fear of negative and positive evaluation and reactivity to social-evaluative videos in social anxiety disorder

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A R T I C L E I N F O

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A B S T R A C T

Social anxiety disorder (SAD) is marked by persistent fear of being scrutinized by others. This and most diagnostic symptoms relate to some form of fear of negative evaluation (FNE). More recent accounts of SAD, such as the *Bivalent Fear of Evaluation Model*, however, complement FNE with fear of positive evaluation (FPE), described as distress and avoidance of positive feedback. An explicit test of the incremental validity of FPE in discriminating SAD patients from controls – over and on top of the explanatory power of FPE – is currently missing and generally, well controlled laboratory experiments with positive and negative social stimuli in this patient group are rare.

To fill this gap, we exposed 35 patients with SAD and healthy controls (HCs) to short social-evaluative video clips with actors expressing negative and positive as well as neutral statements while recording reactivity on experiential measures (valence, arousal, and approval ratings) as well as on facial electromyography and electrocardiography. In addition, participants completed questionnaire measures of FNE and FPE.

Results revealed that FPE questionnaire scores as well as experiential (valence and appreciation) and electromyographical reactivity measures to positive videos improved prediction of group membership beyond the predictive power of FNE questionnaires scores and reactivity to negative videos.

Results document the importance of FPE to more fully characterize and understand social anxiety and SAD. Implications include amendments to future diagnostic criteria, theoretical models, and treatment approaches for SAD.

1. Introduction

Being inherently social beings, humans depend and thrive on a network of approving and supportive social relationships. It is thus unsurprising that negative evaluations represent a threat to this basic affiliative nature. Research has shown that being socially accepted or rejected substantially impacts several aspects of well-being such as physical, emotional, and cognitive functioning (for an overview see Baumeister, DeWall, Ciarocco, & Twenge, 2005). A particular vulnerability to negative evaluations characterizes individuals with social anxiety disorder (SAD), being defined by a marked and persistent fear and avoidance of social situations that pertain the risk of being scrutinized negatively by others' (DSM-5; American Psychiatric Association, 2013). Hence, this fear of negative evaluation (FNE) is a core diagnostic criterion of SAD and acknowledged in theoretical models of SAD (e.g., Heimberg, Brozovich, & Rapee, 2010). Because SAD is one of the most common anxiety disorders with a reported lifetime prevalence of approximately 10–15% in the general population (e.g., Bandelow & Michaelis, 2015; Kessler, Ruscio, Shear, & Wittchen, 2010) and a high comorbidity of other anxiety disorders, mood disorders, and substance use disorders (Chartier, Walker, & Stein, 2003; Koyuncu et al., 2014), treatment innovation that is grounded in theoretical conceptualizations is imperative.

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1.1. Two types of evaluation fears and the bivalent fear of evaluation model: claim and challenges

Somewhat counterintuitively, also positive evaluations may be threatening for some individuals and particularly so for individuals with SAD. In 2008, Weeks and colleagues proposed the concept of fear of positive evaluation (FPE), describing distress by and avoidance of favorable evaluations by others (Weeks, Heimberg, & Rodebaugh, 2008). The psycho-evolutionary model of Gilbert (2001) provides a framework to understand FPE: In addition to fear of negative evaluation (FNE), signifying a symbolic decrease in social rank in hierarchically organized groups, positive evaluation can represent a symbolic rise in social rank, which may lead to conflict with dominant, higher ranked individuals (for an overview see Weeks & Howell, 2014,).

Grounded on this general reasoning, FPE (alongside FNE) has been incorporated in the 'Bivalent Fear of Evaluation Model' (BFoEM; Weeks & Howell, 2012). Accordingly, individuals fear evaluations of both valences, negative and positive, albeit for different reasons: social exclusion is assumed to drive FNE, while potential negative consequences of social rise (e.g., rank-conflict) may fuel FPE. Yet, this theoretical account requires empirical proof and the 'new' component FPE needs to demonstrate independence relative to FNE and incremental validity to gain clinical relevance. This so called *distinct account* underlying the BFoEM proposes an independent role for FPE over and above of the role of FNE. The distinct account has been challenged, among others, by the *anticipation account,* postulating that positive evaluations for good performance on some valued dimension may raise the performance standards and associated social expectations. Such higher standards, in turn, might pave the way for future failure, triggering anticipatory FNE.

Initial evidence seem to be more in line with the distinct account: despite significant variance overlap of psychometric measures of FNE and FPE they each show unique and distinct associations with social anxiety symptoms (e.g., Fergus et al., 2009; Reichenberger, Wiggert, Wilhelm, Weeks, & Blechert, 2015; Rodebaugh, Weeks, Gordon, Langer, & Heimberg, 2012; Weeks, Jakatdar, & Heimberg, 2010). Inspired by the BFoEM several psychometric studies documented its independent association with SAD related symptoms (cross-sectionally; e.g., Reichenberger et al., 2015) and symptom changes (longitudinally; e.g., Rodebaugh et al., 2012). However, laboratory evidence for such incremental validity of FPE (on top of FNE) in discriminating high social anxiety from low social anxiety and healthy from clinically relevant forms of SAD is scarce, which is unfortunate because experimental control affords high internal validity. Thus, laboratory evidence would be necessary to complement questionnaire research and strengthen the empirical basis of the BFoEM. Laboratory implementations of FPE (alongside FNE) in clinically diagnosed SAD patients could further strengthen the evidence in support of a role of FPE in SAD theories and diagnostic nosology.

