

Fear No Sound: Exploring Pedagogies for Rough Vocal Effects (RVEs) in Popular Music

TABLE OF CONTENTS

Part One: Portfolio	2
1.1 Introduction and Rationale	2
1.2 Planned Program of Study	5
• Aims, Objectives, and Expected Learning Outcomes	5
• Activities, Methods, and Resources	6
• Timescale and Review Dates	6
• Literature Review Process	7
1.3 Critical Reflection	9
Part Two: Written Assignment	15
2.1 Literature Review and Critical Analysis	15
• Analysis of Peer Reviewed Literature	15
• Analysis of YouTube Videos	24
2.2 Developing a Working Model for Teaching RVEs	27
2.3 Ethical Considerations	28
References	29
Appendix A: Literature Review Process Spreadsheet	36
Appendix B: Working Model for Teaching Rough Vocal Effects	38

LIST OF FIGURES

Fig 1: Project Gantt Chart	6
Fig 2: Kolb's Experiential Learning Cycle	9
Fig 3: Developments in Kolb's Learning Cycle on the Theme of Anxiety	13
Fig 4: The Levels of the Vocal Tract	17
Fig 5: Supraglottic Vibratory Patterns During RVEs	17
Fig 6: Lower Vocal Tract Structures Related to Twang	20
Fig 7: YouTube Video Coding Table	24

GLOSSARY OF VOCAL EFFECTS TERMS

Creaking: an effect related to vocal fry, often used at the beginning of a word or phrase, making the voice sound broken, tired, or sensual.

Grunt: a consistently rough sounding effect used almost exclusively in hard rock and heavy metal genres, making the voice sound brutal, demonic, or like a roaring animal.

Growl: a rolling, rhythmic guttural effect often used in blues and soul genres, usually emphasizing the beginning of a word or phrase.

Rattle: a rhythmic guttural effect used in rock and metal genres that can sound choked, wet, strangling, or inhuman.

Distortion: a consistently rough sounding effect, sometimes called "fry scream", often used at high pitches in rock music.

PART ONE: PORTFOLIO

1.1 Introduction and Rationale

As my private teaching studio continues to expand, I am exposed to a wider array of musical styles and associated vocal technique challenges. I teach all contemporary styles and take a modern, evidence-informed approach, integrating new perspectives and techniques as they arise (Edwards et al., 2023). However, the rougher-sounding tonal goals of contemporary music, like screaming and growling, are rarely considered in voice pedagogy research (Aaen et al., 2021a). In some subgenres of metal music, “the voice is realized through extended vocal techniques and a certain amount of sound manipulation through technological means” (Radovanovic, 2023, p. 155). Other genres, like rock, punk, and hardcore, often utilize similar vocal sounds and audio production strategies. My goal in this project is to develop an evidence-based approach to teaching a range of rough vocal effects (RVEs) as they are deployed in popular music styles.

Extended, Extreme, or Effects?

My first task is to establish consistent terminology for discussing vocal effects, as the language used to describe these types of sounds is not standardized. Contemporary classical music, sometimes called avant-garde or new music, can include vocal sounds outside the traditional Western classical repertoire (Noble, 2019). Vocal elements that expand upon traditional Western classical singing are referred to as “extended techniques”, while novel sounds like “teeth chattering, screaming, laughing, (and) gibberish” are sometimes differentiated as “extreme techniques” (Ziegler, 2018). As this project is centered on popular music and does not assume classical, bel canto-style singing as “the normative technique that presents anything else as different” (Noble, 2019, p. 5), I have chosen not to use either of these terms.

Instead, I draw my terminology from Complete Vocal Technique (CVT), an internationally recognized teaching method that not only includes vocal effects in its approach but has also conducted dedicated research on these sounds for over thirty years (Aaen et al., 2020). CVT includes intentional vocal breaks (yodeling), rapid melodic ornamentation (riffing), breathy production, and vibrato in the general category of vocal effects, as these sounds are outside the standard modes of vocalizing that CVT teaches (Aaen et al., 2020). From this general category, CVT distinguishes “rough vocal effects” as “controlled rough-sounding noises intentionally added to sung or spoken notes” (Aaen et al., 2021a, p. 1). In this project I explore this specific

group of sounds, abbreviating them as “RVEs” and using further language derived from CVT to distinguish between effect types.

