7-20-2023

How Does Our Voice Reflect Who We are? Different Ways of Relating to the Voice and the Self Using Implicit Association Tests.

Audrey Elizabeth Tucker

HOW DOES OUR VOICE REFLECT WHO WE ARE? DIFFERENT WAYS OF
RELATING TO THE VOICE AND THE SELF USING IMPLICIT
ASSOCIATION TESTS.

by

Audrey Elizabeth Tucker

A Thesis

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

Major: Speech Language Pathology

The University of Memphis

August, 2023

Acknowledgements

Abstract

This study aims to examine individual differences of the voice's contribution to the self via implicit and explicit associations. A new Implicit Association Test (IAT) about the voice was created and presented to vocal performers and community controls. One-hundred eleven participants completed this voice-related IAT, the Vocal Congruence Scale (VCS), and the Voice Handicap Index (VHI) via an in person, monitored, and timed Qualtrics survey. Findings demonstrated an implicit relationship between the voice and the self. Strength of implicit relationships between self and voice were greater for community controls than vocal performers. This IAT revealed divergent validity with the VCS and VHI. Clinical implications suggest that individuals with an explicit voice relationship may require an overt style of communication, while those with an implicit voice-relationship may still rely on their voice as contributing to their sense of self, even if they do not overtly declare such a relationship.

Table of Contents

List of Figures

Introduction

Voice assessment and treatment is a widely known specialization in the field of Speech Language-Pathology (Koenig, 2022). While the occurrence of voice disorders may range based upon the specific population, gender, age, and occupation, voice disorders claim the title of the most commonly occurring pathology throughout the human lifespan (Titze & Verdolini, 2012). Voice problems negatively impact one of the most primal human needs: communication (Bickford et al., 2013). Individuals seeking treatment for voice problems may struggle with increased effort in voicing, effectively conveying emotion, and embarrassment due to the inability to control prosody and vocal quality. Voice treatment serves to affect change in vocal and non-vocal behaviors to ameliorate these issues (Behrman et al., 2008). Some behaviors affect the voice without any vocalizing by affecting tissue changes of the vocal folds, such as increasing hydration, avoiding irritants, steaming, etc. Other behaviors are vocal, such as conserving one's voice through metering out voice use to accommodate rest and recovery, altering one's loudness, warming up and cooling down the voice, or changing the technique of vocalization.

Altering these behaviors can affect an overall change in the way an individual communicates. For example, a clinician may suggest that a patient practice conservation of their vocal load. Depending on the communication style of the individual, these behavioral changes could either be seamless or require increased cognitive load. Those who approach time management efficiently may easily incorporate those skills when planning opportunities to conserve their voice, while others might have to work on both time management and planning, in addition to practicing conservation techniques. Another example might be asking patients to consider changing vocalization techniques to use more respiratory control (rather than laryngeal hyperfunction). Although this change might be easily learned and integrated into conversation,

1

the quality change that accompanies the increased use of respiratory control might disrupt the familiar sound of the individual's voice and this feedback might be disorienting.

These therapeutic changes in communication style may affect deeper psychological constructs and can have a substantial effect on the identity of the voice patient. Hinging on how closely they associate their voice with their identity, asking an individual to change the way they use their voice may be akin to asking them to change their personality (Colton et al., 2011). Depending on their communication surroundings, someone who is gregarious and talkative, and received overt confirmation of that from family and friends may spend their entire life explicitly identifying as a person who is loud. They might even begin the therapeutic interaction with the declarative, "I know that I'm loud and I talk too much." Therapy strategies for someone who carries self-awareness and identifies with this communication characteristic may need to overtly address this conversational style and factor the degree of identity change that might accompany voice change into optimal therapeutic success. Self-reflection activities and counseling techniques that lead the individual to make the best choices for how to maintain their identity, while facilitating a more effective vocal technique, would be vastly different compared to one who possesses less overt awareness or presents with a weaker link between voicing and identity.

The role of voice and identity in rehabilitation should not be underestimated or overlooked. How we change voicing and communication patterns should incorporate a fundamental understanding of the self and identity to maximally improve communication. This project investigated one way to study self and identity in the context of voice and communication.

Literature Review

Sense of Self

The term "self" is an umbrella category under which many related terms reside. As a construct, the self is a common thread between psychology and other social and behavioral sciences (Leary & Tangney, 2012, p. 1), which reflects its ubiquitous nature. Findings from disparate research traditions intersect to address this construct, and it becomes evident that the research area and the concept of the self is not independent, but a complex network that interfaces with many philosophies, approaches, and applications (Morf & Mischel, 2012). Such an involved construct like the self employs various avenues to examine its structure. Indeed, this term can be viewed from many different perspectives, which can be observed in the literature via the numerous self-hyphenated subcategories such as: self-respect, self-image, self-efficacy, self-care, and self-identity. In addition to the categories of self, the research lens into the self can be viewed from several vantage points including: the contribution of the self as synonymous with the total person, the role of personality in the self, the self as a receptor of senses and experiences, the self as the conceptualization of behaviors, preferences, and beliefs, and the self as controller of decisions (Leary & Tangney, 2012, pp. 4-5). Given the wide range of categorical definitions and perspectives, Leary and Tangney (2012, p. 6) petition for more specificity in the field of self-terminology to foster future research growth. However, more specificity of the research into the self would lead to an overwhelming amount of research findings, which might prove too cumbersome in developing a larger concept of the self. With this notion in mind, they recommend that each individual perspective consider the other perspectives in research planning and development.

The self uses different viewpoints, such as the dichotomy between a malleable sense of self, which would change according to environment, or a stable sense of self, which persists across situations (Markus & Kunda, 1986). The self can also be measured via the relative dominance of interoception versus exteroception (Tajadura-Jiménez & Tsakiris, 2014). Another example includes the self as observed via unconscious behaviors or preferences, or overt declarations and choices (Greenwald & Banaji, 2017). While there are a myriad of contrasts that can illuminate various aspects of the self, one that is particularly notable is the distinction between implicit and explicit sense of self. An explicit sense of self is easily understood and often exclusively studied, to the extent that this explicit sense of self is often the only aspect of the self we measure. However, individuals also have an implicit sense of self, which, although hidden, can inform us of a deeper and more fundamental contribution to an individual's experience of themselves (Devos et al., 2012).

As stated by Devos and colleagues (2012, p. 155), the definition "implicit" is noted by an absence of conscious perception, dominance, purpose, and reflection. These authors discuss the discrepancy of the implicit and explicit sense of self, and the conundrum that occurs when the person being studied is also the one providing the information. It is hard to disentangle if the person's true sense of self is being measured or if it is filtered through the lens and biases of the person providing the information. However, the authors contend that there are circumstances that can illuminate the true sense of self particularly when the individual being observed does not have cognitive awareness of their aspects of self. If this form of inaccessible consciousness can be measured, it presents a unique opportunity for researchers to exploit when studying the self. For instance, consider asking individuals to sort playing cards according to their attribute by placing all red cards on the left and all black cards on the right. This should be relatively easy.

Instead, if you ask the individuals to sort diamonds and clubs on the right and hearts and spades on the left, this task may take longer. However, if you are a bridge player, this second sorting task will be much faster because hearts and spades are associated in the game of bridge as higher scoring cards. Thus, this task can sort bridge players from non-bridge players by implicit association (Greenwald et al., 2000 p. 1023).

Understanding the difference in explicit and implicit sense of self can inform researchers of aspects of behaviors and social groups. The discrepancy between the explicit and implicit self may foster defense mechanisms that seemingly provide protection and lessen anxiety (Rudman et al., 2007). For example, Rudman and colleagues found that males who were told they had been rejected from a societal group revealed an increase of *implicit* self-esteem, but not explicit self-esteem. They suggested that the difference between explicit and implicit self-esteem may be heightened in threatening situations, serving as a positive buffer of self-preservation. Additionally, implicit associations are particularly malleable, or situation dependent (DeHart & Pelham, 2007; Gawronski & Bodenhausen, 2006; Grumm et al., 2009; Koole et al., 1999). DeHart and Pelham (2007) found that individuals were more apt to implicitly demonstrate lower self- esteem on days where increased negative life experiences were reported.

