The Role of Voice Persona in Expressive Communication: An Argument for Relevance in Speech Synthesis Design

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Abstract

We present an approach to imbuing "expressivity" in a synthesized voice by acquiring a thematic analysis of 10 interviews with vocal studies and performance experts to inform the design framework for a real-time, interactive vocal persona that would generate compelling and appropriate contextually-dependent expression. The resultant 'tone of voice' is defined as a point existing within a continuous, contextually-dependent probability space. The inclusion of voice persona in synthesized voice can be significant in a broad range of applications. Of particular interest is the potential impact in augmentative and assistive communication (AAC) community. Finally, we conclude with an introduction to our ongoing research investigating the themes of vocal persona and how they may continue to inform proposed expressive speech synthesis design frameworks.

Index Terms: voice persona, expressive speech synthesis, inclusive design, augmentative and assistive communication, thematic analysis

1. Introduction

The human ability to control and manipulate the voice both linguistically and paralinguistically facilitates vocal communication of ideas, emotions, personality traits and identity with subtlety [1,2,3,4], enabling the voice to play a central role in human social interaction. Adaptive modulation of the voice to convey expression and communicate with contextually-appropriate specificity is a critical aspect of human interaction. Our purpose here is to identify key factors implicated in shaping vocal persona with particular focus on the potential contribution in technologies for the augmented and assistive communication (AAC) community.

The notion of vocal personas is described by Tagg as the capacity to control the voice “not just to utter words but also to present our individual or group identity, and to express emotions, attitudes and behavioural positions,” which is a vocal manifestation of an aspect of personality made perceptible to prosody or the singing voice [5]. Describing vocal emotion and personality, Kreiman argues that while humans share some vocal emotion processes with animals, it is our elaborated cognitive processes that allow us to consciously modulate what is produced. This affects what is perceived by others, distinguishing the human voice as a direct window into an internal emotional state [4].

The past several decades of speech synthesis research have seen great progress in modeling and implementing paralinguistic control of the voice. State-of-the-art text-to-speech (TTS) and voice cloning systems, leveraging generative models as primary synthesis engines, are capable of synthesizing speech with impressive similarity to that of a human voice. Depending on the implementation, these systems can generate speech that emulates either the voice of a user or of a desired archetype. Classical parametric synthesis has utilized well-studied parameters, such as spectral and acoustical properties of the human voice, alongside linguistic, prosodic and phonetic contexts [6,7,8], while many generative neural networks seek to learn these parameters as latent features of an observed speech audio dataset [9,10,11,12]. Although their parameter sets may differ, both models are capable of generating intelligible speech with a perceptually-continuous “tone of voice” given the “correct” choice of low-level features. Additionally, recent advances in expressive neural TTS research have enabled control of low-level prosodic features (e.g. speech rate, voice quality, and pitch range) in addition to selection of speaker identity and speaking style. Vocal attributes manipulated for expressivity such as pitch variability, voice quality, pronunciation/stress, and speech rate/cadence can be determined by example [24,25] or by direct control [14,15,16]. Furthermore, the role of personality and expressivity of synthetic voice in social interaction has been shown to increase technologically-mediated engagement and connection [17,18,19,20,21].

However, several key aspects of paralinguistic control demand further study in speech synthesis research. The aforementioned vocal attributes, and, more importantly, their descriptions and categorizations, are often unavailable to the user of a synthesized voice once the voice is built. The inaccessibility of these attributes underscores the need to further explore temporally-dynamic adjustment of vocal acoustic parameters that are (1) implemented from both a production and perception perspective [22], (2) user-determined, and (3) contextually aware. Additionally wanting is a detailed understanding of how to enable speech synthesis to meaningfully explore the intersection and relationship between speaker identity and adjustable prosodic control.

In this paper, we propose a framework for expressive vocal synthesis that leverages a voice persona, drawn from an underlying continuous probability space, that bounds and contextualizes low-level/latent synthesis features, and a user-defined perceptual abstraction that could allow for real-time expressive performance within a chosen voice persona.