1.2. Laboratory implementations of FNE and FPE: reactivity to positive and negative social cues and their role in social anxiety

In the context of the BFoEM and experimental, laboratory based research, studies using explicitly positive and negative social-evaluative stimuli and thus stimuli that can trigger both types of evaluation fears are of relevance. The majority of laboratory studies utilized static facial expressions, affording high experimental control and internal validity but with limited external validity for representing the typically more complex social encounters in daily life. Evidence for altered reactivity to threatening faces on a broad range of perceptual processes in individuals with elevated as well as clinical social anxiety seems to be relatively robust, as reviewed by Staugaard (2010). Less frequently and consistently, altered reactivity to positive facial expression has been reported in subclinical social anxiety and SAD (e.g. in photograph ratings, Campbell et al., 2009; or in ERPs to faces, Felmingham, Stewart, Kemp, & Carr, 2016; Kolassa et al., 2009; Kolassa, Kolassa, Musial, & Miltner, 2007; Kolassa & Miltner, 2006; Rossignol, Campanella, Bissot, & Philippot, 2013). Static images, however, are limited in representing social interactions (as opposed to signaling emotional state of the poser of the expression) or even evaluations of the observer and thus more dynamic social stimuli such as computer-generated or video-animated face presentations came into use. Individuals with subjective elevated scores on a questionnaire measure of FNE did in fact show hyperreactivity in emotional experience and psychophysiology measures to such negative but also positive face stimuli (Mühlberger, Wieser, & Pauli, 2008; Wieser, Pauli, Weyers, Alpers, & Mühlberger, 2009). Our group further increased external validity of stimuli by generating naturalistic videos displaying actors who state positive and negative evaluations (Blechert, Schwitalla, & Wilhelm, 2013). We and others were able to demonstrate in healthy participants selective and unique associations of responses to negative videos with a questionnaire measuring FNE and of responses to positive videos with a questionnaire measuring FPE (Reichenberger et al., 2015; Weeks, Howell, & Goldin, 2013). This stimulus set and validated questionnaire measures of FNE and FPE allows for the examination of FNE and FPE in social anxiety. Thus, although both valence domains – negative and positive – are important, a theoretically interesting question is whether both are equally relevant to predict SAD or if they explain unique variances.

1.3. The present study

The present study aimed at determining the role of the relatively new construct FPE for SAD. Under the general rule of parsimony, new factors in theorizing should only be introduced when adding new information and thus providing incremental validity. Thus, we recruited SAD patients and controls to evaluate whether measures of FPE provide additional diagnostic discrimination after accounting for FNE. Data were derived from two types of implementations of the theoretical constructs of FPE and FNE: once via validated psychometric questionnaires and second behaviorally, by measuring reactivity to naturalistic yet controlled videographic stimuli presented in the laboratory. The latter responses were obtained on self-reported (subjective) and multi-channel psychophysiological measures since evidence suggests that particularly the latter variables can uncover emotional processes that might otherwise be overlooked: an evolutionary notion implies that survival depends on adaptive responses to social threat, and thus the peripheral nervous systems should respond to signs of positive and negative social evaluation. Previous research on heart rate (HR) responses to social cue question the differential reactivity of individuals with versus without SAD (Staugaard, 2010). Still, reactions to social stimuli (especially faces) may manifest in *facial mimicry* (i.e., imitating facial expressions of others; Hess & Fischer, 2013 for review), controlled largely by the zygomaticus major muscle (responsible for smiling in response to happy faces) and the corrugator supercilii muscle (responsible for frowning in response to threatening faces; Dimberg, 1990). Thus, both muscles respond in a valence specific manner and might be useful in the present context.

According to most of the literature reviewed above, we assumed that measures of FNE would be elevated in SAD relative to controls and thus discriminate groups reliably. In addition, and based on the BFoEM, we tested whether measures of FPE would further increase such group separation accuracy and thus explain independent variance in social anxiety symptomatology. Such evidence would have implications for theorizing, nosology, and potentially also for treatment in SAD.

2. Method

2.1. Participants

Thirty-five patients with SAD (23 female) were recruited at the psychosomatic hospital "Schön Klinik Roseneck" in Prien am Chiemsee (Germany). Thirty-five healthy controls (HC; 23 females) were

Table 1
Summary of means (*M*), standard deviations (*SD*), and parametric test statistics of group characteristics.

	SAD (N = 35)		HC (N = 35)		test statistic	p (2-sided)
	M	*SD*	*M*	*SD*		
Age (years)	24.86	8.05	23.77	4.95	t (56.54) = 0.68	0.499
Education (years)	13.53	3.96	14.99	3.11	t (67) = 1.70	0.094
SIAS	30.74	9.65	8.35	5.24	t (50.91) = 11.89	< 0.001
SASKO (speech and attention anxiety)	24.54	6.36	8.43	4.30	t (68) = 12.42	< 0.001
SASKO (fear of rejection)	20.43	4.67	6.40	3.46	t (68) = 14.28	< 0.001
FNE-K	49.11	8.06	28.37	10.21	t (68) = 9.44	< 0.001
FPES	38.86	15.54	12.66	11.17	t (61.75) = 8.10	< 0.001

Note. SIAS: Social Anxiety Interaction Scale; SASKO: Social Anxiety and Social Competence Deficits Questionnaire; FNE-K: German version of the Brief Fear of Negative Evaluation Scale; FPES: German version of the Fear of Positive Evaluation Scale.