Another quality of the implicit sense of self is the subliminal identification with a novel ingroup (Lane et al., 2005). One does not necessarily need to be a group member for an extensive period of time for this group identity association to occur. In one study, Lane and colleagues (2005) evaluated the implicit identity of association with Yale versus Harvard for Yale students. Ultimately, the implicit association with Yale as an institution was stronger for these students. The strength of this association did not differ from students who had only been at the university for a few days as opposed those who had been at the university for a year. The research

5

investigating the implicit sense of self is clearly not at a consensus of its exact properties.

Nonetheless, the unique contribution of the implicit sense of self, particularly the indirect and unbiased view, may provide ways of understanding the strength of a person's identity with respect to voice use without influencing the person's conscious thoughts.

Implicit Association Test

Development

Visibly observing and directly measuring an implicit sense of self is impossible. However, measurement strategies that take advantage of how an implicit sense of self influences responses and behaviors may provide a window to indirectly observe an implicit sense of self. One such measurement is the Implicit Association Test (IAT), developed to measure implicit attitudes in the context of implicit cognition, which is knowledge that resides below the level of awareness (Greenwald et al., 1998). The test was intended to measure the subconscious preferences (or lack thereof) for certain concepts, or *distinctive associations*. The test required participants to sort two target concepts (flowers and insects) with target attribute associations (pleasant or unpleasant). The goal of this task was to test if the participants' implicit view of flowers was pleasant, and insects was negative. They expected the preference of flowers to be positive and insects to be negative would be widely shared among participants. The test consisted of several tasks, in which responses were all timed and averaged. First, the concept of flowers was defined by placing a related word between the concepts: flower and insects. For example, the participant viewed the word "rose" between the target selections of flower or insect. Thus, the participant selected either "flower" or "insect" when they read the word "rose." See figure 1 as an example. They timed each response latency in order to calculate the average response time for the sorting of each trial or *step*. (However, response latencies for the first two

6

items of each step were dropped in analysis due their lengthened times.) In initial studies,

participants received feedback on the correctness of their responses in this step.

FLOWER	STEP 1 (practice trials)	INSECT
●	rose	○
○	spider	●
●	tulip	○
○	beetle	●
●	petunia	○

Figure 1: IAT Step 1. Participants sort the middle item as either a flower or an insect. The dark circles indicate the correct response.

Similarly, in the second step, participants completed an attribute association task by

sorting words into pleasant and unpleasant categories. They did this by taking words that are

characteristically defined as pleasant and unpleasant (e.g., happy and disgust) and having the

participant choose the association (pleasant vs. unpleasant). Again, timing and correct responses

were recorded. See figure 2 as an example.

pleasant	STEP 2 (practice trials)	unpleasant
●	happy	○
○	angry	●
●	peace	○
○	disgust	●
●	love	○

Figure 2: IAT Step 2. Attributes in the middle are categorized as pleasant or unpleasant. The dark circles indicate the correct response.

Then, the authors combined attribute association with concept *on the same key*. This was done to include both concepts and attributes that had already been defined in the prior steps. If the participants have a stronger positive association with flowers, this should be a simple task. See figure 3 for an example.

pleasant or FLOWER	STEP 3	unpleasant or INSECT
●	happy	○
○	spider	●
●	tulip	○
○	angry	●
●	petunia	○

Figure 3: IAT Step 3. The dark circles indicate the correct response.

Finally, in the last set of tasks, the researchers reversed the combination of the attributes and concept targets (for example unpleasant/flower and pleasant/insect, see figure 4.). This task

should be harder if the association between flowers and pleasant are implicitly connected and thus, take longer to complete. However, if there is no implicit connection between flowers and pleasantness the task should be just as simple as the previous task and take the same amount of time. Thus, the *speed* of the response indirectly reflects the ease of the task, or in other words, the speed of the response reflects the *implicit association* between flower and pleasant. This IAT effect is the average latency time between steps 3 and 4, where a greater difference between the timing in step 3 and step 4 would represent an implicit association between the concept and attribute.

pleasant or INSECT	STEP 4	unpleasant or FLOWER
○	rose	●
●	spider	○
○	tulip	●
●	beetle	○
○	petunia	●

Figure 4: IAT Step 4. The dark circles indicate the correct response.

Validation

Once this methodology was initially tested, Bosson et al. (2000) sought to compare the psychometric properties of the IAT with six other existing implicit measures as well as related explicit measures. Through an exploratory project, the authors examined predictive validity and underlying constructs of both implicit and explicit measures of self-esteem (including the IAT) using 40 male and 44 female graduate students. Ultimately, the authors found only weak correlation between the implicit and explicit measures, suggesting that at least for self-esteem,

implicit and explicit self-esteem are different constructs. However, when the explicit measures, such as the Rosenberg Self-Esteem Scale (RSES) and the Self-Liking and Competence Scale (SLC), were given *before* the implicit measures, these tests showed a greater correlation with implicit measures, which indicated that explicit situation or priming may play a role in the implicit measures. When the order of the explicit-first versus the implicit-first tasks were switched, the subliminal attitude-prime task[1] (an implicit measure) and the IAT did not differ in predictive validity. Additionally, the authors found weak correlations among seven different implicit measures. (Stable test-retest reliability was only found for the IAT and the initials-birthday preference task[2].) Although there were the weak correlations among the implicit tasks, the authors discuss that these implicit measures may approach different relationships in different ways. They also suggested that correlations might improve if the underlying constructs are similar. Relatedly, from their findings they asserted that there should be some overlap in implicit and explicit self-esteem measures if the content studied is similar, despite being accessed through two different means (implicit and explicit). For example, higher correlations should be found if both measures purport to capture personal aspects of self-esteem (I am pretty) rather than if one measured personal aspects and the other measuring social aspects (I am popular).

In 2022, Yovel et al. took this notion and tested a new form of the IAT with the goal of a clearer interpretation of general self-worth. Their new adaptation, the Self-esteem Questionnaire-based Implicit Association Test (SE-qIAT), differs from the original IAT because it used items

---

[1] The subliminal attitude-prime task is an implicit measure developed by (Spalding & Hardin, 1999). This is a similar unconscious association task which displayed priming words quickly and required participants to sort antonym word pairs (e.g. "happy/sad") with the priming words (e.g. me vs them).

[2] The Initials-and birthday-preference task required participants to rank the letters of the alphabet and numbers 0-35 based on preference with the notion that personal initials and birthdates will have higher rankings.

from another validated, and explicit, self-esteem questionnaire, the Rosenberg Self-Esteem Scale. They adapt the current IAT by using statements for the stimuli of the Rosenberg Self-Esteem Scale rather than single words. By using these stimuli, the authors believe that the construct of self-esteem was more accurately exemplified. The authors tested the validity of the SE-qIAT by comparing it to the standard explicit Rosenberg Self-Esteem Scale and the original IAT for self-esteem (Greenwald & Farnham, 2000) with increased sample size. Ultimately, findings supported the reliability and validity of the new SE-qIAT. The literature suggests that implicit-explicit correlations are stronger when the same set of stimuli are used in both implicit and explicit measures. The development of other conceptual relationships using the IAT warrants further exploration and adaptations but should include current explicit measures as a guide.

Given the unique nature of the IAT, there might be a tendency for individuals to respond because of the methods used and not because of their underlying implicit sense of self. Greenwald & Farnham (2000) sought to establish the level of this potential method variance in three experiments. In experiment 1, self-esteem was measured using positive and negative association. In experiment 2, implicit gender concept was measured using self-concept with masculine and feminine stimuli. In experiment 3, a resiliency concept was assessed by testing the IAT's validity in predicting responses to success and failure. Experiment 1 and 2 revealed discriminate validity with low correlations among IAT measures and explicit measures, suggesting that the IAT indeed measured the constructs without interference from the unique method. However, experiment 3 demonstrated predictive validity for the participants with high self-esteem measured in experiment 1 with stronger correlations between experiment 1 and 3. The authors suggest that resiliency as measured in their IAT might be related to self-esteem, and that the relation between these two tests was more about the related constructs and not due to the

similar methods. The fact that experiment 2 differed between the two other experiments was evidence that construct cohesiveness and not method variance explained the predicative validity between experiments 1 and 3. In this same article, the authors investigated, test-retest reliability for experiment 1 and 2 and found similar correlations ($r = .55$), which is close to the average of the original 1998 Greenwald IAT. This indicates modest reliability for future use.