The organizing principle supporting this framework is that of the voice persona (as opposed to the distinction between basic emotional characteristics such as happiness or anger [23]), we immediately recognized the highly personal and contextual nature of different personas. Diverse interpretations of “vocal persona” across disciplines complicates efforts to advance understanding of the impact on context on vocal expression. Beyond scholarly literature, the notion of “vocal persona” is often discussed by singers, actors, conversational voice designers, and voiceover artists. However, to the authors’ knowledge, there has neither been a focused study on the self-perception of vocal persona within communities of people who teach or use the voice professionally, nor prevalent academic discussion of the role of voice persona in speech technologies. In addi-
tion to harnessing this collective knowledge and merging diverse academic threads that discuss this concept with experiential knowledge of users, we further aim to incorporate underrepresented voices to the collective understanding of vocal personas. This holistic approach to gathering qualitative data will lead to deeper insight into how voice professionals utilize vocal persona when communicating both in professional and casual contexts. To gather a broad variety of descriptions, we interviewed a participant group of voice professionals to gain insight into their understanding of how the voice operates as a communication device and a form of self-identity, and how they describe their methods of manipulation and control.

In the following section we present our exploratory research on key contributing factors shaping vocal persona from intuitive and humanistic perspectives. We detail the qualitative methodology - thematic analysis - used in this phase of the research and present our initial findings of the factors and contexts that relate to and influence the adoption of vocal persona. We present the theoretical implementation of our persona-informed synthesis control in Section 3. Following is a discussion on how these concepts can inform our proposed framework and more broadly suggests ways the speech synthesis research community could take steps toward addressing the current gap in expressive voice control. We specifically highlight the impact the inclusion of voice persona could have on devices used by the augmentative and assistive communication (AAC) community. Finally, we close the paper with an introduction to our ongoing research investigating the themes of vocal persona and how they may continue to inform expressive speech synthesis design.

2. Thematic Analysis

The meaningful inclusion of expertise from related fields such as digital musical instrument (DMI) design and vocal performance necessitates flexible and adaptive methods to encapsulate participant experience and expertise. It is important for the exchange of ideas and information to happen at all stages of system development, especially in the design stage when inclusion of broader insights can meaningfully impact future directions. Qualitative research methods afford the flexibility of meaningfully including inter-disciplinary voices by allowing for more diverse forms of knowledge expression through semi-structured interviews. Additionally, these methods are well-suited for answering broad, complex questions as they encourage exploratory breadth while preserving nuances in the descriptions of thematic relationships. This study employs thematic analysis as an analysis framework of expert interview data. Thematic analysis specifically allows for the inclusion of an initial hypothesis through a definition of a priori themes that are then iteratively modified throughout the analysis [24].

2.1. Data Collection and Analysis

Qualitative data was collected through semi-structured interviews. This format of interview offered flexibility for participants to focus on areas of the conversation in which they had the most experience or deepest thoughts. Initial questions were written by researchers based on features and themes discussed in previous vocal persona literature. Interviewers were instructed to ensure participants were asked questions pertaining to the a priori themes of interest, namely: physical context, sociocultural context [4, 25], technological context [25], perception of the self and other [4, 25], and perception of agency [27]. Ethics approval was obtained from the Institutional Review Board of Stanford University.

Participants were recruited via email to a community of performers and professionals studying the human voice. Each participant received an experiment information sheet. 10 participants were interviewed and were a mean age of 40.7 (14.4) years old and had at least 10 years experience in vocal studies. Participant professional experiences included acting, singing, vocal instruction, linguistics, and performance studies. 6 of the 10 participants self-identified as fluent in more than one language and 5 participants self-identified as female.

Data was collected through semi-structured interviews conducted online through Zoom video conferencing software. Interviews lasted 1 hour and participants were compensated with a $20 electronic gift card. After obtaining consent from each participant, all interviews were recorded and automatically transcribed via Zoom. The resulting transcripts were then checked by hand, correcting any transcription errors, and removing any identifying information.

Transcripts were uploaded into the Dedoose V 9.0.46 qualitative analysis software. Initial themes and codes were established by the researchers based on findings from previous literature. During the process of transcript coding, researchers read through transcripts and identified excerpts of interest. These excerpts were then paired with one or more existing code(s) which described the content discussed in the excerpt. If a sufficient code did not exist to accurately describe the excerpt’s content, the excerpt was tagged, revisited by the full research team, and a new code(s) added. Transcripts were first coded by a researcher who did not conduct the interview. All codes were later evaluated by the research team and all discrepancies corrected, including the addition, restructuring, or removal of themes, codes, or sub-codes, resulting in 46 final codes. These codes were applied 740 times across 466 excerpts of interest.

2.2. Resulting Themes

It was apparent throughout all 10 interviews that vocal persona plays a key role in both participants’ relationship to human voice and change in voice in response to various internal and external factors. All participants mentioned between 2 and 7 (mean = 4.8) different vocal personas they would adopt in response to various common social and physical contexts. Additionally, they mentioned adjusting their vocal persona in response to a social relationship between 2 and 5 times (mean = 3.3) during the interview.

