



“The Sound of Fear”: Assessing vocal fundamental frequency as a physiological indicator of social anxiety disorder

Justin W. Weeks^{a,*}, Chao-Yang Lee^b, Alison R. Reilly^a, Ashley N. Howell^a, Christopher France^c, Jennifer M. Kowalsky^c, Ashley Bush^a

^a Center for Evaluation and Treatment of Anxiety, Department of Psychology, Porter Hall 200, Ohio University, Athens, OH 45701, USA

^b Division of Communication Sciences and Disorders, Grover Center, Ohio University, Athens, OH 45701, USA

^c Department of Psychology, Porter Hall 200, Ohio University, Athens, OH 45701, USA

ARTICLE INFO

Article history:

Received 13 January 2012

Received in revised form 23 June 2012

Accepted 29 July 2012

Keywords:

Social anxiety disorder

Social phobia

Vocal acoustics

Fundamental frequency

Submissive gestures

ABSTRACT

The relationship between vocal pitch and social anxiety disorder (SAD) has been examined with encouraging initial results, highlighting increased fundamental frequency (F0) as a physiological indicator of SAD. The present series of studies examined the relationship between F0 emitted during social threat and SAD symptoms. Two independent samples of SAD patients, and a sample of demographically-equivalent non-socially anxious controls (NSACs), completed varying social threat tasks which involved speech. Mean F0 emitted throughout the tasks was examined. Male SAD patients emitted greater F0 in comparison to NSACs across studies. For females, this relationship was significant only when examined in patients with SAD of the generalized subtype, and in response to *in vivo* social exposures. Furthermore, gender-specific thresholds for overall F0 emitted during social threat were identified which demonstrated excellent differentiation between patients with generalized SAD and NSACs. These results provide additional support for increased F0 as a physiological indicator of SAD.

© 2012 Elsevier Ltd. All rights reserved.

1. Introduction

Social anxiety disorder (SAD; i.e., social phobia) is characterized by excessive fear of social or performance situations, and is the fourth most common mental disorder, with a lifetime prevalence rate of 12.1% (Kessler et al., 2005). The majority of patients seeking treatment for SAD report moderate-to-severe impairment across various life domains such as education, employment, family relationships, marriage/romantic relationships, and friendships (Schneier et al., 1994; Stein, McQuaid, Laffaye, & McCahill, 1999). Despite the high prevalence of SAD, it is noteworthy that less than 1% of a large sample of research participants who were diagnosed with generalized SAD had this diagnosis recorded in their medical records in the year prior to being surveyed (Katzelnick et al., 2001) – a sobering reminder of the need to better refine the ability to objectively identify, and subsequently treat, patients with SAD. To this end, efforts to enhance the assessment of SAD, with regard to accuracy and efficiency, remain pivotal.

Vocal acoustic analyses are a novel assessment approach for SAD, and have received support from a small number of studies to date. There are notable potential advantages for the

incorporation of vocal acoustic analyses into the broadband assessment of SAD. First, given that vocal characteristics are innately objective, and direct (i.e., physiologically based), vocal acoustic-related assessment of social anxiety symptoms is *less subject to response biases* than clinician-administered or self-report measures. Second, although the behavioral assessment tests and vocal acoustic analyses which have been utilized to examine vocal characteristics of SAD patients have been highly controlled in the present and previous studies, our end-goal for this approach is to develop assessments which are highly practical to routinely implement, yet which would be highly objective and powerful in classifying SAD patients. For example, patients could read standardized paragraphs to a clinician while standing and being audio recorded to assess public speaking concerns,¹ and vocal analyses could be performed on the first audio recording segments available of patients interacting with a clinician (e.g., during the initial stages of a clinical interview) to assess social interaction concerns.

From a basic research standpoint, anxiety has been associated with increased vocal pitch in humans. Speakers produced higher overall vocal pitch during the repetition of short phrases when

* Corresponding author. Tel.: +1 740 593 1094; fax: +1 740 597 3299.
E-mail address: weeks@ohio.edu (J.W. Weeks).

¹ It is worth noting that this situation has been recommended as an exposure for SAD patients with public speaking concerns (i.e., “Reading from a magazine, newspaper...”; see Heimberg and Becker, 2002, p. 217).

asked to imagine themselves in an anxious state than in emotional states including boredom and depression (Johnstone & Scherer, 1999). Furthermore, increased vocal pitch holds specific relevance to SAD within the context of *submissive behaviors*. Consistent with psycho-evolutionary models of social anxiety (Gilbert, 2001), some social anxiety researchers have noted consistencies between social behaviors reported/exhibited by patients with SAD and submissive behavioral displays highlighted by comparative research focusing primarily on nonhuman primates (Kaminer & Stein, 2005). The link between social anxiety-related symptoms (e.g., fears of evaluation) and submissive behaviors has been supported by several studies to date (e.g., see Weeks, Heimberg, & Heuer, 2011; Weeks, Heimberg, & Rodebaugh, 2008; Weeks, Jakatdar, & Heimberg, 2010; Weeks, Rodebaugh, Heimberg, Norton, & Jakatdar, 2009). Moreover, given that social anxiety may be related to dominance/submissiveness more so for males than females (Maner, Miller, Schmidt, & Eckel, 2008), socially anxious males in particular may be likely to exhibit submissive behavioral displays when engaging in social situations.