recruited via flyers, university mailing lists, and online advertisement. Groups were balanced on the group level for gender, age, and years of education (see Table 1). Participants were tested at two different sites: (1) University of Salzburg: Clinical Stress and Emotion Laboratory (HC: N = 26) and (2) Psychosomatic hospital in Prien (HC: N = 9; SAD: N = 35) with an identical testing setup.[2] After an initial screening to assess study requirements, both patients and controls were invited for the first session (i.e., diagnostic session) using the structured clinical diagnostic interview for DSM-IV-TR Axis I disorders “Diagnostisches Interview bei Psychischen Störungen” (DIPS, engl. Diagnostic Interview of Mental Disorders, Margraf & Schneider, 2011), an adapted German version of the Anxiety Disorders Interview Schedule for DSM-IV-TR (DiNardo & Barlow, 1988).[3] All patients met DSM-IV-TR criteria for current SAD and reported anxiety in M = 14.00, SD = 2.00 situations. Comorbid disorders of the SAD group were major depression (N = 16), eating disorders (N=9), other anxiety disorders (N = 17), dysthymia (N = 2), hypochondria (N = 1), somatic symptom disorder (N = 3), borderline personality disorder (N = 2), i.e., comorbidities typically seen in this disorder (e.g., Kessler et al., 2010). Exclusion criteria for the SAD group were current and lifetime psychotic, bipolar, or neurological disorders and for the HC group current and past mental or neurological disorders. Psychometric questionnaires (see below) were filled out on paper between diagnostic and laboratory sessions.

The experimental protocol was approved by the ethics committee of the University of Salzburg. Prior to study participation all participants read and signed an informed consent form and after study completion received financial incentives (30 Euro).

2.2. Questionnaires

Symptom severity for SAD was assessed with the German version (Stangier, Heidenreich, Berardi, Golbs, & Hoyer, 1999; Cronbach's alpha = .94) of the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). This instrument comprised 20 items on a 4-point Likert-type scale. Additionally, general level of social anxiety was assessed with the German Social Anxiety and Social Competence Deficits Questionnaire (SASKO; Kolbeck & Maβ, 2009), more specifically with the subscales ‘speech anxiety and fear of being in the focus of attention’ and ‘fear of rejection’. This instrument entails 44 items subsumed on five subscales, rated on a four-point Likert-type scale. Furthermore, participants completed German versions of the Beck Depression Inventory (BDI-II; Beck, Steer, Ball, & Ranieri, 1996; Hautzinger, Keller, & Kühner, 2006). Fear of negative evaluation was assessed with the German version (Reichenberger et al., 2016) of the Brief Fear of Negative Evaluation Scale – Revised (Carleton, McCreary, Norton, & Asmundson, 2006) and fear of positive evaluation with the German version (Schwarz et al., 2016) of the Fear of Positive Evaluation Scale (Weeks et al., 2008).

2.3. Video set and condition assignment

The current study used 96 (32 negative, 32 positive, 32 neutral) videos of 12 different actors (6 female) from E.Vids (Blechert et al., 2013). Videos were 3000 ms each, followed by intertrial intervals randomly varying between 2400 and 3600 ms (see Fig. 1). In the present task, actors were always presented within one emotion condition (negative, neutral, or positive) only for a given participant. Across participants, however, each actor occurred in each condition with equal probability. In addition, the sentences spoken by a given actor within one condition varied for a given participant (e.g., actor A delivered 8 different negative sentences, actor B delivered 8 different positive sentences). Each participant viewed an equal number of videos from each gender (i.e., 48 videos from male actors). Videos comprised sentences like e.g., “You are so stupid!” in the negative, “It's 4 o'clock.” in the neutral and “One can really count on you!” in the positive condition.

2.4. Procedure

The second session (laboratory: hospital or university) started with sensor application for psychophysiological measurements. Prior to the video-viewing/rating task (Vid-task), participants completed a picture-viewing/rating task (Pic-task) with objects of household and office items which served as a non-social reference for neutral videos (not of interest for the current study). At the end of the Pic-task, participants completed a quiet sitting baseline and a heartbeat perception task (results not reported here). Instructions for the Vid-task were displayed on the computer screen for standardization. Additionally, the Vid-task started with practice trials for rehearsal and to clarify any questions. The objects and videos were presented via E-Prime 2.0 Professional (Psychology Software Tools, Inc., Sharpsburg, PA, USA) on a 15.6-inch notebook monitor (FUJITSU Lifebook AH 502) with a resolution of 1366 × 768 pixel and 60 Hz refresh rate. Videos lasted 3000 ms each followed by intertrial intervals randomly varying between 2400 and 3600 ms (see Fig. 1). After each video, participants were asked “How did you feel while watching this video?” and to rate unpleasantness, arousal and approval (0 = pleasant/calm/approved to 100 = unpleasant/aroused/disapproved; see Fig. 1) via an on-screen visual analogue scale. Subjective ratings were averaged separately across negative, neutral and positive videos. After completion of all tasks and sensor removal, participants completed questionnaires and were debriefed and compensated for participation.

[2] No differences between testing sites have been found on any of the dependent variables in the HC group.

[3] No German adaptation of the DIPS for DSM-5 was available during data collection.