Iterative thematic analysis of participant interviews yielded the following concepts as having a strong relationship with or influence on the adoption of a vocal persona in an expressive communication setting:

- **Physical context** was mentioned as influencing vocal production decisions as it informed the speaker’s relationship to and knowledge of the space. Real-time interaction and self-adjustment would often happen in reaction to acoustic effects of the physical space, background noise, and/or physical proximity to others. This self-adjustment would often inform the adoption of a more pointedly articulated or intelligible vocal tone.

- **Technological mediation** seems to influence vocal production choices in vocal communication. Inclusion or exclusion of the audiovisual modality impacted the ratio of expressive and paralinguistic cues included in vocal tone to convey emotion, intelligibility or intent. Awareness of and proximity to a vocal amplifier such as a microphone greatly influenced the inclusion of specific vocal personas and unique modes of speech.
Voice Acoustics were discussed directly, metaphorically, and with physiological terms. As the participants all had 10+ years of vocal experience, they were able to describe modification of their voice using acoustic and anatomical terminology, but often also relied on simile and metaphor to discuss expressive vocal tones. It was very clear that physicality of the vocal signal within the body was an extremely important feedback mechanism to inform self-awareness of and personal relationship to the voice, especially in new or unfamiliar settings.

Self-Perception of vocal identity uncovered a prevalent concept of a set of vocal tones and production modes that together yielded a baseline vocal identity often referred to as “my authentic voice.” This set of vocal production modes was a smaller subset of all possible vocalizations a person could physically produce. There was commonly a disconnect between internal and external (e.g. via a recording or descriptions from others) perception of one’s own vocal tone.

Perception of Others. All participants said they make assumptions about another person’s personality, intelligence, or experiences based on their voice. Additionally, assumptions of a vocal tone were often made based on physical attributes of a person. These were often informed by social scripting, entainment and expectations.

Sociocultural Context. Social structures such as behavioral and power dynamic roles, often predefined by societal scripts, impacted vocal production and perception. This informed adoption of characterological vocal patterns to uphold such roles. These vocal patterns are referential to those used by a societal archetype. Common examples of this include the stereotypical “valley girl” or “surfer” voices. In line with the findings of Kreiman, it was also apparent that there can often be a conscious or subconscious disconnect between felt emotions and those expressed through the voice. Internal emotional states are often modulated or masked by the speaker depending on the social and physical contexts. The degree of alteration was personal to the speaker and their specific relationship to their environment.

Performativity was employed as a means to manipulate vocal tone and cadence when communicating an intention or expressing an internal state, as well as in discussing the creation and adaptation of identity. Utilizing performativity in the voice occurred when positioning the self within the social environment. Performers have a heightened sense of awareness and duty around how the manipulated or managed voice will be received and exactly what to modify in the voice/body to accomplish this. Through training and experience, this is achieved with attention to vocal mechanics and control over vocal production. However, in settings where self-awareness of mechanical control is less important or understood, vocal performativity is often achieved through mimicry of an archetype or characterological figure. Adoptions of referential and characterological vocal patters highlighted the continuous acoustic space between the “authentic voice,” inside which many personas were employed, as well as that of the character voice.

We found three main organizing principles present across the themes above, namely: information hierarchy, type of mediation, and agency. Decisions around information hierarchy influenced vocal persona by determining prioritization of communicated semantic information, emotional or internal state, and shared referential concepts (such as subtle vocal references to a characterological figure or archetype). The method and degree of vocal mediation influenced vocal persona by confounding certain vocal production choices deemed necessary to align with their surrounding physical, sociocultural and/or technological context. Agency was an extremely common concept discussed around the decision to adopt a particular vocal persona. Information hierarchy and contextual mediation provided cues as to optimal expression of information or internal state through the voice, but the adoption and employment of the vocal persona were heavily impacted by the speaker’s awareness of the possibilities of vocal manipulation both within and external to their “typical” self-perceived voice. The agency of a speaker to consciously adjust to their surrounding context was both important and ubiquitous.

3. Persona-Informed Synthesis Framework

Drawing from theories of performativity, code-switching, and findings presented in Section 2.2, we propose that a vocal persona is sampled from a fluid persona probability space that contextualizes the voice one may use in a certain setting or to embody a certain personality. For example, one vocal persona adopted for “meeting with boss” and another adopted for “visiting friends in a coffee shop” perhaps share a similar distribution space, as visualized by Figure 2. In contrast, a user’s chosen voice for “visiting friends” may have much less overlap with a “delivering a speech” vocal persona.