From a comparative standpoint, animals display submission to more dominant others by making themselves *sound smaller* than they actually are. Natural selection has resulted in the structural convergence of many animal sounds used in distinct contexts (Morton, 1977, p. 855), such that birds and mammals (including humans) use higher-pitched sounds (characteristic of smaller animals) when frightened or appeasing. Evidence across a wide range of species demonstrates that vertebrates tend to universally emit higher pitch when avoiding attack (Collias, 1960).

Fundamental frequency (F0) is an objective index of the rate at which the vocal folds open and close across the glottis during phonation, and is the primary determinant of the auditory impression of vocal pitch. The present study was designed to focus exclusively on F0-related analyses. The relationship between vocal pitch (F0) and social anxiety has been examined, with encouraging initial results. Post-pharmacotherapy decreases in state anxiety in SAD patients were accompanied by corresponding decreases in mean and maximum F0 (Laukka et al., 2008). While these findings are encouraging, it is worth noting that these analyses were restricted to the first 10 s of speeches which were delivered while lying down in a PET scanner. Moreover, this study did not include non-socially anxious control (NSAC) participants. Therefore, this design did not allow for an examination of F0 *over time* in response to continuous social threat, an assessment of the diagnostic utility of vocal characteristics with regard to SAD, nor measurement of F0 in an ecologically valid context (e.g., while standing [rather than lying down], and able to make eye contact with others).

In a more recent study, males who were either high or low in social anxiety took part in a social competition task for the positive attention of a female peer. Specifically, all participants engaged in a semi-structured roleplay involving an 8-min social interaction with two experimental confederates: a female who was trained to relate positively to the participant, and a male who was trained to relate positively to the female confederate, but rudely to the participant (in order to induce implicit social competition for the female peer's attention). Higher social anxiety levels were associated with increased F0 peaks in response to the competitive male confederate, providing evidence for a vocal form of social anxiety-related submissive gesturing within males (Weeks et al., 2011).

In addition, the relationship between F0 and social anxiety symptoms has begun to be examined in children. Scharfstein, Beidel, Sims, and Rendon-Finell (2011) found that children diagnosed with SAD emitted significantly greater mean F0 throughout a structured role play in comparison to children diagnosed with Asperger's disorder, although both SAD and Asperger's disorder patients emitted equivalent mean F0 in comparison to a control sample of typically developing peers (i.e., the typically developing peers emitted mean F0 levels between those of the two patient

groups). Taken together with the findings of Laukka et al. (2008) and Weeks et al. (2011), the findings of Scharfstein et al. indicate that there may exist important developmental considerations pertaining to the relationship between vocal pitch and SAD, in that SAD-related increases in F0 relative to NSACs may not emerge until adolescence/adulthood – this is an important area for future research.

Previous support for the relationship between F0 and social anxiety symptoms in adults notwithstanding, this area of research is still in its infancy, with only two reported studies (Laukka et al., 2008; Weeks et al., 2011) directly focusing on the subject. The present series of studies was conducted to extend findings on F0 as a physiological indicator of social anxiety. In the first study, individuals diagnosed with SAD and demographically-equivalent NSACs were asked to complete a 4-min impromptu speech task. This study is novel in that it is the first to: examine differences in mean F0 in adults as a function of social anxiety *over time* during a public speaking task, and to attempt to identify mean F0 thresholds for potentially classifying SAD patients with respect to diagnostic status. The second study extended the examination of F0 emitted during social threat tasks by assessing audio recordings of individuals with a principal diagnosis of SAD (generalized subtype) completing *in vivo* social exposures using a covert audio recorder. The second study is the first to: examine the relation between F0 and social anxiety symptoms outside of a laboratory environment (thereby enhancing ecological validity); and to control for the effects of general state arousal experienced by speakers. Mean F0 emitted throughout both types of social threat tasks was examined in both studies utilizing specialized vocal analysis equipment. All analyses were performed separately for males and females, given that males and females have distinct F0 ranges (Behrman, 2007).

2. Study 1

The following hypotheses were tested in subsamples of individuals diagnosed with SAD, and demographically-equivalent NSAC participants: (1) mean F0 emitted throughout an impromptu speech task would relate positively to SAD diagnostic severity levels; (2) SAD patients would exhibit increased mean F0 throughout an impromptu speech in comparison to NSACs; (3) increased overall F0 during social tasks would reflect an *SAD-specific* physiological marker, and would not generalize to probable diagnostic status of generalized anxiety disorder or panic disorder; and (4) cutoff thresholds for overall F0 emitted throughout the speech would be established for adequately distinguishing between individuals with SAD and NSACs, as determined by receiver operating characteristic (ROC) analyses. The present study is the first to address the research questions (2), (3), and (4).

3. Method

3.1. Participants

Participants in the present study were undergraduate psychology students ($n=46$), who were recruited to participate in a research study pertaining to SAD and evaluated at the Center for Evaluation and Treatment of Anxiety (CETA) at Ohio University. All participants received course credit for their participation. The majority of the sample was female (67.4%). See Table 1 for specific details on the demographic characteristics of SAD patients and NSAC participants across gender.

Sixteen of the participants in the present study were male, 50% ($n=8$) of whom received a diagnosis of SAD based on the criteria specified in the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association [DSM-IV-TR], 2000). The

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات