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ACOUSTIC PROPERTIES OF DOMINANCE AND REQUEST UTTERANCES IN SOCIAL ANXIETY

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Social anxiety (SA) has been consistently linked to subjectively rated perceptions of nonconfident vocal communication, yet the link between SA and objective vocal properties remains understudied. The present study aimed to explore the association between SA and auditory parameters of planned speech differing in expressive intent. Participants (n = 95) read neutral, command, and request sentences. Acoustic properties (fundamental frequency–mF0, intensity, speech rate, speech fluency) of these utterances were analyzed. Consistent with a pattern of nonconfident vocal performance, SA was associated with a higher mF0 in men and women, and lesser vocal intensity in men. Moreover, as compared to neutral sentences, SA was associated with lesser increase of vocal intensity in command utterances, and greater decrease of vocal intensity in request utterances. In men, but not in women, SA was also associated with slower speech rate in request sentences. Socially anxious men, and to a lesser degree, socially anxious women, appear to exhibit an enhanced use of vocal strategies associated with de-escalation of conflict. The importance of examining the production of nonverbal cues of dominance and affiliation in SA is highlighted.

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Social anxiety disorder (SAD, also known as social phobia) is the fourth most common psychiatric disorder, with a lifetime prevalence rate of 12.1% (Kessler et al., 2005). Individuals with SAD suffer from excessive anxiety around social or performance situations in which they may be negatively evaluated by others. SAD sufferers report impairments in multiple interpersonal, education, and employment domains (e.g., Schneier et al., 1994; Stein, McQuaid, Laffaye, & McCahill, 1999). Additionally, SAD has been found to be highly comorbid with other disorders, such as depression and substance use (e.g., Kessler, Stang, Wittchen, Stein, & Walters, 1999; Schneier et al., 1994).

Cognitive models of SAD underscore the role of dysfunctional beliefs regarding the self and others in maintaining the disorder (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). According to such models, socially anxious individuals tend to perceive themselves as socially inadequate and to underestimate the quality of their performance in interpersonal situations (e.g., Rapee & Lim, 1992; Stopa & Clark, 1993). Because Socially Anxious individuals do not anticipate being effective in interpersonal situations involving conflicts or needs negotiation, they avoid, rather than confront them. These avoidances, in turn, perpetuate the aforementioned negative beliefs.

According to evolutionary models, social anxiety (SA) is an adaptation of a general mechanism facilitating interpersonal interaction within the social group (e.g., Gilbert, 2001). Gilbert argued that because highly socially anxious individuals perceive themselves as inferior to other members within their group, they do not expect to achieve a dominant position. Instead, they strive to avoid possible interpersonal conflicts and fear that such conflicts lead to rejection or exclusion. In order to remain a part of the group and enjoy its resources (e.g., protection, mating options) they seek to de-escalate social competition by using submissive or appeasing behavior. While reducing the probability of an agonistic encounter, submissive behaviors are accompanied by feelings of shame. Shame engenders negative cognitions about self-presentation, which enhance anxiety in social situations (Weeks, Heimberg, & Heuer, 2011).

Cognitive as well as evolutionary models are supported by a number of empirical studies. Consistent with both conceptualizations, individuals high in SA reported having more cognitions of social inferiority and using more submissive behaviors compared to participants low in SA (Aderka, Weisman, Shahar, & Gilboa-

Schechtman, 2009). Participants high in SA were rated as less dominant by interaction partners, as compared to participants low in SA (Oakman, Gifford, & Chlebowsky, 2003). The same study found that, during a disagreement, highly socially anxious as compared to low social anxious women made a greater effort to minimize disharmony, often doing so by expressing self-doubts. In adolescents, students classified as submissive by their peers reported greater SA than those classified as cooperative, friendly dominant, or hostile dominant (Walters & Inderbitzen, 1998). In addition, individuals high in SA were found to suppress their anger feelings, probably in an effort to avoid confrontation (Erwin, Heimberg, Schneier, & Leibowitz, 2003). Highly socially anxious individuals have also been found to refrain from seeking help (Horshc, 2006), possibly underestimating the probability of their requests being granted. Overall, these finding suggests that individuals high in SA tend to make a greater use of submissive/appeasement strategies, and tend to avoid dominance assertion. Moreover, it is possible that SA affects affiliative, collaborative, and help-seeking behaviors and strategies (e.g., Mallott, Maner, DeWall, & Schmidt, 2009; Russell et al., 2011). The aim of the current study is to explore the possible role of vocal communication in the service of such interpersonal strategies.

ACOUSTIC PROPERTIES OF SPEECH

Social dominance and submission are communicated through a variety of nonverbal gestures such as facial expressions, eye gaze, and body posture (De Waal, 1988; Ellyson & Dovidio, 1985; Ohman, 1986). Among those gestures, the acoustic manifestations of vocalization have been shown to play an important role in power negotiation (Scherer, 1986; Scherer, Johnstone, & Klasmeyer, 2003). Vocal parameters are nonverbal features of a spoken message (Tusing & Dillard, 2000). These parameters are less controllable than other types of nonverbal behaviors (Zuckerman, Larrance, Spiegel, & Klotman, 1981) and may serve as a valid indicator of the speaker's current emotional state (Bugental, Beaulieu, Schwartz, & Dragosits, 2009).

Fundamental frequency (F0) represents the rate of vibration of the vocal folds during phonation and speech. It is measured in Hz, and it is subjectively perceived as pitch. Men and women differ widely in mean F0s, which is estimated to average around 220 and 130 Hz

for women and men, respectively (Petersen & Barney, 1952). *Vocal intensity* reflects the effort used by the speaker to produce speech (Laukka et al. 2008). It is measured in decibels (dB), and it is subjectively perceived as voice loudness. *Temporal aspects of speech* are not vocal measures per se, but rather accompany vocalization and include speech rate and speech fluency (e.g., Scherer, 1986; Siegman, 1987; Tusing & Dillard, 2000).

Morton (1977) suggested that during the process of evolution, animals' voices converged in a systematic manner—with animals producing higher-pitched voices in a friendly environment (expressing an affiliative motivation or appeasement) and a lower pitch in a hostile environment (expressing dominance or an agonistic motivation). Moreover, F0 is negatively correlated with body size across primate species (Fitch, 1977). Indeed, the work of Ohala (1982) proposes an evolutionary basis for vocal signaling of dominance by pitch lowering. It is possible that, by using different sounds, organisms make themselves sound larger or smaller then they are, in order to signal different competitive abilities (Ohala, 1984, Weeks et al., 2011).

Several studies have shown a relation between vocal parameters and perceived dominance and submission (for a review see Hall, Coats, & Smith Lebeau, 2005). In general, mean F0 level is found to be negatively correlated with self- and other-rated social and physical dominance ((Jones, Feinberg, DeBruine, Little, & Vukovic, 2010; Ohala, 1984, Puts, Gaulin, & Verdolini, 2006; Puts, Hodges, Cardenas, & Gaulin, 2007). Speech rate is positively correlated with ratings of dominance and competence in Western societies (e.g., Buller, Lepoire, Aune, & Eloy, 1992; Hall et al., 2005; but see Tusing & Dillard, 2000 for a different perspective). Speech latency and speech disfluency showed the opposite trend (Hall et al., 2005, Putman & Street, 1984). Finally, mean vocal intensity is positively associated with dominance rating in the production of spontaneous speech (Tusing & Dillard, 2000).

Studies also explored the effect of power-related social motives (such as dominance and submission) on vocal properties, by activating specific motivational tendencies. Bugental and colleagues (2009) primed participants with stories meant to activate a challenge in a specific social domain. Priming participants with power challenges (i.e., a challenge to one's position in the social hierarchy), resulted in vocal changes, partly moderated by gender. Following power challenges, both men and women showed decreased vocal

intensity. However, only women demonstrated an elevated F0 level as well. They concluded that participants made use of automatic de-escalating strategies in order to defer to a potentially powerful other, with women making a greater use of such strategies.

Leinonen, Hiltunen, Linnankoski, & Laakso, (1996) explored possible shared features of primate vocalizations. Taking an evolutionary perspective, they hypothesized that monkeys and humans share acoustic cues for emotional/motivational states such as social dominance and submission. In their study, Finnish-native speaker participants were asked to produce the name Sara in the context of 10 different connotations, defined by distinct frame stories. Social dominance, evoked via command vocalization, was characterized by higher levels of vocal intensity, relatively short utterances durations (as compared to neutral vocalization) and a typical fall of mean F0. Submissive intent, evoked via the vocalization of help seeking/plea, was characterized by longer syllable duration (as compared to neutral vocalization) as well as by a slight rise of mean F0 and intensity level toward the end of the voiced segment. These findings were replicated in an English-native speaker population (Linnankoski, Leinonen, Vihla, Laakso, & Carlson, 2005). Thus, it appears that dominant and submissive intents are associated with distinct and recognizable vocal patterns.