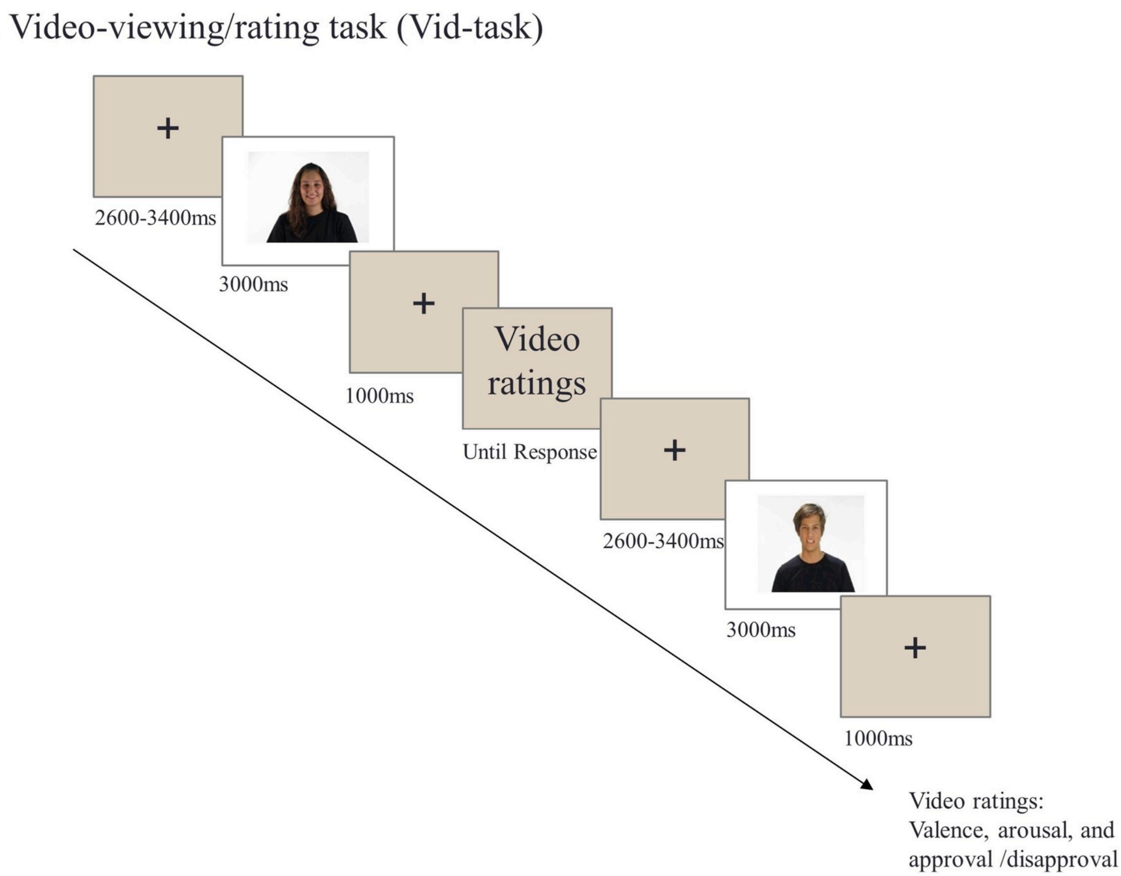

Fig. 1. Illustration of the experimental video-viewing/rating task (Vid-task), including ratings of valence, arousal and approval/disapproval.

2.5. Psychophysiological measures: recording, offline data analysis, and response definition

The 32 channel portable physiological measurement system (Porti, TMSi, Twente, NL) with a 24 bits resolution was used for recording psychophysiological data at 512 Hz.[4] Data was displayed on a laptop screen in order to monitor the online quality of the incoming signals. Facial EMG (musculus zygomaticus and musculus corrugator supercilii, Ag/AgCl electrodes) and ECG measures (heart rate) were bipolar recordings (grounded through a wrist worn wet band). The ECG was recorded using disposable 30 mm × 24 mm hydrogel snap electrodes; the electrodes were applied on the upper sternum and lowest rib on the left side. Facial EMG was recorded using miniature Ag/AgCl electrodes. All recordings (and data preprocessing) followed established guidelines (Fridlund & Cacioppo, 1986; Jennings et al., 1981). Data inspection and manual artifact rejection on EMG and ECG was done in ANSLAB 2.6 (Blechert, Peyk, Liedlgruber, & Wilhelm, 2016). EMG processing comprised a 28 Hz high-pass filter, a 50 Hz notch filter, rectification, and a 50 ms moving average filter. ECG preprocessing comprised a 0.5 Hz high-pass filter, and a 40 Hz low-pass filter. Responses on all channels were defined as averages across the 3s of the video and 1s after the video relative to a 500 ms baseline (extracted from the last 500 ms of the ITI). Separate averages were created for all negative, neutral and positive videos.

2.6. Data reduction and statistical analysis

To test the internal validity of the task, main effects of video valence condition (negative, neutral, positive) were analyzed using repeated measures analyses of variance (ANOVAs) in both groups combined. The alpha level for all analyses was set to 0.05. Manipulation check analyses including neutral videos used *t*-test statistics. Effect sizes are reported as partial eta squared η^2. When sphericity assumption was violated in ANOVAs, the Greenhouse-Geisser correction for repeated measures was applied with nominal degrees of freedom being reported and the epsilon correction ε.

The crucial analyses of the present paper concern the investigation of an independent contribution of FPE from FNE to discriminate between diagnostic groups (SAD vs. HC). The data analytic strategy therefore used stepwise logistic regression for prediction of group membership as the dependent variable (HC coded 0 vs. SAD coded 1) and A) questionnaires as well as B) emotion reactivity to negative and positive videos as independent variables. This represents a rather conservative (parsimonious) test of the BFoEM relative to a FNE-only model of SAD. Regarding A) the FNE score was entered first in the prediction of group membership and FPE scores in a second step. Regarding B, reactivity scores were built for the video measures (valence, arousal, approval, EMG and ECG measures) by subtracting averages for neutral videos from averages for negative and positive videos, respectively. Neutral videos represented a valid comparison category as preliminary analyses revealed no group differences in averages for neutral videos, $ts < 1.86$, $ps > .07$). Then, analog to the analysis of the questionnaires, negative video reactivity was added in a

[4] EEG measures: Each of the 24 unipolar EEG channels was recorded against the average of all EEG channels. The vertical EOG above and below the right eye, Ag/AgCl electrodes) was a bipolar recording. EEG recordings were obtained with an actively shielded 24-channel electrode cap (water electrodes, manufactured for TMSi, Twente Medical Systems International, EJ Oldenzaal, Netherlands). The 24 sites on the scalp, were based on the international 10–20 System. Electrode sites were Fp1, Fpz, Fp2, F7, F3, Fz, F4, F8, Fc5, Fc1, Fc2, Fc6, C3, Cz, C4, Cp1, Cp2, P3, Pz, P4, O1, O2 and M1 and M2. The impedances for all electrodes varied between 80 and 120 kΩ. Due to technical problems, results of the EEG water cap are not sufficiently interpretable.

