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ORIGINAL ARTICLE

What's in a singer's voice: The effect of attachment, emotions and trauma

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ABSTRACT
Research shows that negative experiences in childhood have a long-lasting impact on one's psychological outcomes and one's physiology. The voice is a crucial means of expression, and its complex physiology is believed to be reflective of emotional and mental states. Parenting practices (particularly those contributing to insecure attachment) and traumatic experiences in childhood may thus also influence vocal characteristics. Except for literature on psychogenic voice disorders, the relationship between such experiences and the 'normal' voice is generally unexplored; we propose that a potential relationship is most likely to emerge in singers, for whom the voice is a more central part of their sense of self. In this paper, we test the hypothesis that vocal characteristics relate to attachment and trauma history. Study 1: 25 singers (age 18–35) completed an attachment history questionnaire (ECR-R) and the Singing Voice Handicap Index. Voice range profile and perturbation measures were recorded and analyzed for voice quality assessment. Study 2: 26 singers (age 19–33) completed the attachment history questionnaire, the Childhood Trauma Questionnaire, and the State and Trait Anxiety Inventory. They were also administered the Test of Self-Conscious Affect to assess shame and guilt proneness. Voice range profile, perturbation, and spectrogram measures were recorded and analyzed. The results indicated that anxious attachment, shame, and emotional neglect can predict vocal acoustic measures of intensity and, to some extent, perturbation. This suggests the need to address attachment, shame, and trauma history patterns in the aspiring performer.

Among professionals of voice care, the relationship between the mind and the voice is well known. For instance, psychological conflicts (e.g. spouse or parent relationships) and traumatic experiences are thought to be at the origin of psychogenic voice disorders, such as conversion aphonia (1)—a crippling condition which makes a person unable to speak. It is possible that psychological factors may also affect the voice more broadly, affecting it in systematic ways that do not necessarily result in a clinical diagnosis. Furthermore, to the extent that the voice takes on a different role and thus meaning for different individuals, it could be expected that psychological factors are particularly at play for those individuals whose voice is a more central part of their identity, such as singers. In this paper we explore these questions and empirically investigate a series of hypotheses.

Psychology and voice

We tend to be aware of the relation between the sound of our voice and our mental states. This does not come as a surprise, if we consider that the voice is a source of information about our subjective states and a reflection of the specific life circumstances that bring them about. Some of these intuitions are consistent with empirical research findings. For example, some basic emotions can be inferred from the voice, such as anger, happiness, fear, and sadness (2). Emotions have also been related to different

mechanical processes of phonation. Anger has been found to be associated with 'violent movements between extreme articulatory positions'; tenderness has been associated with 'slow, more supple movements'; and disappointment has been associated with 'progressive relaxation of the tongue and soft palate' (3). As vocal psychotherapist Diane Austin observes, if one's needs and feelings remain unmet, the voice can become inaudible, tense, breathy, or simply 'untrue' (4).

While it is evident that distinct emotional states can affect the voice, it is also reasonable to hypothesize that the physiological subsystems that underlie voice functioning are affected by psychological experiences that may have occurred in a recent or distal past. Discrete traumatic experiences are good candidates, and so is the psychological make-up known as attachment style (5). As we discuss below, both of these psychological factors do impact on human physiology. We propose that because they affect our physiological systems, they also impact the voice. Such an impact, we suggest, is particularly likely to emerge among singers, whose sense of self is directly linked to their voice. Study 1 focuses on the relationship between attachment style and the voice, while Study 2 also looks into the effect of childhood trauma on the voice. Study 2, additionally, examines the relation between specific self-conscious affects (e.g. shame) and vocal characteristics. We start by providing a brief review of the attachment and childhood trauma literature.

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Attachment

An individual's attachment style is largely a reflection of her or his patterns of relating with their primary caregiver (often the mother) during childhood (5). Theorists, beginning with pioneer of attachment theory John Bowlby, argue that the caregiver–child relationship has an evolutionary purpose of protecting young children from hazards, giving them a secure basis for development (6,7). In human societies, adults protect children from both physical and psychological dangers. As a result, the three fundamental elements of attachment are: (1) the level of proximity of the caregiver to the child, including the behavior a child displays during caregiver's absence; (2) the caregiver's role as 'secure base' for the child to feel safe and secure during play and exploration of the environment, knowing the parent will be there in case of need; (3) nurturing by the caregiver, which affirms a sense of safety in the child, who will be more inclined to believe that the environment is generally benign (8). Attachment is a crucial factor in the development of individuals; it has been shown to have a significant impact on the emotional, social, and professional aspects of maturation into adulthood (8–10).