SA AND THE ACOUSTIC PROPERTIES OF SPEECH

Individuals who suffer from SAD often fear that they might show signs of anxiety which will be evident in visual as well auditory aspects of their social performance (e.g., Hirsch & Clark, 2007). Several studies examined the vocal performance of socially anxious individuals in interpersonal situations such as delivering a speech or conducting a conversation with a member of the opposite sex. These studies found that highly socially anxious individuals are often rated by others as less socially skilled, and that their vocal communication is rated as less effective as compared to controls (e.g., Beidel, Turner & Dancu, 1985; Borkovec, Stone, O'Brien, & Kaloupek, 1974; Clark & Arkowitz, 1975; Fydrich, Chambless, Perry, Buergener, & Beazley, 1998; for a review see Baker & Edelman, 2002). Further studies found a relation between SA and temporal features of spontaneous speech. For example, highly socially anxious participants paused more often and for longer durations. They also dem-

onstrated slower speech rate and restricted verbal output (Borkovec, Fleischmann, & Caputo, 1973; Geer, 1966; Lewin, McNeil, & Lipson, 1996). Similar results were obtained in a clinical sample of individuals with SAD (Hofmann, Gerlach, Wender, & Roth, 1997).

Laukka and colleagues (2008) were the first to use acoustic analysis to explore the effect of SA on objectively defined auditory parameters. Speech samples of individuals with SAD (mostly women) were recorded in an anxiety provoking situation (i.e., delivering a public speech) preceding and following a pharmacological intervention. Participants who reported lower anxiety levels following treatment (i.e., treatment responders) demonstrated post-treatment decreases in mean F0, and decreased proportion of silent pauses. In addition, listeners' rated nervousness of speech segments, was positively correlated with mean F0, and proportion of silent pauses and negatively correlated with mean vocal intensity. In another study, Weeks and colleagues (2011) placed socially anxious men in a semi-structured role-play, involving a competitive interaction with another man, over the positive attention of a female peer. Interestingly, highly socially anxious men manifested increase in mean F0, while men low in SA showed the opposite trend. Combined, these results point at fundamental frequency, vocal intensity, speech rate, and speech fluency, as vocal parameters which are likely to be affected by SA.

THE CURRENT STUDY

The present study aimed to explore the association between SA and auditory parameters of planned speech differing in expressive intent (e.g., command, request). So far, all the examinations of acoustic parameters of speech in socially anxious individuals were conducted using spontaneous speech. Clearly, such an examination has a high ecological validity. However, research on the auditory parameters of speech suggests that the phonetic structure of utterances significantly influence its acoustic signature (Menn & Boyce, 1982). For example, people tend to utter longer sentences faster (e.g., Amir & Grinfeld, 2011; Howell, Au-Yeung, & Pilgrim, 1999; Levelt, 1989), or use high F0 to mark questions, and low F0 to mark statements (Bolinger, 1964, 1978; Hermann, 1942). Thus, it

is possible that the differences found between high SA and low SA individuals in spontaneous speech may reflect differences in sentence structure (e.g., length, type of statements) rather than true differences in speech vocalization. Using planned speech eliminates such concerns. Thus, the first aim of our study was to examine the relationship between SA and vocal parameters in the production of planned speech. The second aim of the present study was to explore the effects of expressive intent on vocal strategies. Specifically, we sought to examine whether SA is related to the adoption of conflict de-escalating strategies.

In the present study, participants read aloud neutral, request, and command sentences. Both command and request utterances were geared to elicit compliance: Commands via dominance assertion, and requests via appeasement. Three hypotheses were tested. First, we hypothesized that SA is associated with a nonconfident vocal characteristics. Specifically, based on findings from prior studies linking SA and expression of low social dominance to specific acoustic features, we hypothesized that SA is associated with higher F0 level, lower vocal intensity, slower speech rate, and decreased fluency (decreased vocal confidence hypothesis).

Second, we hypothesized that SA is linked to enhanced vocal de-escalation strategies. Specifically, drawing on the evolutionary model of SA (e.g., Gilbert, 2001; Sloman, Farvolden, Gilbert, & Price, 2006) we reasoned that socially anxious individuals, in an attempt to prevent conflict, will use decreased dominance assertion when uttering a command. Moreover, based on previous studies (Leinonen et al., 1996; Linankoski et al., 2005) we expected SA to be related to a greater increase in F0, lower increase in intensity, and lower increase in speed in command vocalization (*impaired authoritativeness hypothesis*). No specific predictions were made regarding speech fluency.