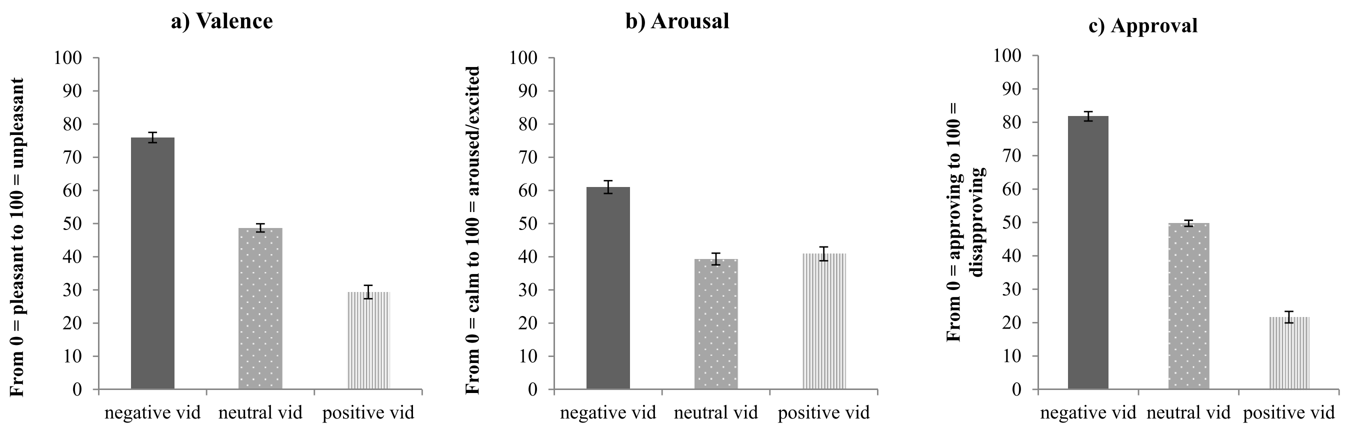

Fig. 2. Displays means of experiential reactivity (valence, arousal, approval/disapproval ratings) evoked by negative, neutral, and positive dynamic social-evaluative video clips (vid). Dark grey bars represent experiential reactivity in response to negative videos, dotted bars in reponse to neutral videos, and lined bars in reponse to positive videos. Line bars represent standard errors.

first step of a logistic regression predicting group membership (HC versus SAD) before positive video reactivity was added in a second step. Nevertheless, in an auxiliary analysis, we checked for the unique effects of neutral videos by predicting group classification by negative and neutral videos in a first step of a logistic prediction, and additionally positive videos in a second step.

3. Results

3.1. Participant characteristics

Each group (i.e., SAD vs. HC) included 12 males and 23 females. Groups did not differ in age or years of education (Table 1). As could be expected, patients had elevated scores on FNE, SIAS, and SASKO but also on FPE.

3.2. Internal validity of the vid-task: analysis across groups

As illustrated in Fig. 2, collapsed across both groups, condition effects replicated our previous findings with this stimulus set (e.g., Miedl et al., 2016; Reichenberger et al., 2015; Wiggert et al., 2017; Wiggert, Wilhelm, Derntl, & Blechert, 2015; Wiggert, Wilhelm, Reichenberger, & Blechert, 2015): on all experiential DVs (unpleasantness/valence, arousal, approval) condition effects were highly significant, $Fs > 74.51$, $ps < .001$. Positive videos were rated less unpleasant and more approving than neutral ones, which, in turn, were rated as relatively less unpleasant/more approving than the negative videos. Arousal was rated higher for negative videos relative to positive and neutral videos which did not differ from each other. Also, corrugator EMG data, $F(2,120) = 8.33$, $p = .004$, $\eta^2 = 0.12$ [CI = 0.04; 0.21], $\varepsilon = 0.56$, replicated previous findings in showing that activity during positive videos (in mV, $M = -0.58$, $SD = 0.95$) was decreased relative to both neutral ($M = 0.08$, $SD = 0.83$) and negative videos ($M = 0.20$, $SD = 2.11$). Thus, higher negative scores indicate higher reactivity. In addition, the zygomaticus EMG data, $F(2,120) = 7.74$, $p = .001$, $\eta^2 = 0.11$ [CI = 0.03; 0.20], showed greater activity during positive videos ($M = 0.03$, $SD = 0.43$) compared to both neutral ($M = -0.17$, $SD = 0.27$) and negative videos ($M = -0.14$, $SD = 0.35$) which is in line with previous findings (Wiggert, Wilhelm, Reichenberger, et al., 2015). No condition effects were found for heart rate, $F(2,120) = 0.82$, $p = .44$, which is also in line with previous reports. Thus, for heart rate, no follow up analyses were undertaken.

3.3. Incremental validity of FPE for group separation: psychometric questionnaires

While SAD patients had elevated scores not only on the FNE but also on the FPE questionnaires this does not represent proof for a unique contribution to group classification. Yet, a logistic regression revealed a significant effect for group classification not only of FNE (Step 1), $B = 0.189$, $SE = 0.041$, Wald's $\chi^2 = 21.7$, $p < .001$, $R^2_{Nagelkerke} = 68.1\%$ but also for FPE entered in Step 2, $B = 0.107$, $SE = 0.037$, Wald's $\chi^2 = 8.39$, $p = .004$, $R^2_{Nagelkerke} = 79.6\%$ supporting its independent contribution to group separation.