To assess attachment styles, researcher Mary Ainsworth (a student of John Bowlby) developed in the 1970s the experimental setting known as the 'strange situation'. In this setting, the quality of a reunion of caregiver and child was studied and found to be a strong indicator of the child's attachment (8–11). Based on observations of such reunions, researchers developed a taxonomy of three basic attachment styles: *secure attachment*, indicated by activity during the caregiver's absence and pleasure at their return; *insecure anxious attachment*, indicated by distress during absence and upon return; and *insecure avoidant attachment*, indicated by a failure to respond to the returning caregiver. In later studies a further category, that of insecure disorganized attachment, was developed (12,13). Disorganized attachment is associated with traumatic experiences in childhood, such as abuse or neglect (12,13). Patterns of attachment in childhood have been shown to persist into adulthood (8–10).

Observing the magnitude of attachment patterns, Bowlby hypothesized the presence of an 'internal working model' (6,7), which comes as a result of the initial attachment and the preconceptions that it created: the way one perceives the self, the environment, and the relationship with the other continues to be based on the working model over time. Models of self and other can be based on positive expectations (resilient self, responsive other) for secure attachment or on negative expectations (incompetent self, unreliable other) for insecure attachment. Adult attachment is directly dependent on infant attachment because of 'internalized' representations of the internal working model (11).

These attachment dynamics that from childhood are re-enacted into adulthood directly influence one's perception of the environment as safe or unsafe and—crucially—directly influence the self-concept and other-concept as 'good enough' or not. These representations are activated with romantic partners, but also play a role in one's sense of self, independent of the specific relationship one is (or is not) in (maintaining a core positive or negative self-image) (10,11). In the studies presented here, since the focus is on adult attachment, the measure used is the Experiences in Close Relationship questionnaire, revised version (ECR-R) (see below). This measure assesses adult attachment through one's general perception of romantic relationships and, more precisely, the degree of anxious and avoidant attachment style. Participants indicate their agreement with statements tapping into the internalized representations mentioned above (e.g. 'I'm afraid that once a romantic partner gets to know me, he or she won't like who I really am', 'I find it difficult to allow myself to depend on romantic partners'). These items assess expectations about rejection or abandonment by an actual or potential partner, reflecting rejection or abandonment in childhood. Being in a relationship at the time of assessment is not necessary.

Attachment and physiology

As explained by Maunder and Hunter, insecure attachment can have an impact on physiological responses and on adults' health conditions (14); this has been shown in several studies that hint at the fact that attachment impacts self-regulation and stress responses. Previous studies also showed that insecure attachment affects a variety of physiological factors such as brain activity, heart rate, and skin conductance response. For example, in approach and withdrawal decisions, individuals with insecure attachment styles show different frontal cortex activity compared to those with secure attachment styles (15). Also, reduced cell concentration in the left hippocampus was found among individuals with anxious attachment (16). These findings suggest a relationship between attachment style and the physiology of the brain.

Here we intend to look at the relationship between attachment and voice. Due to the exploratory nature of this investigation, we do not have very specific hypotheses for the two attachment styles, but overall we expect anxious attachment style to be a stronger predictor than avoidant attachment style because avoidance is associated with higher levels of defensiveness, stronger repression of negative affect, and less self-doubting behaviors (17). Importantly, anxious attachment has been associated with worse health outcomes in adulthood compared to avoidant attachment (18,19), therefore suggesting that its effects on physiology are more damaging than those of avoidant attachment.

Childhood trauma and physiology

When traumatic experiences occur, they affect one's psyche as well as one's body. Research suggests physiological responses are generally altered by traumatic experiences, especially if the latter are prolonged (20,21). Childhood abuse in particular can alter an individual's response to stress (22–25). Additionally, prolonged trauma exposure has been associated with risky physiological and health outcomes such as immunosuppression (26). Furthermore, trauma during childhood can lead to changes in structural and functional properties of the brain that can contribute to psychosocial

disorders in adulthood (22). Adverse childhood experiences have been identified as some of the strongest predictors of fatal health conditions in adults (27).

While, to our knowledge, there is no empirical research on the relationship between attachment and the voice, the effects of trauma on the voice have been investigated in several studies—albeit only from a perspective of vocal pathology. For instance, research has shown that traumatic events can affect one's respiration and also one's voice, in some cases contributing to a clinical voice disorder (28–30), such as conversion or functional dysphonia (vocal impairment in the absence of laryngeal pathology) (31). Other studies on psychogenic voice disorders reveal the impact of traumatic or stressful experiences (e.g. loss of a loved one, unhappiness, conflicts, and accidents) on the voice, showing that symptoms associated with a vocal disorder can occur without a biological cause. When this happens, the cause is often found to be psychological. Instances of emotional trauma associated with cases of aphonia (inability to speak) stem from psychological factors that contribute to muscle tightness in the vocal folds (30).

Given the above-mentioned studies and the well-known relationship between trauma and physiology (and specifically vocal physiology), we expect that experience and severity of trauma will have an impact on the voice.