Interestingly, some pedagogues and authors exploring extended techniques in classical music face similar challenges to those studying vocal effects in popular music. For instance, though mentions of extended vocal techniques have occurred in literature since the 1970s, concrete identification criteria for these sounds are lacking, as they have been defined via various authors’ observations and assumptions over time (Noble, 2019). In addition, these sounds are often met with strong negative opinions by academics and musicians who do not understand them (Ziegler, 2018). I will explore similar issues of identification and listener bias in the section below, as these problems limit the extent to which RVEs can be studied, taught, and understood (Aaen et al., 2020).

Identifying and Differentiating RVEs

While some aspects of timbre can be expressed via acoustic parameters such as attack time, loudness, and duration, perceptual factors “not related to pitch, loudness, and phonetics” are more difficult to define (Pinto, 2023, p. 1). Perceptual cues resist definitive description, as a listener must separate discrete auditory information from the emotional and personal aspects of vocal performance (Heidemann, 2016). Bias also plays a significant role in the interpretation of vocal sounds that may be unfamiliar to the listener (Pinto, 2023).

The few laboratory-based studies that examine RVE physiology also rely on perceptual cues to define vocal effects and include general terms such as growl and reinforced falsetto (Guzman et al., 2014). Broad classifications are sufficient in these cases, as the purpose of most research into RVEs is to determine their potential vocal health impacts (Unterhofer et al., 2022; Guzman et al., 2014), not to develop performance or teaching techniques.

The only available studies that aim to determine best practices for performing and teaching RVEs have been conducted within the CVT framework, which distinguishes five types of rough vocal effects: Distortion, Growl, Grunt, Rattle, and Creaking (Aaen et al., 2021a). Other studies also use the five categories defined in CVT research (Caffier et al., 2018; Pinto, 2023), setting a precedent for my adoption of these terms. By cross-referencing CVT research with cultural and clinically oriented studies, I aim to assemble a comprehensive functional understanding of RVEs using the clearest possible language.

Overcoming Barriers

Definitions for historical voice pedagogy terms are sometimes updated according to changes in scientific knowledge and social context, but specific parameters for many of these terms, including belting and resonance, remain the subject of interpretation and debate (Hoch, 2023). By contrast, CVT uses unique terms that are based on observable physiological events and which are continuously refined through further study (Leppavuori et al., 2021). Many singers, myself included, appreciate the level of specificity provided by CVT terminology. Novel language, however, creates a barrier for teachers and researchers who are not familiar with the CVT model.

Until 2020, the three-year CVT teacher authorization course was only available in person in Copenhagen, DK. As a result, though this method is widely taught in Northern Europe, there are only eleven authorized CVT teachers currently working in the United States (Complete Vocal Institute, 2023). In order to more fully understand this approach I traveled to Copenhagen to participate in a five-day CVT intensive, the resources for which I recognize not all voice teachers or researchers have.

One other non-singing vocal method, Vocal Combat Technique, is taught to actors and voiceover artists who need to execute aggressive vocal sounds without strain (Reid et al., 2022). As singing techniques in popular music are based in speechlike vocal production (Bartlett and Naismith, 2020), I plan to investigate this technique as well.

Due to the limited formal training available it can be assumed that most singers who use RVEs learn to do so autodidactically (Pinto, 2023), but self-teaching does not necessarily result in inadequate technique (Unterhofer et al., 2022). Self-taught singers no longer have to work alone. There is no shortage of free singing advice available online, and though these options may threaten the authority of educational institutions (Edwards et al., 2023), some of this free instruction may be of a high quality. Singers can also find support and community in the process of seeking techniques that work for them.

By synthesizing techniques and teaching approaches from multiple sources, relevant studies in vocal health and physiology, and my own practice experience, I intend to develop an evidence-based approach for teaching RVEs.