3.4. Incremental validity of FPE for group separation: responding to negative and positive videos

Analog to the questionnaire analysis, reactivity to positive and negative videos (with neutral videos subtracted) were entered into stepwise logistic regressions predicting group membership, separately for the independent variables unpleasantness/valence, arousal and approval ratings. Negative video reactivity on unpleasantness ratings, entered in step 1, significantly predicted group membership. In addition, unpleasantness reactivity to positive videos entered in step 2 significantly improved this prediction (see Table 2 for statistics and Fig. 3a for difference scores). Arousal reactivity to negative videos (Step 1) revealed a trend-wise significant effect for group classification,

Table 2
Logistic regression of group classification (HC versus SAD) by valence ratings in the Vid-task.

Predictor	Step 1				Step 2			
	coefficient	*SE*	Wald's χ^2	*p*	coefficient	*SE*	Wald's χ^2	*p*
Valence negative videos	.058	.022	7.14	.008	.070	.023	9.11	.003
Valence positive videos					.042	.020	4.54	.033

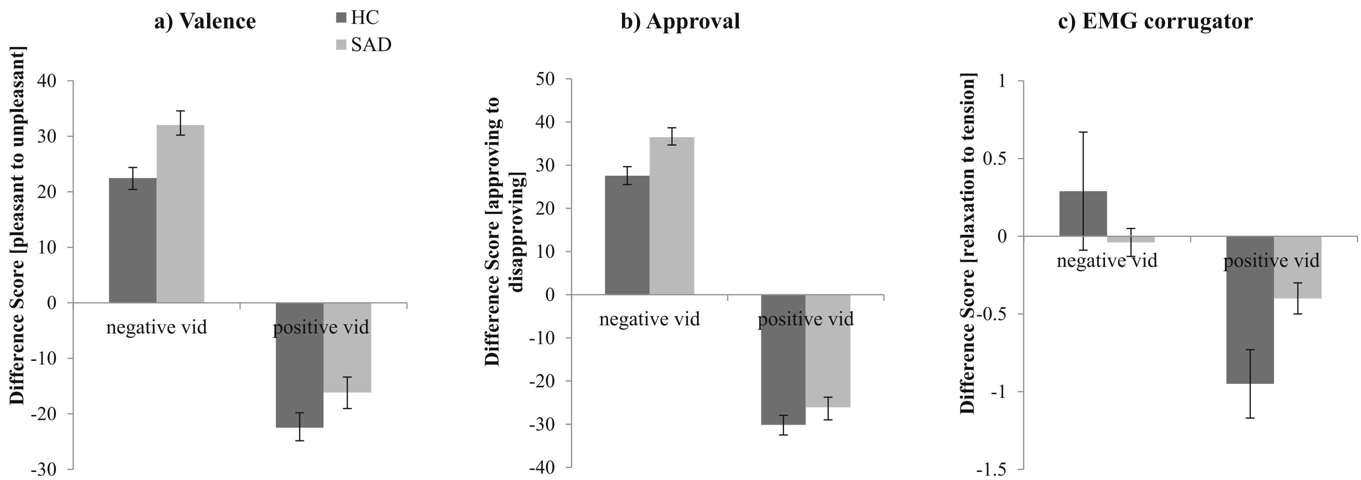

Fig. 3. Displays differences scores of experiential and psychophysiological reactivity (valence, approval/disapproval ratings, EMG corrugator reactivity) evoked by negative and positive (substracted by neutral ones) dynamic social-evaluative video clips (vid). Dark grey bars represent healthy controls (HC), light grey bars represent patients with social anxiety disorder (SAD). Line bars represent standard errors.

Table 3
Logistic regression of group classification (HC versus SAD) by approval ratings in the Vid-task.

Predictor	Step 1				Step 2			
	coefficient	*SE*	Wald's χ^2	*p*	coefficient	*SE*	Wald's χ^2	*p*
Approval negative videos	.060	.023	6.93	.008	.093	.029	10.6	.001
Approval positive videos					.068	.028	5.90	.015

$B = 0.033$, $SE = 0.017$, Wald's $\chi^2 = 3.52$, $p = .061$. However, including arousal reactivity to positive videos (Step 2) did not significantly increment prediction of group membership, $B = -0.003$, $SE = 0.016$, Wald's $\chi^2 = 0.042$, $p = .838$. Video reactivity on approval ratings to negative videos (Step 1) and also approval reactivity to positive videos (Step 2) independently contributed to group classification in that stronger feelings of being disapproved of for negative and positive videos was associated with a higher likelihood of being a patient (see Table 3, difference scores in Fig. 3b).

Corrugator reactivity to negative videos (Step 1) revealed no significant effect for group classification, $B = -0.202$, $SE = 0.256$, Wald's $\chi^2 = 0.621$, $p = .431$. However, including corrugator reactivity to positive videos (Step 2) showed a significant effect for group classification, $B = 0.912$, $SE = 0.435$, Wald's $\chi^2 = 4.41$, $p = .036$, indicative of blunted corrugator responding (i.e., less relaxation; difference scores in Fig. 3c) in the SAD group. Zygomaticus reactivity to negative videos (Step 1), $B = -0.912$, $SE = 0.735$, Wald's $\chi^2 = 1.54$, $p = .215$, and positive videos (Step 2), $B = -0.952$, $SE = 0.703$, Wald's $\chi^2 = 1.84$, $p = .176$, revealed no significant effect for group classification.