Third, following a similar logic, we reasoned that SA is associated with increased submissiveness, which will lead to an over-emphasis of entreatment patterns (*enhanced entreatment hypothesis*). Specifically, consistent with Linnankoski and colleagues, we expected SA to be associated with stronger decrease in intensity and speed in request, as compared to neutral, utterances. Again, no specific predictions were made regarding speech fluency.

METHOD

PARTICIPANTS

Participants were 95 university students (48 women) who took part in the study in exchange for 30 NIS (equivalent to 8 US$) or academic credit.

PROCEDURE

The data were originally collected as part of a larger study concerning the effect of SA and social rejection on acoustic parameters in speech production, conducted at Bar-Ilan University. Participants were invited to take part in a study investigating individual differences in visual perception and vocal production. Upon signing a consent form, participants began the recording session. Next, participants took part in an additional computer tasks (reported elsewhere). Finally, they filled out self-report questionnaires and were debriefed and thanked for their participation.

Recording Voice Signals. Recording sessions were performed individually in a quiet room. The experimenter familiarized the participants with the equipment, and made sure that they read the sentences in a particular order. The experimenter remained present in the room for the whole duration of the recording session. During each individual recording session, the participants' voice was recorded while reading three different types of sentences: neutral (Danny went to work with his dad and Chad helped us on the beach), request (Please open the window) and command (Open the window immediately). Participants were asked to read each sentence twice in a way consistent with their meaning. The sentences order was randomized across participants. Participants' speech signals were recorded using a Sennheiser PC20 headset microphone (High Wycombe, United Kingdom). The microphone was positioned approximately 5 cm from the corner of the participant's mouth and connected directly to a desktop computer. Speech samples were recorded using the GoldWave program (Version 5.12, GoldWave, Inc., 2005), with a sampling rate set at 48 kHz (16 bit), mono channel.

Acoustic Analysis. Acoustic analyses were performed using Praat© software (Version 4.1.2; Boersma & Weenink, 2009). Four parame-

ters were extracted (a) mean fundamental frequency, mF0; (b) mean speech intensity; (c) speech rate, calculated as the number of syllables per seconds across the continuous segment of speech; and (d) speech fluency, calculated as the total duration of unvoiced segments, divided by the total duration of the speech sample.

SELF REPORT MEASURES

Liebowitz SA Scale (LSAS-SR; Leibowitz, 1987), a 24-item self-report questionnaire measuring anxiety and avoidance in social or performance situations on a 0–3 scale. The LSAS has been shown to have high internal consistency, strong convergent and discriminate validity, and high test-retest reliability (Baker, Heinrichs, Kim, & Hofmann, 2002; Fresco et al., 2001). In the present study we obtained a Cronbach's α of .93 for the anxiety subscale and .90 for the avoidance subscale.

Beck Depression Inventory (BDI; Beck, Rush, Shaw, & Emery, 1979), a 21-item, multiple-choice, self-report questionnaire that assesses affective, cognitive, motivational, and somatic symptoms of depression. In the present study we obtained a Cronbach's α of .81 for this measure.

RESULTS

PARTICIPANTS' CHARACTERISTICS

Participants (n = 95, 48 women) ranged in age from 18 to 34, with a mean age of 23.45 years (SD = 3.22). Participants' level of education ranged from 12 to 20 years, with a mean of 13.02 (SD = 1.53). Participants LSAS scores ranged from 0 to 123 with a mean of 40.07 (SD = 21.81). Participants BDI ranged from 0 to 30 with a mean of 6.96 (SD = 6.11).

For each vocal parameter, outliers of more than three standard deviations above or below the mean were excluded from the analysis (as in Weeks et al., 2011). Means and standard deviation for each parameter in each sentence type and gender are presented in Table 1. In order to assess the effect of self-reported depression level on acoustic parameters, we examined the correlation between BDI scores and each vocal parameter. Significant correlation was found only in the case of speech rate (r = -.26, $p < .05$) with higher BDI score associated with slower speech rate. Next, we conducted the

TABLE 1. Means, Standard Deviation (in Parentheses) and ANOVA Analysis Results of Vocal Parameters According to Gender and Sentence Type