In summary, the IAT method reflects loose relationships between other implicit measures and the strength of this relationship increases if the underlying constructs are similar. Likewise, the IAT appears to be sensitive to priming when explicit measures are given prior to the IATs, suggesting that order is important in administering the IAT. Finally, the IAT appears to be sensitive to the words or phrases that are chosen.

Other "self" constructs measured

The IAT has been used to measure the construct of self-agency, defined by Weis et al. (2022) as the capability to adopt and pursue goals. Based on the premise that the IAT is a task that measures the implicit association of words and self-concepts, Weis and colleagues sought to examine if *self*-related first-person pronouns (i.e. "me" and "my") had a stronger relationship to actions (verbs) vs. *other*-related pronouns (i.e. "he" and "him"). If individuals' self-agency could be measured implicitly, then they would associate self-related pronouns more strongly with verbs than nouns. The researchers followed the same methodology employed in the original IAT created by Greenwald and colleagues in 1998 discussed earlier in this section. Participants first categorized verbs vs. nouns, then they categorized self vs. other (i.e. "me" should be categorized as "self" and "her" as "other"). They combined the self/other-concepts and nouns/verbs-attributes in the shared response key. So, verbs were combined with *self*, and nouns with *other*,

which would be a congruent condition. The incongruent conditions would be switched, verbs with *other* and nouns with *self*, and should take longer. See figure 5.

"verbs" or SELF		"nouns" or OTHER
●	Hers	○

"verbs" or OTHER		"nouns" or SELF
○	Hers	●

Congruent Example   Incongruent example
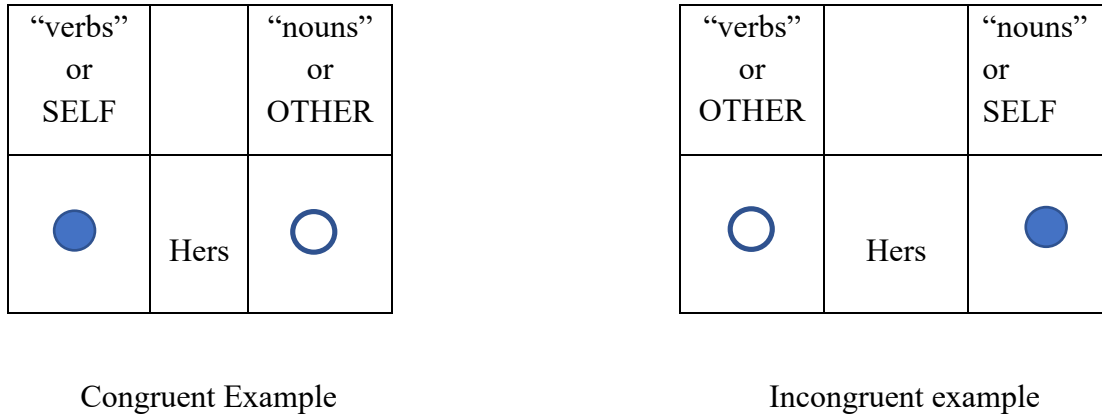
Figure 5: Congruent and Incongruent steps. The dark circles indicate the response indicative of high self-agency.

The IAT finding was the speed with which the congruent responses were selected as opposed to the incongruent responses. In this way, the researchers sought to discover if verbs and self-related pronouns have a stronger relationship by association. The results verified the hypothesis with participants demonstrating notably faster responses with the verb and self-related stimuli. The authors assert that perhaps individuals prefer verb expressions when referencing themselves, and that there is a link between agency, actions as noted in verbs, and the self.

Conner and Barrett (2005) studied whether self-esteem attitudes predict unprompted, affective experiences in everyday settings. The researchers hypothesized that implicit self-attitudes of self-esteem (measured via the IAT) would relate to the intensity of feelings in day-to-day life above what was predicted by only explicit self-esteem attitudes in Rosenberg Self-Esteem Scale. Participants completed direct measures (the Rosenberg Self-Esteem Scale) and indirect measures (the IAT) at the start of the study. Then, each participant went home with a

computer and instructions to indicate how they felt in that exact moment by ranking 29 emotions on a scale of 0-6, 10 times per day. After one week, the participants completed the IAT on the computer. This IAT was curated to assess the concepts ME and NOT ME and the attributes of *pleasant* and *unpleasant*. The authors believe this study showed that implicit self-evaluations predict how one feels in daily life. Implicit attitudes about the self did account for the difference in affective experience, going above and beyond above explicit attitudes on their own.

The IAT also appears to be a valid measure of personality. Back et al. (2009) posited a behavioral process model of personality that specifies explicit and implicit aspects of the self-concept of personality serve as predictors of actual behavior. The authors found that direct measures (questionnaires) of personality predicted behavior for all Big Five personality dimensions being assessed (neuroticism, extraversion, openness, agreeableness and conscientiousness). Indirect measures (IATs) of neuroticism and extraversion also predicted actual behavior. The predictive validity of the IAT for neuroticism and extraversion was incrementally greater than the direct self-report personality measures. As such, the authors suggest that developing new direct and indirect measures that are more closely related to behavioral activation might provide greater insight into how self-attitudes affect future behavior. Additionally, the authors verified that personality traits can be both explicitly and implicitly measured.

Voice and identity

Recent Investigations

Voice is a primary marker of identity (Crow et al., 2019). One's voice and one's self-identity are strongly related; impair one and it will affect the other. Since the voice holds unique individualistic qualities due to anatomy, physiology, and psychology, it stands to

reason that there is a connection between the voice and the reflection of the self. Crow and colleagues (2019) coined the term *vocal congruence* to represent the degree to which the voice reflects the sense of self and established that interoceptive awareness predicts whether the voice is used as a marker of self. The authors suggest that understanding the degree to which the voice reflects the self is important in the success of voice therapy for individuals who may have a voice disorder. For example, individuals high in interoceptive awareness might respond better to therapies that are sensory focused and less mechanical.

However, interoceptive awareness is only one way to conceptualize the relationship between the voice and the self. There may be others, such as explicit and implicit senses of self that might be helpful in addressing what kinds and types of therapy might be best used in voice disorders. For example, Krause et al. (2022) evaluated how exposure to different types of singing styles, as seen on television shows such as *The Voice,* influence an individual's singing self-concept in untrained singers. Four experimental conditions were employed using various recording versions of the song "Happy Birthday". One recording was of an amateur singing, the next was a professional singing in an unembellished style (straight), and the third was a professional singing in the aesthetic style of music typically sung on *The Voice*. The control condition was a piano version of the song with no singing voice. The authors found that participants who heard the piano control version had a significantly higher likelihood to have the desire to improve their own singing versus those who heard the embellished professional version. The results suggest that the exposure to reality television singing has a negative influence on an individual's singing self-concept and that personal aspirations, without comparison, influence self-concept more than an expert performance. This finding is less intuitive given that it is a common belief that master performances would motivate individuals

to become more masterful. This study suggests that personal identity and the affiliation with the self is a better predictor of motivation than aspirations of mastery.

It is undoubtedly important to understand not only the extent of vocal congruence someone has with their voice in order to appropriately and effectively train vocal behaviors, but also to discover the nature of the affiliation one has with one's voice. Given their high degree of training and vocal rapport, many professional and aesthetic voice users such as singers, actors and teachers have an obvious relationship with their voice. Additionally, these voice users are frequent treatment-seekers as the demands placed on their voices expose them to extra risk for vocal pathologies (Roy et al., 2004). In a meta-analysis by Pestana et al. (2017), researchers asserted that singers of all genres are more likely to seek treatment for a voice disorder. A review of voice disorders among teachers by Martins et al. (2014) found that the prevalence of voice problems among teachers is two to three times more likely than the common population. This high prevalence of voice problems in teachers can not only cause an occasional absence from work, but also a change in career (da Costa et al., 2012). Clearly, these populations warrant specialized attention in the treatment space and one might assume implicit affiliations between voice functioning and the self that might be influenced by a voice problem.