Auxiliary analyses used negative, neutral and positive videos separately to check for the unique influence of neutral videos (see Table 4). Results for the impact of negative and positive videos on group classification remained similar with regard to direction and significance. Neutral videos revealed a significant effect for group classification with regard to unpleasantness and approval, however, only when considered simultaneously to positive videos. Thus, the positive videos seem to suppress criterion-irrelevant variance in the neutral videos. A full examination of this pattern, however, is beyond the scope of this report.

To account for comorbid depression in the SAD group, we exploratory computed correlations of the difference scores with BDI scores in this group. Results revealed non-significant correlations for all outcome measures ($rs(31) < -0.303$, $ps > .098$ for subjectively rated emotional reactivity; $rs(28) < 0.341$, $ps > .076$ for EMG reactivity).

4. Discussion

On the background of a current debate about the significance of fear of positive evaluation for models of social anxiety the present study was the first to employ questionnaire and laboratory measures of FNE and FPE, respectively, in a clinical SAD sample. We generally accounted for measures of FNE first in the stepwise prediction of membership in the SAD vs. HC group before adding measures of FPE, thus implementing a conservative test of the role of FPE. Results clearly demonstrated a unique contribution of FPE over and above of that of FNE as evident in the FNE and FPE questionnaires scores and in the hyperreactivity to both positive and negative videos in the response domains subjective unpleasantness and feelings of disapproval. Facial muscular responding (corrugator muscle) to positive videos also discriminated SAD patients from controls. These results will be discussed in detail in the following.

A first set of analyses examined the video watching task in its (internal) validity to elicit responses in both valence domains in all participants. Across groups, the main condition effects (positive vs. negative vs. neutral) were consistently large for experiential reactivity on unpleasantness and disapproval ratings which linearly increased in response to positive to neutral to negative stimuli replicating prior research by our group (Blechert et al., 2013; Miedl et al., 2016; Wiggert, Wilhelm, Reichenberger, et al., 2015). Thus, reactivity in this task provided a valid test of our laboratory implementation of FNE (reactivity to negative videos) and FPE (reactivity to positive videos).

4.1. The role of FPE in SAD: psychometric evidence

As expected, the SAD group exhibited elevated scores on the questionnaires assessing FNE as well as FPE, demonstrating significant concerns with situations entailing negative and positive evaluations in social settings. This finding is well replicated across a number of studies (Fergus et al., 2009; Schwarz et al., 2016; Weeks, Heimberg, Rodebaugh, Goldin, & Gross, 2012). In addition, previous

Table 4
Logistic regression of group classification (HC versus SAD) by different variables separate for the three video conditions in the Vid-task.

Predictor	Step 1				Step 2			
	coefficient	*SE*	Wald's χ^2	*p*	coefficient	*SE*	Wald's χ^2	*p*
Valence								
negative videos	.075	.024	9.40	.002	.123	.033	13.75	< .001
neutral videos	-.023	.029	.651	.420	-.091	.041	5.02	.025
positive videos					.085	.030	7.86	.005
Arousal								
negative videos	.048	.020	5.68	.017	.047	.020	5.39	.020
neutral videos	-.013	.020	.431	.511	-.016	.022	.525	.469
positive videos					.005	.017	.095	.757
Approval								
negative videos	.079	.027	8.75	.003	.171	.044	14.77	< .001
neutral videos	-.014	.034	.175	.676	-.117	.052	5.03	.025
positive videos					.132	.042	9.81	.002
Corrugator EMG								
negative videos	-.071	.340	.044	.834	.056	.554	.010	.920
neutral videos	-.353	.695	.258	.612	−1.58	.925	2.93	.087
positive videos					.963	.454	4.51	.034
Zygomaticus EMG								
negative videos	-.355	.788	.202	.653	.008	.874	.000	.993
neutral videos	2.07	1.16	3.16	.075	2.42	1.25	3.78	.052
positive videos					-.850	.709	1.44	.230

questionnaire-based studies revealed incremental validity of FPE scores above FNE scores to the prediction of various social anxiety measures (e.g., Weeks et al., 2008; Weeks & Howell, 2012). Our results extend this work to a between group setting with clinically diagnosed SAD patients relative to healthy controls in showing that FPE contributed unique variance to the prediction of group membership.

4.2. The role of FPE in SAD: laboratory evidence

Importantly, while questionnaires tap into the individual's self-concepts and are subject to various biases, responses to in-laboratory presentations of standardized yet naturalistic evaluative videographic statements by peers might add crucial information to a test of the BFoEM. In fact, experiential reactivity to both negative and positive videos contributed to group separation even when entering negative reactivity first. This is well in line with prior research demonstrating that individuals with clinical and subclinical forms of social anxiety experienced socially threatening stimuli as more negative than control participants (e.g., Dimberg & Christmanson, 1991; Staugaard, 2010; Straube, Kolassa, Glauer, Mentzel, & Miltner, 2004). Importantly, it underpins the role of reactivity to positive stimuli. Often times termed ‘positivity impairment’ research has repeatedly documented the inability of individuals with SAD to profit from positive feedback or praise (Gilboa-Schechtman, Shachar, & Sahar, 2014; Kashdan, 2007).

Yet, a laboratory setting does not fully protect against reporting biases that may affect any experiential measures and thus also the ratings assessed in the current study. Furthermore, not all emotional responses might be fully represented in the experiential domain such as very fast and/or subtle responses to social stimuli (Dimberg, Thunberg, & Elmehed, 2000). Thus we recorded a number of psychophysiological response variables. In line with our previous results with this videographic stimulus set (Wiggert, Wilhelm, Reichenberger, et al., 2015), mainly the corrugator muscle responded consistently. Specifically, a blunted (relaxation) response to positive videos in SAD patients improved group classification. This facial hyporeactivity could reflect remaining social fear in the context of stimuli supposed to induce positive emotions like pride. It may also represent a type of ‘skepticism’ in individuals with social anxiety when confronted with positive evaluations as previous research has shown that SAD patients exhibit less belief in positive statements about them (e.g., Weeks et al., 2008). Alternatively, the relatively muted facial expressiveness in the SAD group might represent rather implicit, facially displayed avoidance behavior as mirroring a smile of an interaction partner, according to facial mimicry research, can intensify social interactions by signaling affiliative intentions (Hess & Fischer, 2014).

4.3. Taking stock: evidence for the BFoEM and clinical implications

The current results point to the importance of including FPE into theoretical and nosological models and the useful contribution of FPE measures for the diagnostic processes of classifying SAD. Recently, classical cognitive-behavioral models of SAD that highlighted FNE as the main fear domain in SAD (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997) have been updated by including the second fear domain (FPE; Heimberg et al., 2010; Weeks & Howell, 2012). Still, FPE was not incorporated into the revised diagnostic criteria of SAD in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), despite according suggestions (Skocic, Jackson, & Hulbert, 2015). The present results indicate important implications for fear of evaluation models and treatment protocols of SAD. To date, cognitive-behavioral models of as well as treatment strategies for SAD have mostly focused on FNE whereas the present study and prior research have shown evidence for a second fear domain: FPE. In line with the BFoEM, patients with SAD exhibited higher FPE compared to the HC group and recent research has shown that cognitive-behavioral therapy and exposure treatment reduce FPE (e.g., Fergus et al., 2009; Weeks et al., 2012). Fergus et al. (2009) indicated that positive feedback-oriented treatment may contribute to effectively and systematically integrate FPE into existing treatment protocols of SAD. Additionally, specifically targeting FPE by applying an attention bias modification protocol with happy faces as stimuli has been shown to reduce FPE levels (Britton & Bailey, 2018), so that add-on attentional bias modification trainings might complement existing treatments. Furthermore, psychoeducation and cognitive restructuring may benefit from incorporating specific treatment elements focusing on the positivity impairment and FPE in SAD (Weeks & Howell, 2014).

4.4. Limitations, outlook and conclusions

Despite the supporting evidence of the BFoEM, the current study encounters some limitations: First, SAD patients met criteria for mental disorders other than SAD at the time of the clinical interview assessment or prior to it. Therefore, group based analyses were confounded by comorbidity. In order to ensure ecological validity, we did not exclude patients with concurrent anxiety or affective disorders (other than bipolar disorder). As specifically depression was highly comorbid in the current SAD sample and has previously been shown to relate to FNE and FPE (e.g., Reichenberger, Wiggert, Agroskin, Wilhelm, & Blechert, 2017; Weeks et al., 2008), we ran an additional analysis but could not find relations between depression and our residulized outcome variables. However, future study might consider excluding comorbid depression. Second, the SAD sample primarily consisted of individuals seeking inpatient treatment with an average duration of stay of $M = 46.55$ ($SD = 24.63$) days. It is reasonable to argue that this might have affected current results due to findings of Pishyar, Harris, and Menzies (2008) demonstrating a change of emotional reactivity in response to facial expressions after eight weeks of treatment. However, the present consistently large effects for experiential reactivity in the SAD group do not point in this direction. Third, the role of some dependent variables such as arousal ratings, zygomaticus EMG, and heart rate were relatively unclear, in that condition main effects and/or group separation were non-significant. One could speculate that the general intensity of the videos was not high enough to recruit a full range and coherent emotional response across all relevant response systems (see Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). Besides, other response systems might be better suited to tap into both FNE- and FPE-related alteration of reactivity to social stimuli, e.g., hemodynamic brain responses (Miedl et al., 2016) or behavioral measures from the attention (attentional bias, e.g., Britton & Bailey, 2018) or memory domain (e.g., Liang, Hsu, Hung, Wang, & Lin, 2011). Within psychophysiology, more 'social symptoms' might be informative in that regard: blushing might occur in response to both, negative and positive, evaluations, but measures of blushing such as cheek temperature or plethysmography were not included in the current study due to their slow response characteristic (Gerlach, Wilhelm, Gruber, & Roth, 2001). Also in the experiential domain, social and/or more higher-order, self-conscious, emotions might be sensitive like shame, embarrassment but also pride. Regarding the latter, we found that higher FNE goes along with higher pride in response to positive social videos (same as used here) so high FNE individuals seemed to 'profit' from or 'savor' positive feedback while the reverse was true for FPE: the higher their score on the questionnaire the lower their pride in response to positive videos (Reichenberger et al., 2015). Thus, an interesting future direction would extend the set of dependent variables, within both the experiential and the psychophysiological/neuroscientific domain. Furthermore, results indicate that reactivity to neutral videos can provide additional information for group classification (SAD vs. HCs), suggesting that neutral situations might be preferred in patients with SAD. Future research might profit from a closer inspection of neutral situations by explicitly comparing social and non-social neutral (videographic) stimuli. Lastly, a more comprehensive and integrated modelling of SAD would not only account for FNE and FPE but also other domains of anxious symptomatology such as hyperarousal, concerns about visibility of psychophysiological symptoms, avoidance, and social competence deficits. It would be not only likely but also therapeutically important to know whether and how FPE in particular relates to or interacts with these more well-known symptom domains.

In sum, the current study successfully integrated cognitive components of SAD (FNE, FPE) and experiential reactivity to social evaluation in an experimental research protocol. The findings present supporting evidence for the clinical significance and diagnostic utility of the BFoEM in SAD and extend this line of research using naturalistic and dynamic stimuli in the laboratory. Individuals with SAD exhibited enhanced FNE and FPE as well as hyperreactivity to negative social evaluation and attenuated positive reactivity to positive social evaluation.

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