1.2 Planned Program of Study

Aims

- To broaden and formalize my knowledge of rough vocal effects, their physiological and perceptual parameters, and how they are performed.
- To appreciate the emotional, artistic, and cultural importance associated with rough vocal effects in musical styles that include them.
- To consider possible biases present in existing literature with regards to rough sounding vocal effects, including those relating to aesthetic priorities and vocal health.
- To develop a personal vocal practice that encompasses a variety of effects.
- To explore a variety of literature review methodologies to enrich my future research.

Objectives

- To identify current contributors to this topic in peer reviewed journals, texts, videos, and other available media.
- To construct an organized record of relevant research aggregated from a variety of sources and summarize various pedagogical approaches.
- To critically analyze and compare teaching approaches for RVEs.
- To consider empirical evidence, to the extent that it is available, concerning the physiological and performance parameters of rough vocal effects.
- To evaluate the impact this information may have on my performance practice, teaching approaches, and future research.
- To maintain a research journal, including observations from my related vocal practice and teaching experiences, and critically reflect upon the entire learning process.

Expected Learning Outcomes

At the completion of this project, I expect to be able to:

- Identify and differentiate rough vocal effects in live and recorded examples.
- Explain the perceptual and physiological differences between effects.
- Communicate the current state of research regarding this topic.
- Demonstrate each effect with ease and clarity.
- Understand and convey specific practice and performance strategies for each effect.
- Effectively and sustainably perform and teach a range of rough vocal effects.

Activities, Methods, and Resources

- Conduct a preliminary literature review, identifying key readings based on recency, relevance, and peer review status.
- Attend a five-day intensive vocal workshop in Copenhagen, DK to learn the foundations of Complete Vocal Technique (CVT), an established and well researched approach that includes rough vocal effects in its pedagogy.
- Review key readings from peer reviewed journals.
- Review additional publications including pedagogy books, dissertations, theses, articles, and other texts.
- Review publicly available materials including websites, blog posts, videos, and podcasts.
- Maintain a research journal throughout the project period, including my experiences with learning, practicing, and teaching rough vocal effects.

Timescale and Review Dates

The proposed timescale for all research and writing activities is illustrated in the chart below.

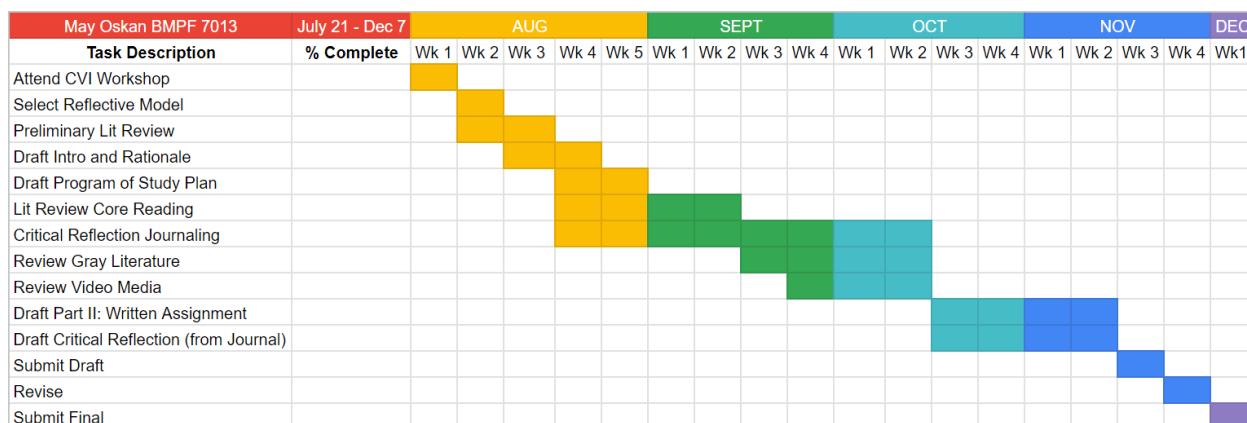


Figure 1. Project Gantt Chart

This process will be reviewed periodically with my tutor. Review dates are as follows:

- August 31st, 2023
 - Initial module meeting. Review the topic and generate research ideas.
- September 25th, 2023
 - Comments on section 1.1 and 1.2 drafts. Discuss literature review methodology, inclusion criteria for YouTube videos, and tracking protocols.
- October 23rd, 2023
 - Review draft in progress, including the selected reflective model.