We present a visualization of the proposed framework in which the relationship between persona probability space \( P \) and latent variables \( Z \) used to synthesize a voice is shown (Figure 1). We present this framework generally, allowing for the parameter space to consists of classical synthesis parameters such as a necessary and sufficient spectral/acoustic set or a set of learned latent variables (denoted in Figure 1 as S/A and LLV, respectively).

We characterize this persona probability space \( P \) as a distribution of parameters that describe an \( N \)-dimensional probability mixture model describing low-level synthesis features \( Z = \{ Z_1, Z_2, ..., Z_N \} \). Sampling persona \( P \) defines the set of \( N \) probability density functions (PDF) \( f_a(z_n|\theta_n) \) for each synthesis parameter \( Z_n \), where \( \theta_n \) are the parameters describing the PDF. Sampling a different persona \( P' \) defines another set of \( N \) PDFs \( f_b(z_n|\theta_n) \) for each latent feature \( Z_n \). These distribution spaces could be as overlapped or as separated as is perceptually meaningful for the user.

The bottom row of the flowchart in Figure 1 shows how perceptually-meaningful expressivity attributes affect the low-level features utilized by a speech synthesis engine. We propose the concept of a macro as a perceptually-informed abstraction that modifies the low-level features such that the modification yields a vocal tone aligned with the intended expressivity. For example, a user may want to modify how “excited” the voice sounds within the bounds of current persona \( P \). An “excitement” control gives the user the ability to modify the “amount” of excitement in their current voice on a scale from 0 to 100. Given control variable \( x \in X \sim Uniform[0, 100] \), a function \( m_a(x) = w_a \cdot y_a(x) \) maps \( x \) to a corresponding modification value applied to PDF parameters \( \theta_a \). Here, \( w_a \) is a scalar weight corresponding to the involvement of synthesis feature \( Z_a \) in the high-level “excitement” macro \( M_a \). \( y_a(\cdot) \) is a transformation that allows for the weighting of each macro to be configurable and potentially learned or selected by the user. Macro \( M \) is the set of functions \( m_a(\cdot) \cdot \forall \theta_a \in \{ 1,...,N \} \). Within a persona, a set of \( K \) macros \( \{ M_1, ..., M_k, ..., M_K \} \) can be created by or presented to the user that allow for modification that is useful or meaningful. Within our current proposed design, these macros multiplicatively combine to determine the modification to \( \theta_n \).
More explicitly, a user-determined set of $K$ macros can modify the parameters $\theta_{na}$ describing a PDF $f_{n}(z_{n}|\theta_{na})$ within the current persona mixture model $P_{a}$ such that:

$$\theta_{na} = (\prod_{k=1}^{K} m_{nk}(x_{k}))\theta_{na}, \forall n \in [1...N].$$

The proposed framework aims to maximize user agency in speech synthesis by allowing for differing levels of user-desired control. The framework allows multiple levels of interaction through the use of common “default” personas and macros that work immediately but are highly configurable. Users are able to customize macro controls and persona attributes to create a user-experience that is catered to and determined by each user. This enables power users wanting detailed control over expression macros to modify hyper specific macros by accessing the low-level parameter weights $w$ and warping functions $y(\cdot)$. The ability of users to dictate the level and complexity of interactions with their vocal personas is of paramount importance.

4. Additional Insights

The community of AAC users, specifically those who utilize synthesized voice as a primary mode of communication, is of great interest. The ability to adapt or adjust the voice with greater personalized control over identity-associated features and personality characteristics is a crucial point of development and exploration in enhancing and augmenting AAC user experience [31]. These features can promote a greater connection to and ownership of their voice, an extremely personal medium of human connection and communication [32]. In addition to a deepened understanding of vocal personas, several design insights were generated over the course of this study that would not have been discussed without the qualitative analysis framework.

These design insights include improved user feedback mechanisms that could be implemented to promote a more embodied experience of voice communication, specifically for AAC users. Insights regarding the disconnect between internal self-perception of one’s voice and external perception of a recording highlight the possible need for a separate playback system for AAC users that emulates internal self-perception more closely. Additional feedback elements, such as haptics, could be used to promote feelings of embodiment when communicating. Additionally, devices could be developed to have increased environmental awareness, listening and responding to changes in room acoustics, background noise level, and other auditory events such as pausing and repeating a phrase if a loud, interrupting noise is detected. Finally, active communication of user agency could be a higher design priority to highlight the distinction between device and user error. This would invite a richer interpretation of AAC user agency, motivated by the finding that the perception of agency and intention was an important factor in vocal communication.