Voice, identity, and treatment concerns.

Individuals that relate their voice to a part of themselves unconsciously may have a hard time untangling their own biases with respect to how they sound, such as why they dislike a certain style of singing or training. On the other hand, an individual with a conscious view of their voice as their identity may find it difficult to cognitively shift their ingrained ideas of how they should sound (which may be long standing and no longer serve a functional purpose.) Treatment that changes the way an individual experiences their own voice might be ineffective in

both situations with their bias originating from vastly different genesis; one implicit, the other explicit. Thus, addressing the relationship between the voice and the self might first determine if these biases are consciously held or unconsciously embraced.

The way we see our voice as a part of ourselves could also determine if we even seek treatment in the first place. For example, if an actor is more implicit in their view of voice as self, vocal difficulties may not show up as a voice pathology per se, but rather as a difficulty cultivating a specific character. This individual will be more apt to seek acting coaching rather than medical advice. Additionally, if a teacher experiences vocal difficulty and seeks treatment, they might need to revisit a long-cherished teaching technique of explaining things in multiple ways. A teacher may find it challenging to let go of this teaching technique in order to further conserve their voice use. This explicit identification of being an effective teacher as one who conveys extensive verbal information might affect treatment adherence to conservation techniques. Hence, someone with a greater sense of implicit voice as self may not realize that a vocal problem warrants professional attention, whereas someone with a greater explicit sense of voice as self may be overly reactive to even the smallest voice deviation. Just as the self-esteem IAT predicts spontaneous behavior, perhaps a vocal congruence IAT could predict behavior as it relates to vocal identity, and thereby inform treatment strategies.

Purpose

The purpose of this study was to examine: 1) if an implicit relationship connecting the voice to the self can be detected with the IAT and 2) if the IAT will correlate other explicit measures of the voice. For the first research question, this study used an IAT validity technique, the known group validation approach (Lane et al., 2005) that employs a group that is known to have a relationship between a concept (in this case, *self*) and an attribute (in this case, *preferred*)

17

and compare IAT timings with a control group. We hypothesize that compared to community controls, vocal performers, who have an obvious relationship with their voice, will have a stronger timing difference score between steps 3 and 4.

For the second research question, this study correlated the voice-related IAT scores with two self-report measures known to link voicing and the self, the Vocal Congruency Scale (VCS; Crow et al., 2019) and the Vocal Handicap Index (VHI; Jacobson et al., 1997). We hypothesize that if the new voice-related IAT scores correlate with the VCS then it would show that the relationship between the voice and the self is a construct that is both implicitly and explicitly measured. However, if the voice-related IAT and the VCS do not correlate then it could mean that an explicit knowledge of how the voice relates to the self is a separate construct than an implicit sense of the voice and self. We also hypothesize that the voice-related IAT would negatively correlate with the VHI based on past literature that suggests that vocal congruence and voice handicap are negatively correlated (Crow et al., 2019; Gartling et al., 2021).

By determining if professional voice users see their voice as a part of themselves through different filters, treatment can be affected. Individuals who approach their voice as part of themselves from an explicit perspective may need a more overt style of treatment, while those with a more implicit perspective may still value their voice greatly, even if they do not need to discuss their voice to the same extent. Under what conditions and for what individuals do implicit and explicit attitudes overlap (Lane et al., 2007)? Research in this area may help identify those who require different approaches and perspectives in voice therapy, thus affecting treatment. While many IATs have been conducted, one that identifies association between voice and sense of self has yet to be attempted.

Participants

Participants in this study consisted of mainly students from the University of Memphis Communication Sciences and Disorders program, the Rudi E. Scheidt School of Music, the Department of Theatre & Dance, and the Department of Psychology. A total of 111 participants (25 males, 83 females, and 3 nonbinary individuals) between the ages of 17-65 (M=23.9, SD=6.3) were included in this study. 1 participant was excluded due to technical difficulties and an incomplete survey. There were 66 healthy controls and 45 performers included in analysis. Please see table 1 for greater detail on the demographics of these individuals.

Table 1
Demographics of each participant group.

Group	Community Controls			Vocal Performers		
Average Age	25.8 years			20.6		
Gender	Female	Male	Non-binary	Female	Male	Non-binary
Amount	58	6	2	26	19	1

Inclusionary criterion consisted of all participants (both performers and controls) having healthy, typically functioning voices as determined by a score below 30 on the Vocal Handicap Index self-report measure (VHI; Jacobson et al., 1997). Inclusion criterion for the performer group required that participants have a greater than expected relationship with their voice as an actor or singer, reflecting a large segment of a typical clinical population. Singers and actors had to either be in pursuit of a performance degree in or have a minimum of 5 years' acting experience if they had no formal training. All participants (both performers and controls) were literate in English for both reading and speaking as observed during initial consenting, and

participants had sufficient cognitive abilities to follow the directions of the study. Exclusion

criterion for all participants consisted of voice disorders as well as any neurological or structural

impairments as determined through self-report. This was an exploratory research project and no

previous research on these particular methods were known. In a previous study (Crow et al.,

2019), there were about 50 individuals who completed the VCS with appropriate power. Also,

the range of participants from some past IATs were between 41-300 total participants (Bosson et

al., 2000; Greenwald et al., 1998; Greenwald & Farnham, 2000; Weis et al., 2022; Yovel et al.,

2022).

Measures

Independent measures

All independent measures were administered via a Qualtrics interface and survey

completion was done on personal tablets and phones.

Implicit Association Test. Because we do not know if there is an implicit relation

between the voice and self, a new IAT was developed. This was done to evaluate if the IAT can

identify an implicit relationship between the voice and the self (to answer research question 1).

Three domains of interest were developed: Self-Esteem, Communication, and Voice. This IAT

used "ME" and "NOT ME" as a *concept* and "preferred" or "not preferred" as *attributes*. This

self-esteem concept utilized target words (e.g. self, other) to be sorted as "ME" or "NOT ME."

These words were a direct replication of the Greenwald and Farnham study and served as an

unrelated concept comparison. To assess an implicit sense of self related to voice use, we sought

to contrast that with an implicit sense of self related to communication. Because voice-related

words mostly refer to expression and communication, we chose to employ a related concept

comparison, non-vocal communication. If our target attribute words were only voice-related, we

would not know if the sense of self was specific to voice or if it was measuring a communication-related sense of self. Therefore, for the training of the attributes, the *target* words for "preferred" and "not preferred" had two types of words. Half were voice-related words (e.g. sing, laugh) and half were non-vocal communication (e.g. write, wave) related words. Please see Appendix A for an example and a complete list of all target words as they related to the attributes, Self, Communication, and Voice. This IAT included 5 steps as used in the IAT development and based on methodology in Greenwald and colleagues (1998).

Informal Intake. Participants completed an informal intake surveying demographics. At the end of all measures, participants were asked if they identified as an actor, singer, teacher, or none of the above.

Vocal Congruence Scale. The Vocal Congruence Scale, (VCS; Crow et al., 2019) is a 10-item self-rating scale. It is designed to determine the extent to which an individual's voice is congruent with their self-perception. This explicit scale was used for convergent validity and given after the IAT to avoid priming influences.

Voice Handicap Index. The Voice Handicap Index (VHI; Jacobson et al., 1997) is a 30-item questionnaire that asks an individual to rate the function of their voice and the effect of their voice on their life. The measure can be used to assess functional, emotional, or psychological deficits that an individual experiences as a result of a voice disorder and will serve to verify inclusion criteria as well as discriminant validity.

Dependent measures

Timing difference. The primary variable of interest was the timing differences between steps 3 and 4 (the congruent and incongruent trials) of the IAT for the three domains described prior for Self-Esteem, Communication, and Voice. This timing difference assessment served to

21

answer the primary research question: can the IAT identify an implicit relationship between the voice and the self? In addition, scores on the IAT were correlated with the explicit VCS measure to assess construct validity of the IAT for voice and the self to answer the second research question: Will the IAT correlate to other explicit measures of the voice?