Literature Review Process

Rather than reporting original scholarship, literature reviews use primary scholarship as data, seeking to “describe, summarize, evaluate, clarify, and/or integrate the content of the primary reports” (Cooper, 1988, p. 107). Integration will be essential to this project, as there are very few papers that directly address pedagogies for RVEs. An integrative review “generates new knowledge” about “new or emerging topics that would benefit from a holistic conceptualization and synthesis of the literature” (Torraco, 2016, p. 7). I will need to draw material from several related fields to support a holistic view of this topic, including clinical, cultural, and artistic perspectives. My first challenge is to maintain focus. I used Cooper’s taxonomy, a tool for systematically evaluating literature reviews (Cooper, 1988), to clarify the structure of my project. Taxonomy categories appear in bold below.

Along with addressing potential inconsistencies in the existing literature, integrative reviews have the potential to offer new models, conceptual frameworks, and perspectives (Torraco, 2016). Practical application is the **focus** of my review, with the **goal** of integrating emergent concepts into a useful approach for teachers and performers wishing to incorporate rough vocal effects into their practice. My **audience** consists of fellow voice practitioners and interested singers. As I believe that these sounds can be taught healthfully through the use of evidence-based techniques, the **perspective** of this project is one of position rather than neutrality. **Coverage** of existing literature will be comprehensive in terms of the limited body of research on teaching RVEs. Research synthesis is often less concerned with rigor and exhaustive coverage than it is with “how to maximize the quality of the synthesis within the available resources” (Suri, 2011, p. 66). I intend to highlight pivotal works that have provided direction to the study of this topic (Cooper, 1988), especially those that are “influential, highly original, controversial, or provocative” (Torraco, 2016, p. 2). Non-pedagogical literature will be incorporated as needed to fill in gaps in understanding. The **organization** of this review will be conceptual, grouping materials based on common themes.

I will begin by summarizing papers directly related to teaching strategies for RVEs. At this time, all available studies relating to singing voice pedagogy and RVEs are based on the language and definitions presented in Complete Vocal Technique. One paper discusses the Vocal Combat Technique framework, which is used to train non-singing professional voice actors. As directly relevant literature is scarce, I will also review a selection of YouTube videos offering technical instruction for performing RVEs.

Using YouTube for research poses unique challenges. Videos are ranked and recommended differently for each user based on browsing history, prior videos watched, location, cookies, popularity of new content, and other unknown factors of the YouTube algorithm (Sui et al., 2022). To assess a representative sample of videos, I will clear my browser history and cookies before searching and use an incognito window not linked to my account, sampling videos in the order they are presented – the order in which interested singers and teachers are likely to see them (Sui et al., 2022).

After considering all available pedagogy materials, I will review additional clinical and laboratory-based studies to refine my understanding of the anatomy and mechanics of RVEs. There is, however, a difference between knowing the mechanics of a vocal gesture and being able to teach it. From a perceptual motor learning standpoint, instruction that focuses on internal processes and body movement is less effective than instruction that targets external goals (Crocco and Meyer, 2021). I will use additional texts on evidence-based voice pedagogy to help me translate physiological information into useful teaching cues. Evidence-based voice pedagogy is a framework that integrates teacher experience and student goals with relevant, recent voice science research (Ragan, 2018), relying on the synthesis of new ideas with tried and tested practices in order to meet students' changing needs.

Research synthesis requires interpretation of the findings, rather than simply aggregating information (Suri, 2011) and as with all qualitative work “creativity is essential for drawing metaphorical inferences and recognizing links and patterns among phenomena” (Finfgeld, 2003, p. 903). Reviewing discussions about individual performers' approaches to RVEs, the impacts of audio technology on performance, and listener biases surrounding these sounds will ground my interpretation in cultural, perceptual, and artistic contexts as well as raw data.