4.1. Future work

One area for future research is the role of distinctly scoped contexts. Our conjecture is that long-term temporal contexts may influence the adoption of certain vocal personas, while short-term contexts influence production choices within a persona. We are developing this hypothesis further. A second area of exploration is that of the AAC design generated and questions raised in this work. The research team is dedicated to centering the opinions of AAC users in the development of new paradigms that prioritize user-agency by following the “Nothing about us without us” Disability design philosophy [33]. AAC users were not consulted during this portion of the study as the research team chose to focus on participants with professional voice study and performance experience in order to generate initial topics of discussion with AAC users. The challenge and importance of including vocal persona as a design aspect in AAC paradigms became extremely clear throughout the analysis given the many factors that it influences and is dependent upon. This rich, complex factor has clear potential to enhance AAC user experience and enrich other voice synthesis systems. We will explore these ideas with AAC users, conversational UX designers, and speech scientists in future work.

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6. References

[1] K. R. Scherer, “Personality inference from voice quality: The loud voice of extroversion,” *European Journal of Social Psychology*, vol. 8, no. 4, pp. 467–487, 1978.

[2] W. Apple, L. A. Streeter, and R. M. Krauss, “Effects of pitch and speech rate on personal attributions,” *Journal of Personality and Social Psychology*, vol. 37, no. 5, pp. 715–727, 1979.

[3] N. Campbell, “Getting to the heart of the matter: Speech as the expression of affect; Rather than just text or language,” pp. 109–118, 2 2005. [Online]. Available: https://link.springer.com/article/10.1007/s10579-005-2699-y

[4] J. Kreiman and D. Sidits, “Foundations of Voice Studies: An Interdisciplinary Approach to Voice Production and Perception,” *Foundations of Voice Studies: An Interdisciplinary Approach to Voice Production and Perception*, 4 2011.

[5] P. Tagg, “Vocal Persona,” in *Music’s Meanings*, 2012, ch. 10.

[6] X. Serra, “A system for sound analysis/transformationsynthesis based on a deterministic plus stochastic decomposition,” Ph.D. dissertation, Stanford University, 1989.

[7] T. Yoshimura, K. Tokuda, T. Kobayashi, T. Masuko, and T. Kitamura, “Simultaneous Modeling Of Spectrum, Pitch And Duration In HMM-Based Speech Synthesis,” in *Sixth European Conference on Speech Communication and Technology*, 1999.

[8] H. Zen, K. Tokuda, and A. W. Black, “Statistical parametric speech synthesis,” *Speech Communication*, vol. 51, no. 11, pp. 1039–1064, 11 2009.

[9] Y. Wang, D. Stanton, Y. Zhang, R. J. Skerry-Ryan, E. Battenberg, J. Li, R. Prenger, and B. Catanzaro, “Mellotron: Multi-speaker corpus for exploration of voice attributes,” *Computer Synthesized Speech Technologies: Tools for Aiding Impairment*. IGI Global, 2010, pp. 50–70.

[10] A. J. Fiannaca, A. Paradiso, J. Campbell, and M. R. Morris, “Vocesetting: Voice authoring us for improved expressivity in augmentative communication,” in *Conference on Human Factors in Computing Systems - Proceedings*, vol. 2018-April, 2018. [Online]. Available: https://doi.org/10.1145/3173574.3173857.

[11] A. Stan and B. Lörincz, “Generating the Voice of the Interactive Virtual Assistant,” in *IntTechOpen*, 2 2021.

[12] L. Zhang, L. Jiang, N. Washington, A. A. Liu, J. Shao, A. Fournier, M. R. Morris, and L. Findlater, “Social Media through Voice,” *Proceedings of the ACM on Human-Computer Interaction*, vol. 5, no. CSCW1, pp. 1–21, 4 2021.

[13] J. Kreiman and B. R. Gerratt, “Reconsidering the Nature of Voice,” in *The Oxford Handbook of Voice Perception*. Oxford University Press, 12 2018, pp. 166–188.

[14] P. Cook, “Remutilizing the musical instrument: Co-design of synthesis algorithms and controllers,” *Journal of New Music Research*, vol. 33, pp. 315–320, 09 2004.