Group difference condition. Two groups of respondents, performers and community controls, were compared on the three domains being measures in the IAT: Self-esteem, Communication, and Voice. This analysis, called a known group validation approach, might provide insight into the sensitivity of the IAT to measure the voice as self relationships between individuals who use their voice for performing and those who do not.

Procedures, Instrumentation and Experimental Set Up

Recruitment included an emailed invitation presenting an opportunity to complete a survey following a class or group meeting. The invitation included an announcement to bring a tablet or cell phone to the class or meeting. Surveys taken on a phone in landscape mode were encouraged for fast response selection with a thumb or index finger. The participants were then given the opportunity to stay and take a short survey about their vocal identity in a controlled environment after their class or meeting ended. All of those willing to participate in the survey continued to do so on their personal phone or tablet. Following consent and instructions, the participants completed the IAT and the informal intake. The VCS and the VHI were completed last. Once finished, participants were thanked for their participation. For consistency, the survey was always given in a classroom in a group environment and the same instructions were given every time. Please see Appendix B for a copy of the instructions given.

Extensive work was done in Qualtrics so that each IAT target word was displayed individually, and the participant was timed based upon their first click and last click on the page.

This was done via coding embedded into each word, which was displayed in Qualtrics as a separate question.

Analysis

There are multiple ways to analyze the basic form of the IAT and multiple studies have looked into how to best analyze responses (Greenwald et al., 2003). However, the basic assumption from responses is that responses to congruent trials (step 3 and 3R) should be faster than incongruent trials (step 4), if there is a close association between the concept and the attribute; in this case ME/NOT ME and preferred/not preferred, respectively. Initial versions of the IAT scoring system took response times from the congruent trials and subtracted response times from the incongruent trials. In order to account for the large degree of inter- and intra-participant variability, initial data cleaning techniques included recoding the raw response times that were less than 300 ms, as 300 ms, and greater than 3,000 ms, as 3,000 ms (Greenwald et al., 2003). However, in recent years, IAT studies have included on-line testing without the control of a supervised testing session, which presented greater variability in response times. Thus, more recent data cleaning techniques removed any latencies greater than 10,000 ms because the variance of the latency times included other influences such as internet speed, environmental distraction, etc. Thus, removing latencies of 3,000 ms was too conservative a process.

After data was cleaned, the remaining response times were logarithmically transformed (Greenwald et al., 2003). Comparisons between logarithmic transformations of the response times and a more recent data transformation technique showed that, for each individual, dividing response-time-difference for each trial by the standard deviation of all trials produced data with less noise.

23

For this study, we chose to use the original data cleaning technique of recoding response times of less than 300 ms, to 300 ms, and greater than 3,000 ms, to 3,000 ms. Given that our study presented the IAT in a supervised session, recoding these variables using the conventional approach seemed to best match the experimental conditions in which the study was conducted. However, in an analysis of six different analysis methods for the IAT (Greenwald et al., 2003), logarithmic transformations of the response time difference were not as robust when correlating the IAT with other explicit measures. Thus, for each participant, we chose to divide response time differences for each trial by the standard deviation of all trials produced for that individual.

Response time difference between congruent and incongruent

To answer the question, if the IAT can be used to assess an implicit sense of self and voice, response times for each trial were cleaned and transformed, and they were entered into three separate Student t tests comparing the control group with the performer group in the domains of Self-esteem, Communication, and Voicing. Using a known group validation approach (Lane et al., 2007), if performers present with a greater response-time difference for the Voicing domain, then we can assume that the IAT can measure the implicit association between the self and voicing. We did not expect that there would be group differences between controls and performers in the Self-esteem or Communication domains. The total significance level was set at .05. However, Bonferroni corrections were made to account for multiple comparisons.

Correlations with other self-report measures of voice

To verify that the IAT is measuring a similar construct of voice and self, the average IAT scores for voicing were correlated with the VCS and the VHI. Correlations between the three subscales of the IAT and the VCS could yield one of two desirable outcomes. A relatively high correlation would verify that the IAT is measuring aspects of how an individual relates their

24

voice to their self, thereby establishing construct validity to the IAT. A relatively low correlation would possibly suggest that explicit sense of self with relation to the voice is different than an implicit sense of self.

Correlations between the subscales of the IAT and the VHI could suggest that perceived voice handicap is related to an implicit sense of voice and self. Past literature (Crow et al., 2019; Gartling et al., 2021) demonstrated a negative correlation between the VHI and the VCS, suggesting the higher the perceived voice handicap, the less likely the voice influences the sense of self. Thus, we would expect that if the IAT indeed was measuring a sense of self and the voice, it would be negatively correlated with the VHI.

Results

To answer the question if an implicit relationship connecting the voice and self can be detected with the IAT, response times for each trial were cleaned and transformed. A total of 20,160 possible data points for timing (90 words x 2 trials x 112 participants), no data points were less than 300 ms and there were 638 data points above 3,000 ms that were recoded as 3,000 ms (218 for performers, 2.71%, and 420 for controls 3.35%). Raw response times in ms, on average, were faster for performers (M 971, SD 149) than controls (M 1109, SD 183; t(358) = 7.90, p <.001).

Three separate Student t tests were performed, comparing controls with performers on the Self-Esteem, Communication, and Voicing domains of the IAT. For our two comparison IAT domains, Self-Esteem and Communication, controls and performers did not significantly differ. On the Self-Esteem domain of the IAT, controls' difference score in ms (M -381, SD 251) were not significantly different than the performers' difference score in ms (M -296, SD 112; t(2805) = -2.11, p = .032). On the Communication domain of the IAT, controls' difference score in ms

(M -280, SD 119), there was no significant difference compared to the performers' difference

score in ms (M -223, SD 112; t(2741) = -1.45, p = .146). However, on the Voicing domain of the

IAT, controls' difference score in ms (M -351, SD 122) was significantly greater than the

performers' difference score in ms (M -241, SD 117; t(2737) = -2.75, p = .006), suggesting that

controls may have a greater implicit relationship between the voice and self. Refer to figure 6 for
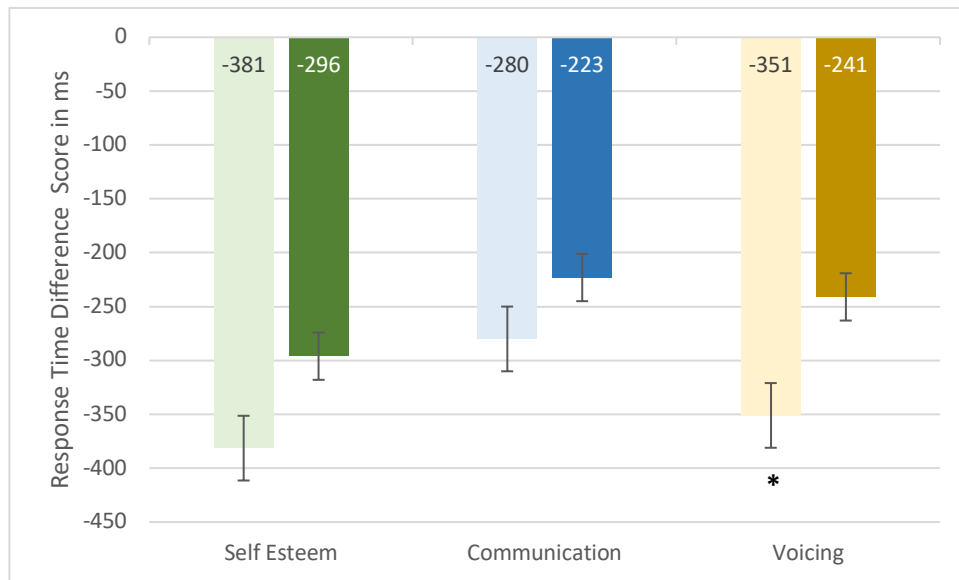
a graphical display of the data.

Figure 6: Difference scores in ms between congruent and incongruent trials for three IAT domains, Self-Esteem, Communication, and Voicing, for controls (lighter shaded graph) and performers (darker shaded graph). Error bars represent standard error. * denotes significant difference of p = .006.

Given the timing differences between controls and performers was statistically

significant, additional analysis included a subset of control participants that were time-matched

with the performers. Difference scores from controls were matched to performers within the

closest time. Again, three separate Student t tests were performed. For our two comparison IAT

domains (Self-Esteem and Communication), controls and performers did not significantly differ.

On the Self-esteem domain of the IAT, controls' difference score in ms (M -283, SD 123) was

not significantly different than the performers' difference score in ms (M -276, SD 172; t(2805) = -2.11, p = .032). On the Communication domain of the IAT, controls' difference score in ms (M -216, SD 120), there was no significant difference compared to the performers' difference score in ms (M -219, SD 94; t(2741) = -1.45, p = .146). However, on the Voicing domain of the IAT, controls' difference score in ms (M -401, SD 118) was significantly greater than the performers' difference score in ms (M -223, SD 103; t(2517) = -4.25, p < .001), suggesting that controls may have an implicit sense of self with respect to their voice. Refer to figure 7 for a graphical display of the data.
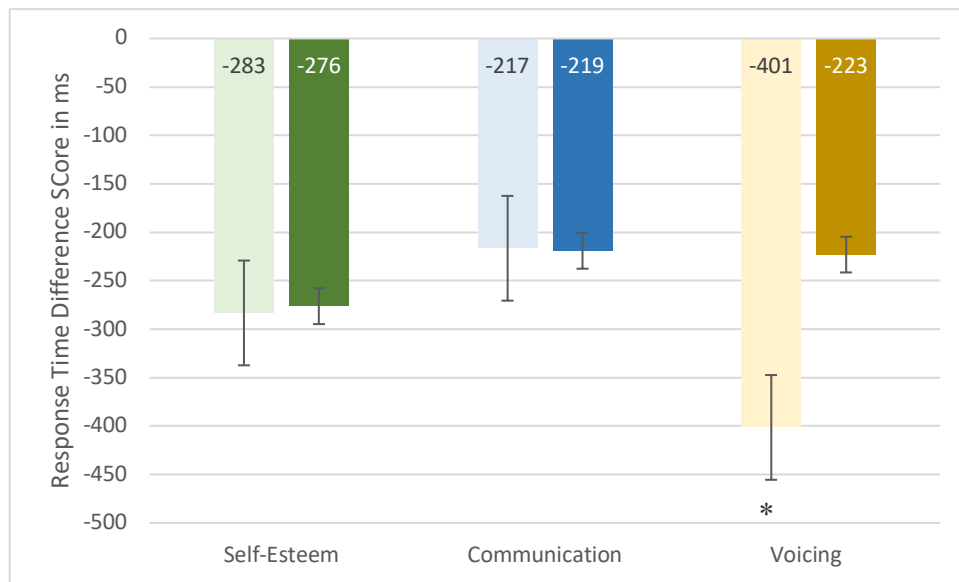

Figure 7: Scores matched for time, difference scores in ms between congruent and incongruent trials for three IAT domains, Self-Esteem, Communication, and Voicing, for controls (lighter shaded graph) and performers (darker shaded graph). Error bars represent standard error. * denotes significant difference of p < .001.

To answer the second question, whether the IAT correlated with other explicit measures of the voice, the three domains of the IAT were correlated with VCS, the total score for the VHI, and the three domains of the VHI. Refer to table 2 for the R-values for all correlations. No correlation existed between any of the IAT domains and the two explicit voice measures: the

VCS and VHI. However, the three domains of the IAT significantly and strongly correlated with each other; Self-Esteem and Communication r = .797, Self-Esteem and Voicing, r = .876, and Voicing and Communication, r = .866. Additionally, the VCS mildly correlated with two subscales of the VHI; VCS and Physical r = -.235, and VCS and Emotional, r = -.288. The VCS also mildly correlated with the total score of the VHI, VCS and VHI, r = -.240. Not surprisingly, the three subscales of the VHI and the total score of the VHI had moderate to strong correlations with each other: Functional and Physical, r = .652, Functional and Emotional, r = .603, Functional and Total, r = .838, Physical and Emotional, r = .733. Physical and Total, r = .923, and Emotional and Total, r = .862.

Table 2
Correlations among the three domains of the IAT, the VCS, and the three subscales and total score of the VHI for all participants.

	IAT Self-Esteem	IAT Communication	IAT Voicing	VCS Total	VHI Functional	VHI Physical	VHI Emotional	VHI Total
IAT Self-Esteem	1							
IAT Communication	.797**							
IAT Voicing	.876**	.866**						
VCS Total	-0.087	-0.122	-0.086					
VHI Functional	0.081	0.030	0.033	-0.148				
VHI Physical	0.088	0.126	0.062	-.235*	.652**			
VHI Emotional	0.000	0.092	0.040	-.288**	.603**	.733**		
VHI Total	0.069	0.099	0.059	-.240*	.838**	.923**	.862**	

Bold typeface indicates a significant relationship. * = significance at .05 level ** = significance at .01 level. Blue shaded cells denote correlations of the three IATs. Green shaded cells denote correlations between the VCS and the VHI. Yellow shaded cells denote intercorrelations within the subtest and total of the VHI.

Discussion

This new IAT uncovered a significant relationship between voice and self. However, the only significant relationship found was in the difference score of the control group in the Voicing domain, which represented an unexpected finding. The control group had a significantly greater implicit difference score in the Voicing domain, not the performers who were hypothesized to have a greater implicit relationship with the self and the voice. When a subset of the fastest control group participants were time matched to the performers, an even greater difference was found for the Voice domain. Performers and community controls did not differ on the Self-Esteem IAT or the Communication IAT, suggesting that these two groups did not differ in aspects of the self related to communication ability or self-esteem.

No correlation was found between any of the IAT domains with the two explicit voice measures, but the three subscales did strongly correlate with each other. The VCS mildly and negatively correlated with the VHI, which replicates past literature (Crow et al., 2019; Gartling et al., 2021). Additionally, the three VHI subscales had moderate to strong correlations with one another and the total score, replicating past literature (Jacobson et al., 1997).

Based on our initial hypothesis, one might expect the performer group to possess the greater difference score, revealing a greater implicit relationship with voice. But in this experiment, the implicit relationship between the voice and the self was not found in the performer group; rather, in the community controls. There are several explanations as to why an implicit relationship may have only been revealed among the control group as opposed to the performer group. During the informal intake following the IAT, participants had the opportunity to self-identify as an actor, singer, teacher, or none of the above. Nineteen members of the control group did self-identify as professional voice users, 5 selected that they identified as

29

singers, and 15 selected that they identified as teachers. Perhaps this particular community control group possessed a greater than expected implicit relationship with voice that is unique to the group. However, it is unlikely that only 19 professionals (performers and teachers) drove the IAT affect for the community controls when 46 performers in the performing group did not show similar timing differences.

Another explanation for these findings is that given the nature of the training of vocal performers, they may rely on outside, explicit affirmation of their relationship with their voice. Vocal performers spend a considerable amount of time working on external aspects of their voice, which might keep their voice in their conscious awareness. Presumably the control group has not spent the same amount of time working on voice-related activities. Nonetheless, it might be that the voice is a primary contribution to their sense of self for everyone. In a study by Hughes and Harrison (2013), individuals rated multiple voice recordings including a recording of their own voice. They rated their voice as more attractive than other's voices without knowing it was their own voice. Investigations into vocal perception also suggest that there are neural pathways that can identify individuals based on their voice functioning (Belin et al., 2011). So, it seems likely that the voice is a major contributor to one's sense of self, whether it is overtly known or not. What is not known is if an implicit relationship between the voice and the self is a default condition and if voice training or performing bring an explicit awareness of the voice and sense of self. Alternatively, it could be that the implicit and explicit sense of self as it relates to the voice is an individual difference, where temperament or perceptual abilities cause some individuals to be more explicit in their understanding of their self as it relates to their voice. Future work in this area might address these questions.

The overall timing of responses suggests that the relationship between implicit and explicit vocal identities in performers may not be straightforward. Generally, performers response times in all trials were faster than the control groups responses. It is entirely possible that because these response times were faster, a difference score between congruent and incongruent trials might have been truncated, thereby reducing any timing differences between trials. Despite these observations, when timing between performers and controls were matched, controls showed a stronger implicit relationship. If there was a truncated effect due to faster overall times in both the congruent and incongruent trials, then controls would not have shown this effect.

Another confound due to the timing differences between congruent and incongruent trials may have to do with the differences of sex in this population. Overall, men were faster in response times for all steps on all domains. Additionally, the performer group had a higher percentage of men (19 in the performer group and 6 in the control group). Although there was a significant difference between the raw speed of responses between males and females, the timing differences between males and females did not influence the results. Thus, faster responses overall still resulted in interpretable timing differences between congruent and incongruent trials.

Table 3

Timing differences among sex differences. Note that the timing of individuals who reported as non-binary (total of 3) were not included in the final calculation between males and females.

	Step 3		p value	Step 4		p value
	Female	Male		Female	Male	
Self	0.921	0.810	0.023	1.177	0.926	0.002
Communication	0.996	0.838	0.006	1.219	0.935	0.001
Voice	1.048	0.845	0.002	1.311	0.957	0.000

Finally, the IAT tests employed in this study may not have optimally captured the voice and self, which would explain the difference between the performers and the controls. In studies

of the past (Greenwald et al., 1998; Greenwald & Farnham, 2000), correlation r-values found between IATs and explicit self-report measures were much higher in those studies (around $r =$ .46; Greenwald & Farnham, 2000) than the r-values between these IATs and the VCS and VHI found in this study (around .09). The lack of correlation between implicit and explicit measures could indicate that implicit sense of self as it related to the voice is a separate construct from the explicit sense of self as measured by the VCS and the VHI. However, it is more likely that the words selected for the voice-related IAT were not optimal and may not reflect any aspects of the voice and self. Yovel et al., (2022), developed an IAT that revealed implicit-explicit correlations were stronger when the same set of stimuli are used in both explicit and implicit measures. With this in mind, future studies might wish to utilize verbiage in the explicit measure of the VCS in a voice related IAT for concepts and attributes. If a similar pattern of responses between community controls and performers still arises from the data, it would strengthen the assumption that implicit and explicit senses of self as they related to the voice are indeed separate constructs.

Implications for Clinical Practice

With the understanding that individuals may have an implicit relationship with their voice and not necessarily an explicit one, we should acknowledge that despite not overtly stating that their voice is an important contributor to their sense of self, it nonetheless might be. In this study, most non-performing individuals possessed a stronger implicit relationship connecting their voice and self. As such, clinicians who might assume that performers have a more "important" relationship with their voice and self should be cautioned that this might not be the case. This covert relationship might explain why some voice patients react negatively to treatment without being able to elucidate why. It might also explain why some patients have seemingly extreme emotional reactions to having a voice impairment. Therapeutic activities and discussions that

address this relationship between the voice and the self, particularly in those who might have an implicit relationship, might be necessary to fully address adherence difficulties or to effectively counsel patients on how their voice use might affect their sense of self.

Additionally, counseling may be different if someone has a greater implicit relationship connecting the voice and self as opposed to those with an explicit relationship. Those with a greater explicit voice-and-self relationship may benefit from counseling that allows the individual to overtly state their experience. Alternatively, those with a greater implicit relationship connecting the voice and self may benefit from counseling that addresses underlying beliefs and limitations.

Another consideration for treatment concerns the way in which clinicians present vocal tasks. If the patient's voice relationship with the self is implicit, treatment strategies may need to focus on bringing voicing behaviors to conscious awareness before they can be modified. On the other hand, for individuals who have a strong explicit awareness that the voice reflects the self, generalization might be problematic. If the voice's relationship to the self is explicit, newly acquired vocal tasks may take longer to become automatic. Generalization strategies might need to be focus on fading explicit awareness of the voice. This might prove difficult in a population of individuals who have come to rely on their explicit evaluation of their voice functioning. Either way, understanding the relationship that voicing behaviors have on a sense of self should guide clinical strategies for learning new behaviors and generalizing them.

Conclusion

Our awareness of how our patients relate to their voice as a part of their self can influence our clinical practice. Determining how different voice users see their voice, implicitly or explicitly, can affect our treatment. This investigation found that community controls presented

with a stronger implicit relationship connecting their voice and self than performers. These unanticipated findings reflect that the voice may be important to all individuals, whether implicitly or explicitly. Clinical considerations should account for the nature of the relationship between the voice and the self.

References

Back, M. D., Schmukle, S. C., & Egloff, B. (2009). Predicting actual behavior from the explicit and implicit self-concept of personality. *Journal of Personality and Social Psychology*, *97*(3), 533–548. https://doi.org/10.1037/a0016229

Behrman, A., Rutledge, J., Hembree, A., & Sheridan, S. (2008). Vocal hygiene education, voice production therapy, and the role of patient adherence: A treatment effectiveness study in women with phonotrauma. *Journal of Speech, Language, and Hearing Research*, *51*(2), 350–366. https://doi.org/10.1044/1092-4388(2008/026)

Belin, P., Bestelmeyer, P. E. G., Latinus, M., & Watson, R. (2011). Understanding Voice Perception. *British Journal of Psychology*, *102*(4), 711–725.

Bickford, J., Coveney, J., Baker, J., & Hersh, D. (2013). Living with the altered self: A qualitative study of life after total laryngectomy. *International Journal of Speech-Language Pathology*, *15*(3), 324–333. https://doi.org/10.3109/17549507.2013.785591

Bosson, J. K., Swann, W. B., & Pennebaker, J. W. (2000). Stalking the perfect measure of implicit self-esteem: The blind men and the elephant revisited? *Journal of Personality and Social Psychology*, *79*(4), 631–643. https://doi.org/10.1037/0022-3514.79.4.631

Colton, R. H., Casper, J. K., & Leonard, R. (2011). *Understanding voice problems: A physiological perspective for diagnosis and treatment* (4th ed.). Lippincott Williams & Wilkins.

Conner, T., & Barrett, L. F. (2005). Implicit self-attitudes predict spontaneous affect in daily life. *Emotion*, *5*(4), 476–488. https://doi.org/10.1037/1528-3542.5.4.476

Crow, K. M., van Mersbergen, M., & Payne, A. E. (2019). Vocal Congruence: The voice and the self measured by interoceptive awareness. *Journal of Voice*, *35*(2), 324.e15-324.e28. https://doi.org/10.1016/j.jvoice.2019.08.027

da Costa, V., Prada, E., Roberts, A., & Cohen, S. (2012). Voice disorders in primary school teachers

and barriers to care. *Journal of Voice*, *26*(1), 69–76.

https://doi.org/https://doi.org/10.1016/j.jvoice.2010.09.001

DeHart, T., & Pelham, B. W. (2007). Fluctuations in state implicit self-esteem in response to daily negative

events. *Journal of Experimental Social Psychology*, *1*(43), 157–165.

https://doi.org/https://doi.org/10.1016/j.jesp.2006.01.002

Devos, T., Huynh, Q.-L., & Banaji, M. R. (2012). Implicit self and identity. In M. R. Leary & J. P.

Tangney (Eds.), *Handbook of self and identity* (2nd ed., pp. 155–179). The Guilford Press.

Gartling, G. J., van Mersbergen, M., Crow, K., Lewandowski, A., Smith, L. J., & Gartner-Schmidt, J. L.

(2021). The Patient Experience: The Relationship Between Vocal Handicap, Congruency, Perceived

Present Control, and Mood Across Four Voice Disorders. *Journal of Voice*.

https://doi.org/10.1016/j.jvoice.2021.08.007

Gawronski, B., & Bodenhausen, G. v. (2006). Associative and propositional processes in evaluation: An

integrative review of implicit and explicit attitude change. In *Psychological Bulletin* (Vol. 132, Issue

5, pp. 692–731). https://doi.org/10.1037/0033-2909.132.5.692

Greenwald, A. G., & Banaji, M. R. (2017). The implicit revolution: Reconceiving the relation between

conscious and unconscious. *American Psychologist*, *72*(9), 861–871.

https://doi.org/10.1037/amp0000238

Greenwald, A. G., & Farnham, S. D. (2000). Using the implicit association test to measure self-esteem and

self-concept. *Journal of Personality and Social Psychology*, *79*(6), 1022–1038.

https://doi.org/https://doi.org/10.1037/0022-3514.79.6.1022

Greenwald, A. G., Mcghee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in
implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, *74*(6),
1464–1480.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and Using the Implicit
Association Test: I. An Improved Scoring Algorithm. *Journal of Personality and Social Psychology*,
85(2), 197–216. https://doi.org/10.1037/0022-3514.85.2.197

Grumm, M., Nestler, S., & Collani, G. von. (2009). Changing explicit and implicit attitudes: The case of
self-esteem. *Journal of Experimental Social Psychology*, *45*(2), 327–335.
https://doi.org/10.1016/j.jesp.2008.10.006

Hughes, S. M., & Harrison, M. A. (2013). I like my voice better: Self-enhancement bias in perceptions of
voice attractiveness. *Perception*, *42*(9), 941–949. https://doi.org/10.1068/p7526

Jacobson, B. H., Johnson, A., Grywalski, C., Silbergleit, A., Jacobson, G., Benninger, M. S., & Newman,
C. W. (1997). The voice handicap index (VHI): Development and validation. *American Journal of
Speech-Language Pathology*, *6*(3), 66–69. https://doi.org/10.1044/1058-0360.0603.66

Koenig, E. (2022). Becoming a voice specialist in the absence of a dedicated fellowship. *Perspectives of
the ASHA Special Interest Groups*, *7*(October), 1–3. https://doi.org/10.1044/2022_persp-22-00068

Koole, S. L., Smeets, K., & Dijksterhuis, A. (1999). *The cessation of rumination through self-affirmation*.

Krause, A. E., Forbes, M., Lowe-Brown, X., & Krause, A. (2022). *Does reality television-style singing
influence singing self-concept?*

Lane, K. A., Banaji, M. R., Nosek, B. A., & Greenwald, A. G. (2007). Understanding and Using the
Implicit Association Test: IV What We Know (So Far) about the Method. In B. Wittenbrink & N.
Schwarz (Eds.), *Implicit Measures of Attitudes* (pp. 59–102). The Guilford Press.
www.implicit.harvard.edu.

Lane, K. A., Mitchell, J. P., & Banaji, M. R. (2005). Me and my group: Cultural status can disrupt cognitive consistency. *Social Cognition*, *4*(23), 353–386.

Leary, M. R., & Tangney, J. P. (2012). The self as an organizing construct in the behavioral and social sciences. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of Self and Identity* (2nd ed., pp. 1–6). The Guilford Press.

Markus, H., & Kunda, Z. (1986). Stability and malleability of the self-concept. *Journal of Personality and Social Psychology*, *51*(4), 858–866.

Martins, R. H. G., Pereira, E. R. B. N., Hidalgo, C. B., & Tavares, E. L. M. (2014). Voice disorders in teachers. A review. *Journal of Voice*, *28*(6), 716–724. https://doi.org/https://doi.org/10.1016/j.jvoice.2014.02.008

Morf, C. C., & Mischel, W. (2012). The self as a psycho-social dynamic processing system: Toward a converging science of selfhood. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 21–49). The Guilford Press.

Pestana, P. M., Vaz-Freitas, S., & Manso, M. C. (2017). Prevalence of voice disorders in singers: Systematic review and meta-analysis. *Journal of Voice*, *31*(6), 722–727. https://doi.org/10.1016/j.jvoice.2017.02.010

Roy, N., Merrill, R. M., Thibeault, S., Parsa, R. A., Gray, S. D., & Smith, E. M. (2004). Prevalence of voice disorders in teachers and the general population. *Journal of Speech, Language, and Hearing Research*, *47*(2), 281–293. https://doi.org/10.1044/1092-4388(2004/023)

Rudman, L. A., Dohn, M. C., & Fairchild, K. (2007). Implicit self-esteem compensation: Automatic threat defense. *Journal of Personality and Social Psychology*, *93*(5), 798–813. https://doi.org/10.1037/0022-3514.93.5.798

Spalding, L. R., & Hardin, C. D. (1999). Unconscious unease and self-handicapping: Behavioral

consequences of individual differences in implicit and explicit self-esteem. *Psychological Science*,

10(6), 535–539. https://doi.org/10.1111/1467-9280.00202

Tajadura-Jiménez, A., & Tsakiris, M. (2014). Balancing the "inner" and the "outer" self: Interoceptive

sensitivity modulates self–other boundaries. *Journal of Experimental Psychology: General*, *143*(2),

736–744. https://doi.org/10.1037/a0033171.supp

Titze, I. R., & Verdolini, K. A. (2012). *Vocology: The science and practice of vocal habilitation*. National

Center for Voice and Speech.

Weis, P. P., Nikadon, J., Herbert, C., & Formanowicz, M. (2022). The verb–self link: An implicit

association test study. *Psychonomic Bulletin and Review*. https://doi.org/10.3758/s13423-022-02105-0

Yovel, I., Aviram, G., Kahana, N., & Katz, B. A. (2022). Testing a new indirect measure of general self-

worth: The self-esteem questionnaire-based implicit association test. *British Journal of Social

Psychology*, *61*(1), 100–120. https://doi.org/10.1111/bjso.12472

Concept Practice

ME	Step 1 (30 practice trials)	NOT ME
◯	self	◯
◯	other	◯
◯	my	◯
◯	they	◯
◯	mine	◯

Attribute Practice

preferred	Step 2 (60 practice trials)	not preferred
◯	sing	◯
◯	write	◯
◯	speak	◯
◯	text	◯
◯	vocalize	◯

Congruent Trial

ME or preferred	Step 3 (90 trials)	NOT ME or not preferred
◯	self	◯
◯	other	◯
◯	sing	◯
◯	write	◯
◯	vocalize	◯

Congruent Trial with Reversed Sides

NOT ME or not preferred	Step 3r (15 trials using a subset of 5 target words in each construct)	ME or preferred
◯	write	◯
◯	sing	◯
◯	text	◯
◯	speak	◯
◯	type	◯

Incongruent Trial

ME or not preferred	Step 4 (90 trials)	NOT ME or preferred
◯	self	◯
◯	other	◯
◯	sing	◯
◯	write	◯
◯	vocalize	◯

This is an example of the IAT used for this study. Step 3r serves as the reversal of the attributes in step 3 as the purpose of a balance, which was used in previous IATs. Because participants might associate answering on the left more than the right side of the target, step 3r removes response bias. The same words will be used for all trials. There will be a total of 15 "me" words and 15 "not me" words (30 for self-esteem), and 30 voice-related words and 30 non-voice communication related words.

* The specific words in the me/not me concept are taken directly from Greenwald and Farnham, 2000.

All words used in the newly created IAT

Self words	Voice words	Communication words
self	sing	write
other	speak	texting
my	vocalize	typing
they	hum	smile
mine	chat	point
theirs	pitch	smirk
I	intone	pen
it	chortle	nod
myself	song	eye contact
you	recite	wave hello
my own	enunciate	silent
he	lip trill	hand shake
my personhood	talk	hug
she	shout	listen
my feelings	chant	journal
his	resonate	hear
my thoughts	discuss	watch
hers	laugh out loud	observe
my home	banter	notate
yours	gab	author
my name	confer	email
them	dialogue	poet
my body	converse	text message
male	yell	tweeting
my date of birth	talk	read
your own	speak up	scribble
my soul	monologue	jot down
female	discourse	send a letter to
me	articulate	written
not me	holler	novelist

Appendix B

These are the exact instructions that were given before every survey

Thank you for participating in our survey. This survey will present you with a lot of words that you will be sorting into one of two categories. The point of this survey is to sort these words as fast as you can.

To make sure that everyone is responding in the same way we would like you to place (or hold) your phone flat and sort the words with your thumbs (model this).

Again, it is important that you sort these words *rapidly* and go with your gut instinct. It will not be helpful if you overthink your answers because there are no "wrong" answers to these questions. So, try to sort the words as fast as possible. The questions in this portion auto advance, so you do not have to press the next button.

After you sort the questions, you will fill out two other questionnaires. The instructions for each questionnaire will be given to you in the survey.

To begin I will give you a participant number and a QR code.

Once you open the QR code on your phone, place your phone in landscape mode and begin the survey after you complete the consent form.

Total time for this survey will be about 20-25 minutes.

Thank you!