Anxiety and shame

Research has investigated how anxiety can impact physiological functions leading, for instance, to deep and irregular breathing (29). By affecting one's breath, anxiety can affect one's voice; individuals with high anxiety levels seem to be more prone to developing benign voice disorders (28), and a decrease in anxiety matches decreases in Fo, frequency range, and frequency of silent pauses (32). Importantly, higher anxiety levels have been associated to traumatic experiences in childhood and insecure attachment (33).

Self-conscious affect might also be related to voice. Feelings of shame have been associated with negative conceptions of the self and a sense of humiliation in front of others (which for singers could be related to stage fright) (34). Importantly, shame is associated with feelings of being 'small', a sense of shrinking and worthlessness (35). Also, shame proneness is about feeling 'exposed' (35). For this reason, we expect shame to relate to vocal intensity and perhaps perturbation. Other measures of self-conscious affect, such as guilt, detachment, pride, or externalization of blame, may also be related to voice characteristics, but here we focus on shame. Research has shown a relationship between shame and insecure attachment (36) as well as childhood trauma (37).

More evidence from performance and implications for singers

As noted above, the effects of psychological factors on the voice are even more likely to be present among singers, for whom the voice is a more central part of their identity.

While we are aware of no psychological study specifically targeting this population, there is some evidence that traumatic events affect the performance of musicians (38,39). Specifically, parental conflict and dysfunctional family environments affect musicians' level of anxiety and their relationship with their instrument (40–42). This is of particular relevance because musicians, as other performers, experience performance-related anxiety; this is generally due to the demands of the music business, the constant feeling of being evaluated, and stage fright. In some cases, musicians even develop performance-related injuries. Low self-confidence levels also seem to contribute to injury proneness (40).

Singers, as musicians, should also be affected by these dynamics. In the case of singers, their instrument is the voice, which is even more likely to be affected by psychological states, compared to other musical instruments, since it can be directly affected by somatization processes. The laryngeal nerve, for instance, is sensitive to emotional changes (2). Emotional distress affects laryngeal muscles in the same way that a factor as damaging as smoke affects the throat of a non-smoker, causing muscular twitches in the larynx. By contrast, in the absence of emotional distress, laryngeal muscles appear relaxed (43).

A form of distress particularly relevant for singers, stage fright, has been analyzed from a therapeutic psychological perspective by McGinnis and Milling (44). During intense stage fright, the heart races and the throat dries up. Both physiological changes have been shown to affect vocal performance (34). Moreover, McGinnis and Milling observe that stage fright symptoms are unmistakably similar to those of social phobia, which has been shown to have a relationship with attachment patterns and trauma (17,22). This raises the possibility that stage fright, and its vocal consequences, may likewise relate to attachment and trauma. Because the voice is singers' primary instrument and it is very central to their sense of self, we hypothesized that attachment styles and trauma history relate to acoustic characteristics of the voice among singers.

Hypotheses

We hypothesize that insecure attachment styles and trauma, as well as measures of self-conscious affect (mainly shame, but possibly guilt, pride, detachment, and externalization) relate to perturbation measures and measures of intensity.

Study 1

Method

Participants

Participants ($n = 25$; 14 women, 11 men) (Table 1) were recruited through music programs at universities and conservatories, as well as via Craigslist, a popular online listing of classifieds. In Study 1, age range information is present, but information from each participant was not available; in Study 2, all ages are reported and will be taken into account because of possible age demarcation due to cartilage ossification at age 25 (2,45).

Table 1. Means and standard deviations in Study 1.

	M	SD
Anxious attachment	3.14	1.08
Avoidant attachment	2.92	1.26
Shimmer	10.01	10.96
Jitter	0.9	1.68
Intensity reduction at register change	3.56	3.62
Noise/breathiness	1.36	0.77
Irregularity/roughness	0.98	0.36
Maximum volume/maximum intensity	104.16	5.32
Volume dynamic/intensity range	59.24	7.32
Singing Voice Handicap Index	1.69	0.38

18–35 years of age.

Singers self-identified regarding performance and style as either musical theatre singers (10), choral singers (6), or jazz singers (9). All had a minimum of 5 years of vocal training.

This study was approved by the Institutional Review Board at The New School for Social Research, New York.

Materials

Attachment style was assessed using the ECR-R (Experiences in Close Relationships–Revised). The ECR-R is a 36-item questionnaire designed to assess individual differences in attachment-related anxiety (i.e. insecure versus secure about their partner's availability and responsiveness) and attachment-related avoidance (i.e. comfortable versus uncomfortable being close to others). The Cronbach alpha for both scales is very high (0.93 for the anxious attachment scale and 0.95 for the avoidant scale) indicating strong internal consistency (46,47).