[15] G. Terry, N. Hayfield, V. Clarke, and V. Braun, “Thematic analysis,” *The SAGE handbook of qualitative research in psychology*, vol. 2, pp. 17–37, 2017.

[16] B. Sweet and E. C. Parker, “Female Vocal Identity Development: A Phenomenology,” *Journal of Research in Music Education*, vol. 67, no. 1, pp. 62–82, 4 2019.

[17] S. Y. Park and M. E. Whiting, “Beyond Zooming there: Understanding nonverbal interaction online,” *Microsoft New Future of Work Symposium*, pp. 1–8, 2020. [Online]. Available: https://aspredicted.org/blind2.php?https://www.microsoft.com/en-us/research/publication/beyond-zooming-theresearchingnonverbalinteractiononline/.

[18] J. I. Charlton, *Nothing about us without us*. California Press, 1998.

[19] G. Pullin and S. Hennig, “17 ways to say yes: Toward nuanced tone of voice in AAC and speech technology,” pp. 170–180, 6 2015. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4847598/

[20] D. J. Higginbotham, “Humanizing vox artificialis: The role of speech synthesis in augmentative and alternative communication,” in *Computer Synthesized Speech Technologies: Tools for Aiding Impairment*. IGI Global, 2010, pp. 50–70.

[21] A. J. Fiannaca, A. Paradiso, J. Campbell, and M. R. Morris, “Voicesetting: Voice authoring us for improved expressivity in augmentative communication,” in *Conference on Human Factors in Computing Systems - Proceedings*, vol. 2018-April, 2018. [Online]. Available: https://doi.org/10.1145/3173574.3173857.

[22] A. Stan and B. Lörincz, “Generating the Voice of the Interactive Virtual Assistant,” in *IntTechOpen*, 2 2021.

[23] L. Zhang, L. Jiang, N. Washington, A. A. Liu, J. Shao, A. Fournier, M. R. Morris, and L. Findlater, “Social Media through Voice,” *Proceedings of the ACM on Human-Computer Interaction*, vol. 5, no. CSCW1, pp. 1–21, 4 2021.

[24] J. Kreiman and B. R. Gerratt, “Reconsidering the Nature of Voice,” in *The Oxford Handbook of Voice Perception*. Oxford University Press, 12 2018, pp. 166–188.

[25] P. Cook, “Remutilizing the musical instrument: Co-design of synthesis algorithms and controllers,” *Journal of New Music Research*, vol. 33, pp. 315–320, 09 2004.

[26] G. Terry, N. Hayfield, V. Clarke, and V. Braun, “Thematic analysis,” *The SAGE handbook of qualitative research in psychology*, vol. 2, pp. 17–37, 2017.

[27] B. Sweet and E. C. Parker, “Female Vocal Identity Development: A Phenomenology,” *Journal of Research in Music Education*, vol. 67, no. 1, pp. 62–82, 4 2019.

[28] S. Y. Park and M. E. Whiting, “Beyond Zooming there: Understanding nonverbal interaction online,” *Microsoft New Future of Work Symposium*, pp. 1–8, 2020. [Online]. Available: https://aspredicted.org/blind2.php?https://www.microsoft.com/en-us/research/publication/beyond-zooming-theresearchingnonverbalinteractiononline/.

[29] K. Linklater and A. Sloch, *Freeing the natural voice*: imagery and art in the practice of voice and language. Hollywood California: Drama Publishers, 2006.

[30] P. Eckert, “The limits of meaning: Social indexicality, variation, and the cline of interiority,” *Language*, vol. 95, no. 4, pp. 751–776, 2019.

[31] J. Butler, “Gender trouble, feminist theory, and psychoanalytic discourse,” *Feminism/postmodernism*, vol. 327, pp. 324–340, 1990.

[32] B. E. Bullock and A. J. Toribio, *The Cambridge Handbook of Linguistic Code-switching*. Cambridge University Press, 2009.

[33] G. Pullin, J. Treviranus, R. Patel, and J. Higginbotham, “Designing interaction, voice, and inclusion in AAC research,” *AAC: Augmentative and Alternative Communication*, vol. 33, no. 3, pp. 139–148, jul 2017.

[34] R. Patel and T. T. Threats, “One’s Voice: A Central Component of Personal Factors in Augmentative and Alternative Communication,” *Perspectives of the ASHA Special Interest Groups*, vol. 1, no. 12, pp. 94–98, 3 2016.

[35] J. I. Charlton, *Nothing about us without us*. California Press, 1998.