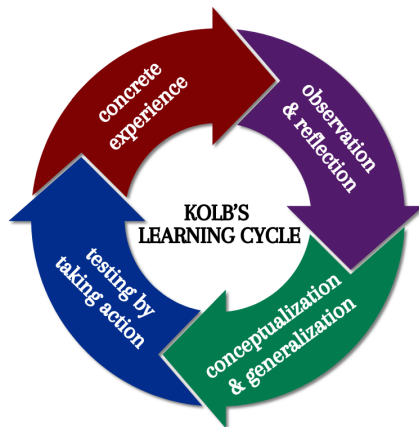
Throughout this process I will maintain a spreadsheet tracking the research methods, goals, limitations, and conclusions of each study. By aggregating data in a single document I will have clearer visibility of the links, conflicts, and possible dialogues between the papers I review. Keeping separate columns for my own notes, I will code papers using the thematic content analysis method (Burnard et al., 2008), allowing new theories and possible models to emerge inductively in the process (Constantinou et al., 2017). This spreadsheet, included in Appendix A (pp. 36-37), also provides readers with “sufficient information about the synthesis process so

that they can make informed decisions about the extent to which the synthesized findings may be adapted to their own contexts” (Suri, 2011, p. 63). In other words, singers and teachers will be able to see how I arrived at my recommendations and adjust the resulting model to suit their practice.

My working model for teaching RVEs, presented as a table in Appendix B (p. 38), provides a simple overview of the auditory profile, physiological action, and teaching approaches for each vocal effect.

1.3 Critical Reflection

Kolb’s learning cycle proposes that, through reflecting and conceptualizing concrete experience and then testing the learning in new situations, ideas are constantly refined and integrated (Vince, 1998). I selected this reflective model because of its emphasis on experience as the catalyst for the “endlessly recurring cycle” of learning (Kolb and Kolb, 2018, p. 8), as illustrated in the diagram below.



Kolb and Kolb (2018) suggest organizing an experiential curriculum “as a series of learning cycles to form a deepening spiral... that expands in complexity and application”, further developing the students’ understanding each time the material is visited (p. 2). I view my approach to teaching voice as similarly cyclical, allowing students to access more ease and automation with each exposure to a given technique.

Figure 2. Kolb’s Experiential Learning Cycle (Vince, 1998; Kolb and Kolb, 2018).

My process of inquiry began with my experience teaching singers who needed to perform rough vocal effects safely and sustainably. One student was in the process of recording a hardcore album and had experienced discomfort and acute vocal injury in the past as a result of performing his high-impact style of vocalism, which includes Grunt, Distortion, and Rattle. Another student wished to incorporate some Distortion into his pop-punk recording project, and

many other students wished to add Growl and Distortion textures to their live rock performances. I had received other inquiries regarding metal vocals, which at the time I was not comfortable teaching because I wasn't able to perform Grunt satisfactorily myself. By the time I began this project, rough vocal effects were a frequent topic in my studio, and though I was comfortable performing most effects (with the exception of Grunt), I felt I lacked the appropriate tools to teach and troubleshoot these sounds with my students.

Engaging with the experiential learning cycle improves the learner's skill in acquiring knowledge as well as inspiring further inquiry (Vince, 1998). As I moved through my own deepening spiral, developing my teaching abilities through exposure to research, instructional videos, and personal practice, I also furthered my skills as a vocalist and identified future opportunities for research and study.

Navigating the Literature

Few studies explore contemporary music singing in general (Bartlett and Wilson, 2017), and specific research on RVEs is even more scarce (Aaen et al., 2020). As rough vocal effects are an emerging topic in voice pedagogy, this review "is more likely to lead to an initial or preliminary conceptualization of the topic (i.e., a new model or framework) rather than a reconceptualization of existing models" (Torraco, 2016, p. 7).

I cast a wide net of inclusion when I first approached peer reviewed literature, reading a broad selection of topics including cultural discourse on punk and metal music, accounts of extended voice use in classical music, the evolution of singing technique as a result of technological advancement, and the anatomy and mechanics of supraglottic structures. This survey reading gave me a sense of the overall research landscape, but as "informed decisions about sampling are critical" to accomplishing research synthesis (Suri, 2011, p. 63), I needed to determine a purposeful sample.