The Singing Voice Handicap Index consists of 36 items (each scored from '0 = never' to 'always =4') on singing voice-related dysfunction and assesses the level of physical and emotional voice disability in singing mode. It was created to measure the psychological consequences of voice disorders (48).

The voice analysis was conducted using LingWAVES (49), a software program used for professional voice and speech analysis (Figure 1 and Figure 2). LingWAVES has been previously used in voice analyses and has been shown to be a reliable instrument to measure perturbation and voice profiles (50,51). The LingWAVES sound level meter (52) was used for the recordings (subjects were positioned 30 cm away from the sound level meter).

Procedure

The study consisted of two phases: subjects first completed questionnaires online (ECR-R and the Singing Voice Handicap Index mentioned in *Materials*) using Qualtrics research software and, in the second phase, came to the laboratory (a vocal room, sound pressure level (SPL) 40 dB sound floor, at the New School University) to have their singing voices recorded.

Subjects were scheduled for in-person recordings after completing the online questionnaires. They were instructed to come in only if they were well rested and had avoided smoking, caffeine, and alcohol the day of the recording. No subject reported any vocal problems at the time of the recording. They were given 5 minutes to warm up before

data recording. The phonetogram (voice range profile) was recorded to determine intensity and range (all intensity variables are calculated by LingWAVES and are shown in Figure 1A). LingWAVES's keyboard was used to guide participants (semitone-scaled intervals), unless they requested to ascend or descend independently from a comfortable middle range note of choice.

The data set included maximum intensity and intensity range, voice profile percentage or model fit, and the amount of intensity reduction during the register change. Subjects' sustained phonation was recorded on an 'ah' at comfortable pitch and loudness for perturbation and voice quality assessment. The mid-portion of each token was analyzed, trimming 500 ms for onset and 500 ms for offset to eliminate instability during onset and offset of voicing. Analysis was conducted on a 5-second segment to ensure adequate sampling of voice stability. A minimum of one token per subject was used.

While the purpose of the present research was not to evaluate vocal health or potential dysphonia, we used LingWAVES's Dysphonia Severity Index (DSI) to obtain continuous measures of jitter, shimmer, irregularity/roughness, and noise/breathiness. Norms for perturbation in LingWAVES are explained by the formula in the LingWAVES Manual: (DSI $=0.13*$MPT $+0.0053*$Fo-high $- 0.26*$I-low $- 1.18*$jitter $+12.4$) (49). This is calculated based on a multivariate analysis of a large database of over 1,000 normal and pathologic voices developed by the Belgian Study Group on Voice Disorders (53). The results of the formula can later be classified into levels of impairment; however, the authors are not using perturbation measures to make a case for potential impairment. Additionally, norms were checked from Baken and Orlikoff (54 p. 128) for intensity in singers after 2.5 years of vocal training (mean maximum SPL for women between 18 and 38 years of age ranges from 99 to 112 dB; mean maximum SPL for men between 18 and 39 years of age ranges from 92 to 116 dB) (51). Our data are within normal range (Table 1).

Results

Data were analyzed using SAS (version 9.2). Bivariate Pearson correlation coefficients were computed between vocal and attachment variables, followed by multiple regressions.

Vocal variables used from the phonetogram were maximum intensity/maximum volume, intensity range/volume dynamic, and the volume/intensity drop/reduction during the register change (VDRC) (Figure 1).

From the perturbation and voice quality assessment data (Dysphonia Severity Index in LingWAVES) we used jitter %, shimmer %, roughness/irregularity, and breathiness/noise. The unit of measure of irregularity/roughness and breathiness/noise is N/H (noise-to-harmonics ratio). All means are reported in Table 1. The DSI profile is shown in Figure 2.

These variables were approximately normally distributed except for jitter, shimmer, and irregularity, which were positively skewed. Natural log transformations were