		Male (N = 46)	Female (N = 48)	All	ST F(2,88–92)	G F(1,88–92)	ST × G (2,88–92)
mF0	Neutral	127.38 (18.5)	196.85 (21.98)	162.86 (40.36)	128.17 **	280.68**	3.36*
	Command	146.64 (21.98)	222.47 (27.28)	185.36 (45.41)			
	Request	133.95 (21.69)	207.23 (22.56)	171.37 (42.91)			
Intensity	Neutral	70.62 (4.43)	69.03 (4.16)	69.81 (4.34)	179.3 **	1.77	2.4+
	Command	73.64 (5.58)	72.24 (4.58)	72.93 (5.12)			
	Request	68.13 (5.05)	67.51 (3.91)	67.82 (4.49)			
Speed	Neutral	6.16 (.98)	6.25 (.68)	6.21 (.84)	10.99**	.53	2.53+
	Command	6.19 (.86)	5.95 (.89)	6.07 (.88)			
	Request	5.97 (.89)	5.80 (.65)	5.88 (.78)			
Fluency	Neutral	4.58 (4.25)	4.74 (3.54)	4.66 (3.89)	1063.89**	.09	.46
	Command	17.78 (4.71)	17.98 (5.47)	17.88 (5.09)			
	Request	34.57 (7.75)	33.48 (5.78)	34.02 (6.82)			

Note. G = gender; ST = sentence type +P < 0.1. *p < .05; **p < .01

analysis of speech rate using the BDI score as a covariate. However, adding the covariate did not change the general pattern of results and therefore will not be reported further.

Vocal Pattern of Utterance Type. Before testing our hypotheses, we sought to verify that neutral, command and request sentences differed in their vocal patterns. To this end, four separate mixed model ANOVAs were conducted (one for each parameter—mF0, intensity, speed, and fluency) with gender (2 levels: male and female) as between subject factors, and sentence type (3 levels: neutral, command and request) as a within-subject factor.

As expected, women demonstrated significantly higher mF0 than did men,($M = 208.85$, $SD = 22.63$; $M = 135.99$, $SD = 19.32$ respectively; $F(1,89) = 280.68$, $\beta = 0.75$ $p < .001$). No significant gender differences were observed on any of the other parameters (all Fs<1.76, p>.21).

As can be seen from Table 1, a main effect for sentence type was found for all acoustic parameters. Follow-up comparisons show that command sentences were uttered in a higher mF0 level, $t(1,93) = 14/92$, $p < 0.001$, higher intensity, $t(1,93) = 11.12$, $p < 0.001$, and lesser fluency, $t(93) = 24.14$, $p < .001$, and as compared to neutral sentences. Request sentences were uttered in a higher mF0 level, $t(93) = 8.02$, $p < .001$, lower intensity, $t(93) = 8.94$, $p < 0.001$, lesser fluency $t(1.93) = 43.95$, $p < .001$, and slower speed, $t(93) = 4.62$, $p < .001$, as compared to neutral sentences. In sum, vocal intensity qualitatively differentiated between requests and command utterances, while the parameters of mF0 and fluency changed similarly in both communicative types of utterances.

Table 1 also shows that a significant Sentence Type × Gender was found for mF0, and almost significant interactions were found for vocal intensity, and for speed. When uttering commands (as compared to neutral sentences), women raised the demonstrated higher mF0 level, $F(1,92) = 4.62$, $p = 0.03$, and slower speech rate as compared with men, $F(1,92) = 4.10$, $p = 0.04$. When uttering requests (as compared to neutral sentences) expressed higher mF0 level, $F(1,92) = 3.72$, $p = 0.04$, and lower vocal intensity as compared to men, $F(1.92) = 4.79$, $p = 0.05$).

Decreased Vocal Confidence Hypothesis. Four separate regression analyses with vocal parameters of neutral sentences (mean of mF0, intensity, fluency, and speed) as dependent variables and SA, gender, and SA × Gender as predictors were conducted.

Consistent with our hypothesis, SA was positively correlated with mF0, t (93) = 2.67, beta = .14, $p < .001$). As expected, a highly significant effect of gender was also observed $t(93) = 16.73$, $p < .001$. The SA × Gender effect was not significant $t(93)<1$. Due to the great gender differences on this parameter, we have also conducted follow-up analyses within each gender. SA significantly correlated with mF0 in men ($r = 0.30$, $p = .043$), and almost significantly in women ($r = .28$; $p = 0.056$).

With respect to vocal intensity, we identified an almost significant effect of SA, $t(93) = 1.83$, $p = 0.069$). No gender effect was observed ($t<1$). The effect of SA was modulated by a significant SA × Gender interaction, $t(93) = 2.04$, $p = 0.02$ such that SA was found to be associated with lower vocal intensity in men ($r = -.35$, $p < 0.01$), but not in women ($r = 0.09$, $p = .62$). In addition, no significant associations emerged between SA and speed or fluency (all Fs < 0.85), and no main effects of gender or SA × Gender interactions emerged ($p > .39$).

Impaired Authoritativeness Hypothesis. To address this hypothesis, we again conducted four regression analyses (mF0, intensity, speed, and fluency). Specifically, we sought to examine whether SA is associated with distinct expressive tactics in the production of command as compared to neutral sentences. Vocal parameters of the neutral utterance (mF0, intensity, speed and fluency), SA, gender, and SA × Gender were used as predictors to explain the corresponding vocal parameters of the command utterance. First, we regressed the mF0 of the command sentence (predicted variable), on the mF0 the neutral sentence, SA, gender, and SA × Gender variables. Inconsistent with our hypothesis, SA was not found to be associated with higher mF0 level $t(93) = 1.34$; $p = 0.18$, slower speed $t(93) = 0.87$, or greater dysfluency $t(1,93) = .43$ in the command sentence (as compared to the neutral sentence). No SA × Gender effects were found (all ts < 1). However, with respect to intensity, a main effect of SA was found, $t(93)= 2.46$, $p = 0.16$. Importantly, this main effect was modified by a SA × Gender interaction $t(93) = 2.05$, $p = 0.04$), such that this association was evident in men ($r = -.25^{**}$, $p < .01$) but not in women ($r = -.02$, $p = .80$). In sum, our impaired authoritativeness hypothesis was partially supported.

Enhanced Entreatment Hypothesis. An identical analytic approach was used to test the entreatment hypothesis. Specifically vocal parameters of the neutral utterance (mF0, intensity, speed, and fluen-

cy), SA, gender, and SA × Gender were used as predictors to explain the corresponding vocal parameters of the request utterance. With respect to mF0 and fluency, we found no effects of SA and no SA × Gender interactions (*t*s < 1). With respect to intensity, we found an effect of SA $t(93) = 2.34$, $p = .02$, beta = -.12) such that socially anxious individuals tend to pronounce their requests in a lower intensity level (less loud) as compared to neutral sentences. No SA × Gender interaction was found. Finally, with respect to speed, while we did not identify a main effect of SA ($t < 1$), a SA × Gender interaction was found $t(93) = 5.03$, $p < 0.01$). Specifically, socially anxiety was associated with a decreased speed in request utterance in men ($r = -.30^{**}$, $p < .01$) but not in women ($r = .18$, $p = .14$). In sum, our enhanced entreatment hypothesis was only partially supported.

DISCUSSION

SA AND PARAMETERS OF VOCAL PERFORMANCE

The first aim of the current study was to examine the association between the acoustic properties of planned speech and SA. We hypothesized that SA would be associated with a less confident pattern of vocal performance. This hypothesis was partially supported by our data: SA was associated with higher fundamental frequency in uttering simple sentences. Moreover, SA was associated with decreased vocal intensity in men, but not in women. No associations between SA and speech rate or speech fluency were found. To the best of our knowledge, our study is the first to demonstrate F0- and intensity-related differences as a function of SA in planned speech and in the absence of stress-inducing social interaction.

Prior studies reported that socially anxious individuals were often perceived as less socially skilled than nonanxious controls; however, the examination of specific behaviors did not reveal group differences (e.g., Beidel et al., 1985; Baker & Edelmann, 2002). It is possible that higher pitch and softer volume of socially anxious individuals contributed to them being perceived as more nervous or less secure. Indeed, Laukka and his colleagues (2008) found that mF0 SA was positively correlated with observer-rated levels of nervousness, and negatively correlated with vocal intensity. High-pitched and soft voices in men may communicate submissiveness

and may therefore be perceived as less dominant or poised than would low-pitched loud voices (Morton, 1977; Weeks at al., 2011).

Past research found that SA was related to temporal aspects of spontaneous speech (such as speech fluency, e.g., Lewin et al., 1996). However, in the current study, SA did not affect temporal aspects of speech performance. A possible reason for this discrepancy may be our use of planned, rather than spontaneous speech. According to Rapee and Heimberg (1997), when the situation is clearly defined, socially anxious individuals' performance may not be affected, as task demands are relatively low. Spontaneous initiation of speech may involve increased task demands, as one worries about the content, as well as the manner, of communication. These concerns may possibly lead to disruption in additional vocal/speech characteristics. Once the content of one's speech is prescribed, it may be possible to overcome speech disfluency.

VOCAL PATTERNS OF EXPRESSIVE INTENT

Consistent with the findings of Leinonen and colleagues (1996), we observed distinct vocal profiles in command and request utterances. Specifically, command utterances were characterized by increased mF0, higher intensity, and less fluency, as compared to neutral utterances. Request utterances were characterized by increased mF0, decreased intensity, slower speech rate and greater disfluency as compared to neutral utterances.

Our findings are partially consistent with prior research which explored the nonverbal expression of emotion and social motives. mF0 level was previously found to be elevated in the expression of a variety of emotional states (i.e., fear, anger, joy; Banse & Scherer, 1996) and is assumed to be strongly influenced by changes in the sympathetic nervous system (Scherer, 1986). In the current study participants demonstrated higher mF0 levels in the utterance of both command and request sentences, which may indicate an increase in the level of overall emotional arousal. Sympathetic arousal may have contributed to the decrease in fluency, observed both in command and request vocalization (Leary & Kowalski, 1995).

Vocal amplitude differentiated commands and requests, as participants expressed higher intensity levels when commanding and

lower intensity level when uttering requests. The demonstration of high vocal intensity levels when uttering commands was reported in previous studies (Leinonen et al, 1996; Linnankoski et al., 2005) and has been consistently linked to the expression of strong negative feelings or dominance attempts (e.g., Kimble & Musgrove, 1988). In addition, in the present study request vocalization was characterized by a slower speech rate (a tendency that was previously reported by Leinonen et al., 1996 and Linnankoski et al., 2005). In the context of social hierarchy, slower speech and lower vocal intensity were both perceived by Western participants as a signal for lower social status (Hall et al., 2005). Combined, these findings suggest that slower speech rate and lower vocal intensity during request utterances may signal submission and reflect an enhanced strategy aimed to recruit listeners' support and compliance.

Our result also highlights gender differences in vocal profiles of command and request sentences. As compared to men, women demonstrated a stronger increase in mF0 levels and greater decrease in speech rate in command (as compared to neutral) utterances. In addition, as compared to men, women exhibited a stronger increase in mF0 levels and stronger decrease in vocal intensity in request (as compared to neutral) utterances. Taken together, women appear to make greater use in de-escalating strategies, making themselves sound less dominant in both types of expressive intents.

Our findings are partially consistent with Bugenthal et al., (2009), who reported gender-moderated vocal changes in response to a power-challenge manipulation. As in our study, Bugental and colleagues' observed changes in vocal intensity following a power challenge in both men and women. However, changes in mF0 levels were found in women only. Taking a biological perspective, Bugenthal and her colleagues noted that in addition to signaling submission, increased pitch may also serve as a help seeking signal (Marler, Evans, & Hauser, 1992). Among nonhumans, female and juveniles are more likely to use high-pitched voices to signal others for assistance when confronted with a potential threat. Alternatively, it is possible that, as a group, women attempt to use signals of affiliation, rather than dominance when placed under social stress (e.g., Taylor, 2006).

SA AND EXPRESSIVE TACTICS

The second aim of our study was to explore the association between SA and the expression of dominance and submissiveness. We expected SA to be associated with de-escalation strategies in the production of dominance utterances, and with the use of amplification strategies during the utterance of requests. Our results partially supported these hypotheses, while also suggesting that gender plays an important role in shaping vocal expression under such conditions. In line with the impaired authoritativeness hypothesis, SA was associated with decreased amplification of vocal intensity in uttering commands, as opposed to neutral sentences in men, but not in women. With respect to the vocalization of request sentences we found that, among men, SA was associated with greater decrease in speech rate. Socially anxious men and high as well as low socially anxious women tended to utter their requests in a softer volume. In sum, in the current study, women and socially anxious men exhibited a greater use of de-escalating strategies: decreased use of vocal strategies associated with the expression of dominance, and enhanced utilization of vocal strategies associated with the expression of submissiveness.

Our gender-moderated findings fit within the evolutionary perspective. A few authors have argued that, while female reproductive performance depends mainly on the ability to sustain investment in offspring over long periods of time, male reproductive success relays on his ability to negotiate social and physical dominance (Campbel, Muncer, & Odber, 1997; Smuts, 1987). Nonverbal signals, such as vocal pitch or loudness, function as markers for body size and physical ability (Greenewalt, 1968; Morton, 1977; Ohala, 1984). Low- pitched and loud voices are associated with perceived dominance in both men and women (e.g., Puts et al., 2006). However, the use of voice as a power-negotiation strategy may be more adaptive for males. Thus, among males, expressing dominance vocally maybe more conspicuous and therefore more likely to lead to conflict. Socially anxious men, prone to worries regarding their social status, may use de-escalating vocal tactics to avoid social confrontation.

Our results accord with the study by Maner and his colleagues (Maner, Miller, Schmidt, & Eckel, 2008), where participants were randomly assigned to either win or lose a rigged competition with a confederate. Socially anxious men (but not women or low socially

anxious men) responded to this dominance threat with substantial decreases in testosterone, which reflects submissiveness and a desire to avoid further competition (Mehta & Josephs, 2006). Taken together, the current findings may be interpreted as suggesting that SA may be linked more strongly with concerns about social dominance in men than in women (Maner et al., 2008; Kivlighan, Granger, & Booth, 2005), and with appeals to affiliation more strongly in women than in men (e.g., Taylor, 2006; Marler et al., 1992).

Interestingly, in our study, both command and request utterances gave rise to somewhat similar de-escalation tactics in socially anxious individuals: softening the approach with decreased vocal intensity and (in requests) decreased speed. This interpretation is consistent with the conceptualization of Trower, Gilbert, and Sherling (1990). The authors proposed that socially anxious individuals tend to perceive the social world as threatening even in the absent of threat signals, and to exhibit automatic responses aiming to avoid or de-escalate the social interaction, often by making submissive gestures (see also Weeks et al., 2011).

LIMITATIONS AND CONCLUSIONS

In closing, we would like to mention several limitations of our study. First, our task was based on reading given utterances rather than on naturalistic speech production. In addition, the participants did not expect their responses to have actual social consequences. Such methodology allows us to examine the effect of utterance intent on vocal and speech parameters, but at the same time limits our ability to generalize the results to other performance situations. The comparison between spontaneous and planned speech may enable further exploration of parameters affecting nonverbal expressive strategies. Second, although our findings indicated differential vocal measures profile as a function of sentence type, our present methodology does not allow us to conclude whether these differences were related to the sentence structure or communicative functions (Menn & Boyce, 1982) or to the speaker's motivational state. Future studies may therefore consider using identical utterances, while controlling for speaker's emotional/motivational state. Third, because our recordings were performed using a headset microphone, whose position could shift, our intensity measures may have been affected

by idiosyncratic changes arising from movements towards or away from the microphone. However, we believe that a consistent bias such that highly SAs were positioned at a greater distance from the microphone than were low SAs is unlikely. Clearly, this limitation does not affect the differential intensity (of command vs. neutral or request vs. neutral) measures. Yet, a replication of our findings with more specialized equipment is needed. Fourth, while prior studies used subjective ratings to explore the effect of SA on vocal performance, our study was based on acoustic analysis only. Future studies may combine performance-based and impression-based measures in the evaluation of vocal effectiveness. Integration of perceptual and acoustic approaches may deepen our understanding of the links between subjective experience, nonverbal expression, and perception of social dominance. Fifth, while command utterances are clearly geared to elicit compliance via dominance assertion, request utterances are less unequivocally mapped into the submissiveness domain. One can foster compliance with requests either by entreatment as well as by appeal to affiliative tendencies of the listener. A further exploration of the different ways in which individuals use vocal strategies to elicit compliance with their requests is warranted. Finally, our data were obtained in an undergraduate sample and therefore may be limited in terms of generalizability to clinical samples. The examination of vocal performance and specifically the expression of dominance, submission, help-seeking, and affiliation in clinically diagnosed individuals is an important future step.

We believe that acoustic analysis, an under-utilized measure in the field of psychology (Bugenthal et al., 2009), has allowed us to gain a greater understanding of the subtle ways in which individuals use expressive behaviors to negotiate social standing. Our results also suggest that socially anxious men and women may utilize different strategies to avoid interpersonal conflict and promote cooperation. We also believe that understanding individual differences in expressive behaviors in SA may shed additional light on the nature of this condition. Taken together with other findings of nonverbal behaviors of socially anxious individuals such as gaze and posture (e.g., Weeks et al., 2011), our study provides an indirect support for the evolutionary model of SA (e.g., Gilbert, 2001).

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