I began with a group of papers about the pedagogical approach and physiological foundations of Complete Vocal Technique, since this framework is well established and specifically teaches RVEs for popular music singing (Aaen et al., 2021a). CVT uses a unique set of terms to describe four general vocal gestures, called the four vocal modes (Aaen et al., 2021b).

I have heard anecdotal arguments from other singing teachers and researchers that the use of specialized terminology in CVT makes this approach exclusive and hard to understand, but after reading these foundational papers and reviewing the free material on the CVT website, I think these frustrations are underinformed. As a singer and teacher of contemporary styles, terms derived from specific physiological events and perceptual measurements make more sense to me than the pre-scientific language borrowed from the historically dominant field of Western classical music (Pinto, 2023).

Singing voice terminology is “typically context and practitioner dependent” and “terms have the potential to be... confusing and even contradictory” (Lemon-McMahon and Hughes, 2018, p. 70). Several studies based in Complete Vocal Technique focus on defining vocal sounds regardless of genre, working to overcome the “lack of consensus” that causes a “discrepancy between current research into the singing voice and the practices of singers around the world” (McGlashan et al., 2017, p. 385.e11). To date, CVT-oriented research includes the most specific available definitions for rough vocal effects, so these five papers formed the basis of comparison for the other studies and videos I reviewed. Out of about sixty additional papers, I selected nine non-CVT studies based on their direct relevance to RVEs. Due to the small sample size and disparate methodologies, most of which were quantitative, my aim was not to directly compare these studies but to “produce new knowledge by making explicit connections and tensions... that were not visible before” (Suri, 2011, p. 63). My multimodal approach speaks to this intention, as I considered white and gray literature as well as firsthand experience in my review.

During this project period I traveled to Copenhagen for a five-day intensive to learn to confidently identify the five rough vocal effects Distortion, Growl, Grunt, Rattle, and Creaking (Aaen et al., 2021a). In order to understand CVT research and perspectives on RVEs it was also necessary to familiarize myself with the foundations of the CVT approach, including the parameters of the four vocal modes. Each day-long session began with a topical overview, then proceeded with live teaching in a masterclass format in which every attendee sang and applied the morning’s learning. This structure epitomized the experiential learning cycle, allowing the reflections and conceptualizations from each masterclass experience to be acted upon and tested the following day (Kolb and Kolb, 2018).

The faculty of the Complete Vocal Institute in Copenhagen, all of whom had decades of experience teaching within the CVT framework, invited collaboration and exploration and

acknowledged the emotional and social dynamics of the learning environment in the “here and now” (Vince, 2022 p. 985). Learning from teachers who both welcomed and were knowledgeable about rough vocal effects was a liberating and deeply valuable experience.

Creators on YouTube unsurprisingly exhibited a range of attitudes toward rough vocal effects. By clearing my browser history and using an incognito window (Sui et al., 2022) I began my search with a blank slate, as if I were an interested singer who had never sought vocal instruction on the platform before. This was not a perfect approach, as the YouTube algorithm displays videos based on a variety of factors, and each user sees a curated selection that is altered with every search and viewed video (Sui et al., 2022).

As I found in my previous paper on the training experiences of professional vocalists, free online media is a common supplement to, or replacement for, formal voice training. Of the surveyed singers who used online resources, 69% used YouTube (Oskan, 2023). Therefore I might assume that any singer looking to learn about vocal effects on YouTube has searched for and watched voice related content on that platform before, which would influence the order of the videos presented.

That said, searching YouTube incognito placed me in a different perspective than I normally experience, as the voice related videos displayed when I use my account are more specific to my interests. Noticing this difference gave me empathy for singers who seek to improve their vocal technique through YouTube. The sheer volume of videos and variety of approaches was daunting, even though I have experience selecting and vetting online materials that most self-taught singers do not.

I used a variety of search terms that a curious beginner might use and found the lack of specific language surrounding RVEs (Aaen et al., 2020) to be a barrier. Search terms including the words “vocal effects” returned higher quality results in terms of vocal technique instruction, but also brought up unrelated videos about mixing live or studio vocals. Search terms including the words “how to scream” seemed to limit the variety of effects covered to those that are more often performed at higher pitches, like Distortion. I have included YouTube video links in the reference list for the purpose of transparency.

Synthesis and Understanding

Approaching new topics and modes of expression may be a source of anxiety and self-doubt for learners, especially in environments where one does not feel well represented (Schaap and Berkers, 2014). As a vocalist and teacher who respects all styles of popular music, I may have approached this project with less anxiety than a more classically-oriented teacher might have felt. Still, I found it helpful to consider the following “insights into how peoples’ individual and collective anxieties shape action and inaction” (Vince, 2022, p. 987). The graphic below applies Kolb’s learning cycle to the subject of learner anxiety, showing two possible pathways.

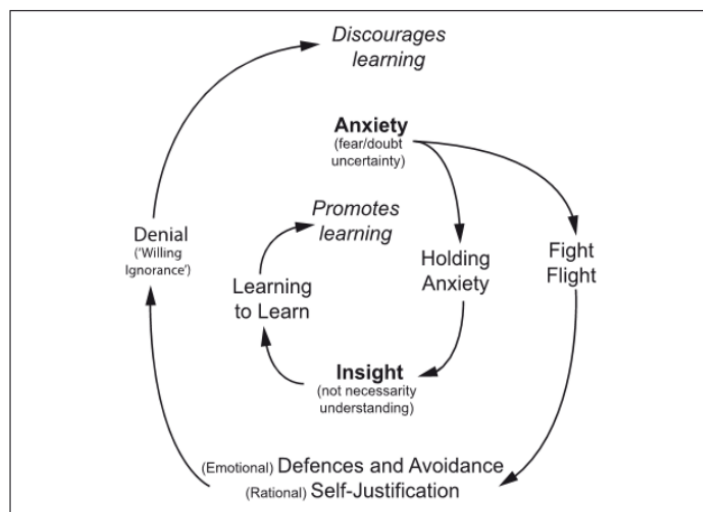


Figure 3. Developments in Kolb's Learning Cycle on the Theme of Anxiety (Vince, 2022, p. 984).

These pathways resonate with my experience teaching rough vocal effects, as some students will try an effect and immediately declare that they can't make that kind of sound. By rationally justifying their emotional response, they prevent themselves from trying again. Just as “metal music has always been about provoking a strong reaction” (Radovanovic, 2016, p. 51), rough vocal effects can be a similarly polarizing topic for singing students.

Vocal effects mimic the sounds of intense emotional states, often evoking fragility, fear, aggression, or despair (Caffier et al., 2018; Tsai et al., 2010). Expressing these sounds, even in isolation from a real emotional trigger, can feel extremely vulnerable, so it is important to acknowledge the emotional weight of these sounds and their potential impact on the student. Allowing emotions to be present can lead to further insights, as emotions are at “the heart of the relationship between reflection and action in any given context” (Vince, 2022, p. 986). This concept led me to move with intention through my research process, as well.

By allowing the presence of fear, doubt, and uncertainty, learners are more able to disturb entrenched processes and enable new ways of thinking, and one learner's willingness can encourage others to overcome their own passive or defensive attitudes (Vince, 2022). It is my hope that this project inspires others to embrace the full potential of the voice in all its complexity, for "as vocal pedagogues and singers we should not fear sound" (Aaen et al., 2022, p. 10).

PART TWO: WRITTEN ASSIGNMENT

Fear No Sound: Exploring Pedagogies for Rough Vocal Effects (RVEs) in Popular Music

2.1 Literature Review and Critical Analysis

This literature review aims to aggregate existing knowledge about rough vocal effects, including information about physiology, performance strategy, and best teaching practices. I will begin with peer reviewed research, using two primary pedagogical approaches as springboards for discussion. An analysis of YouTube instructional videos will follow. An attempt to thematically synthesize these disparate materials will round out this survey, toward the development of a working model for teaching RVEs.