(a) <u>Singing profile</u>

Pitch:	Max	E5	(659.3 Hz)
	Min	D#2	(79.6 Hz)
	Range	**37 HT**	(579.7 Hz)
Volume:	Max	109 dB(A)	
	Min	53 dB(A)	
	Dynamic	**56 dB(A)**	
Norm profile coverage		**89 %**	
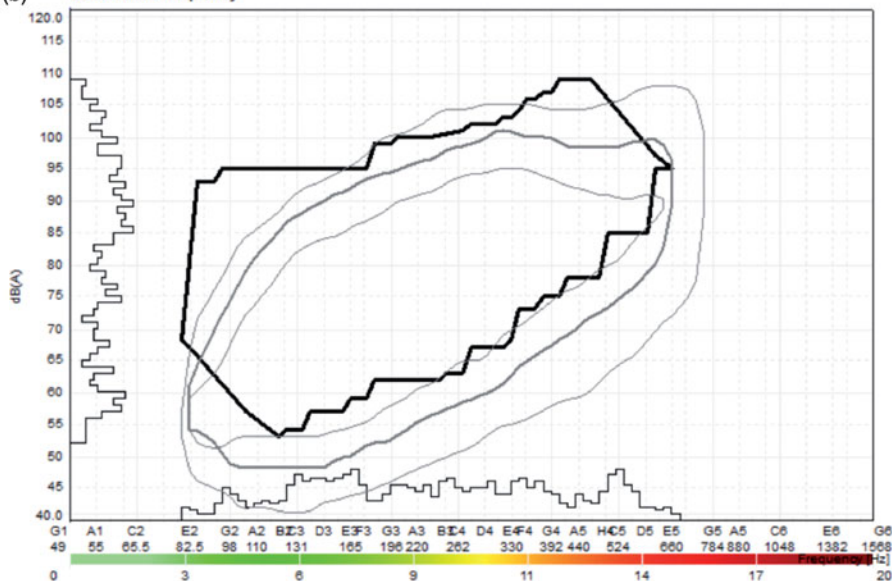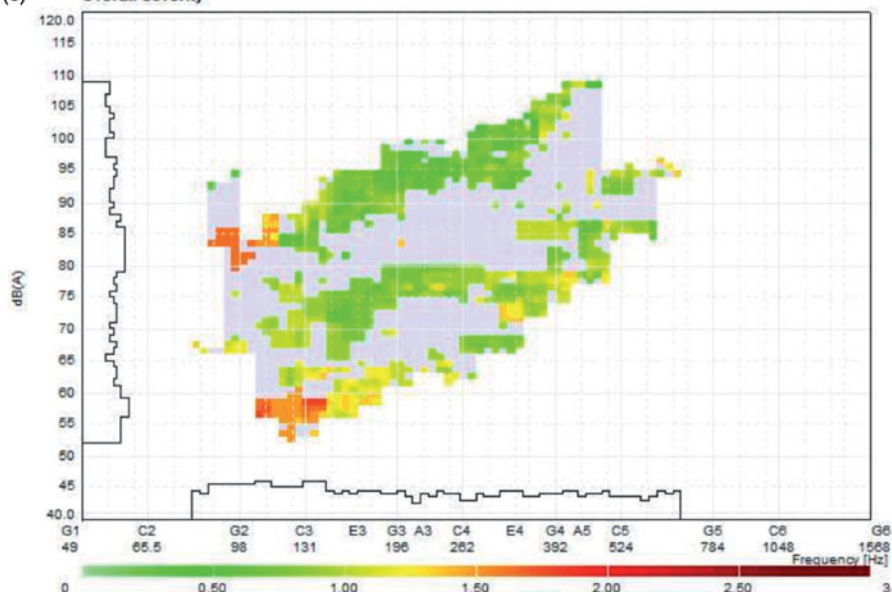
Figure 1. Phonetogram (voice range profile) in LingWAVES.

computed to meet the assumptions of our statistical tests. As predicted, several variables in the phonetogram and perturbation measures were significantly correlated with the measures of anxious and avoidant attachment (Table 2); importantly, anxious attachment negatively correlated with maximum intensity in the phonetogram ($r = -0.43$, $P < 0.05$), and positively correlated with jitter ($r = 0.52$, $P < 0.01$) and irregularity ($r = 0.40$, $P < 0.05$). Avoidant attachment correlated with jitter ($r = 0.49$, $P < 0.05$) and shimmer ($r = 0.40$, $P < 0.05$).
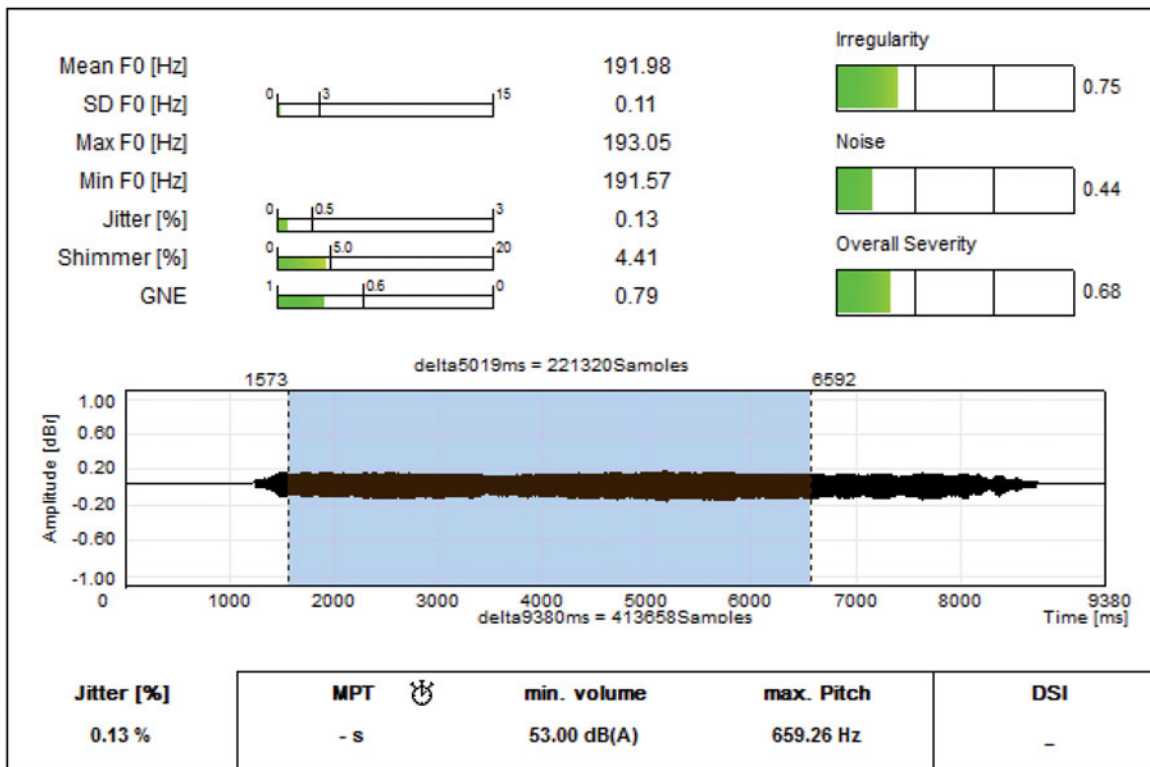
dichotomous variable, and the attachment variables were entered as continuous predictors (after being centered), along with the interaction term. This strategy was used for all vocal characteristics. Across dependent variables, neither the main effect of gender (all P values >0.14) nor the interaction of gender and anxious attachment (all P values >0.37) were significant. The interactions of gender and avoidant attachment (all P values >0.17) were also not significant.

Discussion

Study 1 explored the relationship between attachment style and the voice among singers. Anxious attachment significantly negatively correlated with maximum intensity. It positively correlated with jitter and irregularity. Also, avoidant attachment positively correlated with jitter and shimmer. While this investigation was exploratory, given the lack of empirical studies addressing these questions, the findings are consistent with the tentative hypotheses we put forward, and they are meaningful given the known relation to attachment and physiology, defensiveness, and self-doubt.

The negative correlation between the Singing Voice Handicap Index (48) and volume/intensity reduction during the first register change was unexpected, as high voice discomfort should be associated with a *larger* (not smaller) intensity drop in the register change (which could be interpreted as the singer 'backing off'). One possible explanation is that our sample of singers did not have a specific complaint of voice dysfunction. Cohen and colleagues (48) created and validated the Singing Voice Handicap Index for voice patients who are aware of their voice disability and possible disorder. In this study, our subjects are singers without specific dysphonia. It is our belief that some degree of confusion may have occurred when subjects read a survey that questioned the physical and emotional health of their voice for the first time. No other correlations were found with the Singing Voice Handicap Index, probably for the same reason.

Broadly, the results of this study support the idea that attachment quality is related to characteristics of the voice.

Study 2

Method

Study 2 aimed at replicating and extending findings from Study 1 by also exploring the relations of trauma, anxiety, and self-conscious affects (particularly shame) with vocal characteristics.

Participants

A total of 26 participants (musical theatre singers) between the ages of 19 and 33 were recruited through conservatories or online (via the talent website Backstage.com) (Table 7); 20 subjects were female, and 5 were male (one participant selected 'other'). This study was approved by the

Table 7. Means and standard deviations in Study 2.

		M	SD	*n*	%
Age		23.84	3.02	26	
Gender	Female			20	76.92
	Male			5	19.23
	Other			1	3.85
Maximum intensity		102.5	6.32	26	
Intensity dynamic		57.08	7.75	26	
Jitter		1.42	1.72	26	
Shimmer		7.77	5.29	26	
Irregularity		0.94	0.32	26	
Childhood trauma		37.6	10.49	26	
Anxious attachment		3.46	1.12	26	
Avoidant attachment		3.26	1.16	26	
Trait anxiety		2.23	0.57	26	
Shame		49.65	9.63	26	
Training (years)		9.07	4.009	26	

Institutional Review Board at The New School for Social Research, New York.

Materials

As in Study 1, the ECR-R was used to assess adult attachment styles, and LingWAVES Software for gathering data about the voice.

The Childhood Trauma Questionnaire Short Form (56,57), a self-report measure, was administered to assess trauma. It is 28-item self-report scale constructed to assess different kinds of abuse and neglect in childhood and adolescence. Subscales estimate abuse (Emotional, Physical, and Sexual) and neglect (Emotional and Physical). Additionally, there is a three-item Minimization/Denial subscale to control for response bias, specifically the minimization of abuse. The Childhood Trauma Questionnaire has adequate reliability, with high internal consistency. In prior studies, the Sexual Abuse, Emotional Neglect, Emotional Abuse, and Physical Abuse subscales had Cronbach's alpha coefficients ranging from 0.81 to 0.95 (56,57).

A revised version of the State–Trait Anxiety Inventory (STAI) (58), a 40-item self-report measure of trait and state anxiety, was used. The main version of the STAI contains 20 items for trait anxiety and 20 items for state anxiety. The revised version uses six items for state anxiety. Participants are asked to report their frequency of anxiety-related experiences on scales ranging from 'almost never' to 'almost always'. The STAI shows adequate reliability and validity coefficients. Internal consistency coefficients in prior studies range from 0.86 to 0.95, and test–retest reliability correlations have ranged from 0.65 to 0.75 over a 2-month interval (58,59).

The TOSCA-3 (Test of Self-Conscious Affect version 3) (60,61) was used to assess shame proneness (47). It contains 16 scenarios, and participants are asked to indicate their likelihood of responding ('1 = not likely' to '5 = very likely') in ways indicative of shame and other self-conscious emotions (including guilt, pride, detachment, and externalization). Reliability coefficients for the TOSCA-3 range between 0.60 and 0.80. Using scenarios rather than brief labels depicting the emotions (e.g. shame, guilt) is one of the TOSCA's

Table 8. Maximum intensity in spectrogram.

Variable	B	SE B	β
Emotional neglect	−1.62	0.71	−0.50*
Physical neglect	0.87	0.71	0.26
Adj R²	0.11		

*$P < 0.05$.

Table 9. Mean intensity in spectrogram.

Variable	B	SE B	β
Emotional neglect	−0.68	0.25	−0.56*
Physical neglect	0.38	0.25	0.31
Adj R²	0.16		

*$P < 0.05$.

advantages, since it is easy for adults to confuse the labels of guilt and shame (52–54).

The Singing Voice Handicap Index was not used in the second study following considerations presented in the previous discussion.

Procedure

The procedure for Study 2 was almost identical to the steps and criteria of Study 1. The exception was administering the Childhood Trauma Questionnaire at the end of the whole study, in person, with the purpose of not upsetting participants before they sang. Participants were also asked to rate their level of identification as a singer on a scale ranging from 1 to 5. The state anxiety scale was also administered in person, before participants took the Childhood Trauma Questionnaire. Participants completed the other scales (discussed in *Materials* of Study 2) before visiting the lab. Another difference from Study 1 is that a spectrogram of singers performing an ascending glissando was performed on an 'ah' vowel (for different intensity-related information) after recording the phonetogram and sustained phonation for perturbation measures.

In Study 2, subjects also had sensors on their fingers to gather physiological data for purposes that are not discussed here.

Results

Data were analyzed using SAS (version 9.2) to explore relationships among acoustic variables, attachment, trauma, and self-conscious affect. For a few analyses, data from all participants were not available due to recording errors or outliers. In those cases, the degrees of freedom will be reported (in all other cases, data from all 26 participants were used). As in Study 1, anxious attachment negatively correlated with maximum intensity in the phonetogram (approaching significance, $r = -0.37$, $P = 0.05$). Maximum intensity also negatively correlated with shame ($r = -0.59$, $P < 0.01$). Also, not surprisingly, anxious attachment and shame were positively correlated ($r = 0.40$, $P < 0.05$). Thus, we decided to utilize the Hayes (2013) bootstrapping procedure to investigate whether shame mediated the relationship between anxious attachment and maximum intensity. We observed a significant indirect effect of anxious attachment on maximum intensity via shame, $b = -1.36$ (95% CI −3.41, −0.10), and the effect was large, $\kappa2 = 0.21$ (95% CI 0.02, 0.45). Furthermore, the direct effect was not significant, indicating that shame fully mediated the anxious attachment–maximum intensity relationship, $b = -1.04$ (95% CI −3.41, 1.32). Guilt and anxiety were not reliable mediators (all confidence intervals for the indirect effects included zero).

Relations between the neglect measures from the Childhood Trauma Questionnaire and intensity on the spectrogram were examined in multiple regression analyses, with maximum and average intensity regressed on physical and emotional neglect. For both maximum intensity (Table 8) and average intensity (Table 9) there was a negative effect of emotional neglect. None of the measures of abuse reliably related to the intensity measures.

No effects of age, gender, or training were found on the key vocal characteristics, and so they were not included as covariates. Unexpectedly, correlations between perturbation measures and attachment (and trauma) were not found. Also, we observed a marginal negative correlation between shimmer and trait anxiety ($r = -0.38$, $P = 0.05$). However, given that many of the perturbation measures had bimodal distributions, the results of these parametric tests may be unreliable. In future research, these relations should be tested using larger samples in which these variables should present more normal distributions.

Maximum intensity in the phonetogram also negatively correlated with trait anxiety ($r = -0.45$, $P < 0.05$). Additionally, intensity dynamic was negatively correlated with externalization of blame ($r(23) = -0.49$, $P < 0.05$). Interestingly, singers' level of identification as a singer negatively correlated with anxious attachment ($r = -39$, $P < 0.05$) and with the total number of above-threshold trauma for abuse and neglect ($r = -0.48$, $P < 0.05$).

Discussion

The results of Study 2 replicate the relationship between anxious attachment and intensity. Furthermore, Study 2 reveals that this relationship is mediated by shame. This is consistent with our conjecture that this relationship is due to a negative self-image leading one to feeling 'small'. While we did not plan to examine the relationship with other variables measured by the TOSCA, for exploratory purposes we looked at correlation between guilt and voice characteristics and found that guilt did not exhibit significant correlations. This is consistent with literature that describes guilt and shame as distinct emotional experiences. Research that looks at shame and guilt as distinct emotional experiences suggests that guilt is a moral and adaptive emotion; it is about an actual behavior rather than about the self specifically. Shame, on the contrary, is a more dispositional attribution and may thus represent 'the darker side of moral effect' (33).

Of interest, while shame mediated the impact of anxious attachment on intensity, anxiety (which is not associated particularly with 'feeling small') was not a reliable mediator. Among others, the negative correlation between

externalization of blame and intensity dynamic is also interesting, since the scale of externalization of blame assesses defensive mechanisms against shame proneness ([62]). Externalization is defensive inasmuch as it helps one externalize factors that would otherwise lead to self-blame. Externalization, however, signals that the tendency for self-blame (and therefore shame) is present.

Particularly interesting is the result that emotional neglect in childhood predicted both average and maximum intensity in the spectrogram. One way to explain this relationship (even though possible mediators or moderators were not found in this research) could be that experiences of neglect in childhood—even more than abuse—are associated with higher behavioral withdrawal and avoidance of any stimulation that would lead to arousal ([63]). This is consistent with case studies in psychotherapy settings that have found an association between emotional neglect and feelings of disempowerment, loneliness, and an even greater inability to process feelings ([64]). These characteristics could be related to lower intensity in singers as a way of withdrawing from a vocal task that invites one to be both emotionally and physically engaged.

General discussion

In this contribution we aimed at exploring some psychological factors that may be related to voice characteristics among singers. We looked specifically at attachment style, trauma, and the emotion of shame. In Study 1, results suggested a relationship between insecure attachment (anxious specifically) and voice characteristics of singers. In Study 2, the relationship between anxious attachment and maximum intensity was replicated, and it was mediated by shame proneness. Also, emotional neglect predicted lower intensity in the spectrogram, which can be interpreted as shunning expansive behaviors (i.e. being louder).

The negative relationship found between identification as a singer and both the total above-threshold trauma and anxious attachment could point to the fact that traumatic experiences in childhood and anxious attachment impair a singer's sense of identity. As previously observed, insecure attachment can have an impact on one's sense of identity by contributing to a negative self-image. Training and practice of singers may allow them to be more expressive of their emotions and personality, but their negative sense of self can strongly influence them. Addressing psychological issues may thus also contribute positively to their singing. While emotional and psychological elements can affect a singer's voice, their consequences are often regarded as 'technical issues' or temporary emotional distress due to the immediate circumstances. These findings point to the possibility that behind a technical difficulty in the voice there might be deeply rooted emotional issues.

Limitations and future directions

Limitations in this study include the small sample and little information on vocal history and demographics about the subjects (especially in Study 1). Further research is needed to explore more in depth the relationships between the voice and psychological characteristics, particularly affective ones and across levels of training, performance, and age groups. It should also be noted that these findings are to be considered preliminary, and that the studies themselves were exploratory in nature. Replication and sharpening of the hypotheses are thus clearly needed.

Conclusion

The effect of one's attachment and trauma history, as well as feelings of shame, impacts on voice quality and vocal control. The results of the presented studies all point to the need to address further the relation between psychological factors related to early emotional development and voice characteristics among professionals.

Note

1. To explore this issue further, we created a combined variable averaging the two types of insecure attachment (anxious and avoidant; see Fraley et al. ([46])). This composite score predicted maximum intensity $\beta = -0.39$, $SE = 0.19$, $t(23) = -2.09$, $P = 0.04$; jitter $\beta = 0.56$, $SE = 0.17$, $t(23) = 3.30$, $P = 0.003$; and shimmer $\beta = 0.41$, $SE = 0.18$, $t(23) = 2.17$, $P = 0.04$.

Disclosure statement

The authors report no conflicts of interest.

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