Fourteen papers and fourteen YouTube videos were included in this review. For working notes on each paper, see the literature review process spreadsheet included as Appendix A (pp. 36-37). YouTube video links are included in the reference list.

RVE Pedagogy: Complete Vocal Technique

Only two papers centered on determining best practices and ideal outcomes in teaching RVEs. The first study aims to systematically measure the acoustic impacts of RVEs when combined with different types of phonation, toward the adoption of “physiologically delineated terminology for vocal effects... as opposed to viewing all rough sounding effects as ‘vocal distortions’” (Aaen et al., 2021a, p. 12). This paper is authored by researchers in the Complete Vocal Technique community, including CVT founder Cathrine Sadolin. The stated purpose of developing this terminology is twofold, both for “pedagogical precision, and to ensure reliability and validity in future research” (Aaen et al., 2021a, p. 12). The participant sample consisted of thirty-two professional singing teachers trained in CVT. Each singer sustained vowels in each of the four CVT vocal modes (Neutral, Curbing, Overdrive, and Edge) while adding and removing each of the five CVT-identified rough vocal effects (Grunt, Growl, Distortion, Rattle, and Creaking). Acoustic impacts were recorded and analyzed using specialized software and vocal fold activity was measured via electroglottography (EGG). Voice Handicap Index (VHI) questionnaires were used to measure the self-reported pre- and post-experiment vocal health of the participants.

Aaen et al. (2021a) succeeds in delineating specific terminology for five distinct vocal effects, as each effect condition was shown to impact the acoustic spectrum in particular frequency bands with statistical significance. Of the five effects, only Creaking and Grunt impacted EGG

waveforms, indicating that these effects alter the phonation of the vocal folds themselves. Creaking appears to be a type of vocal fry, taking place at the vocal fold level with no vibration of supraglottic structures involved (Aaen et al., 2021a). EGG results were altered in the Grunt condition except in one case, where the waveform was unimpacted (Aaen et al., 2021a).

I believe the participant who was able to maintain normal vocal fold phonation during Grunt was using a technique similar to Kargyraa, a “very low-pitched, bass-type singing technique” (Lindestad et al., 2001, p. 78) used in traditional Mongolian folk music. In Kargyraa singing, the ventricular folds vibrate at the same frequency as the vocal folds but only close every other cycle, creating a regular pattern of subharmonics below the fundamental and between harmonic partials (Lindestad et al., 2001). The vibrations of the ventricular folds create frequencies an octave below the sung fundamental. This may be the same effect that enables octavists, singers “mainly encountered in Russian Orthodox liturgical music” (Arnold, 2023, p. 1), to sing an octave below the standard bass vocal range.

This Kargyraa-style Grunt, involving vibration of both the vocal and ventricular folds, is sometimes used in popular music styles by vocalists of all genders (see Tatiana Shmayluk of Ukrainian band “Jinjer” and William Ramos of American band “Lorna Shore” for examples). Other singers perform a version of Grunt that has no discernable pitch (such as Alissa White-Gluz and Angela Gossow, the current and former vocalists for Swedish band “Arch Enemy”). I agree with Aaen et al. (2021a) that a more granular view of Grunt physiology would be a worthwhile subject for future research.

During Distortion, Growl, and Rattle conditions, the supraglottic sound sources that vibrate to generate the “noise” of each effect appear to be controlled independently of the vocal folds, suggesting that these effects can be added to any phonation type (Aaen et al., 2021a). In a previous study by the same authors, these four vocal effects were tested for statistical recognizability, both by laryngostroboscopy and blind-panel assessments. That study found each vocal effect “could be related to [a] particular and discrete vibratory pattern of supraglottic structures” and that each could be recognized by voice clinicians and singing teachers with a high level of accuracy (Aaen et al., 2020, p. 162.e5). Specific pharyngeal gestures, such as narrowing or constriction of the throat, allow supraglottic structures to approximate and vibrate together (Aaen et al., 2020; Caffier et al., 2018). The graphic below may aid in visualizing the pharyngeal space, the location of supraglottic structures, and the six levels of the vocal tract as

described in the following table summarizing the physical action of each vocal effect (Aaen et al., 2020, p. 162.e7).

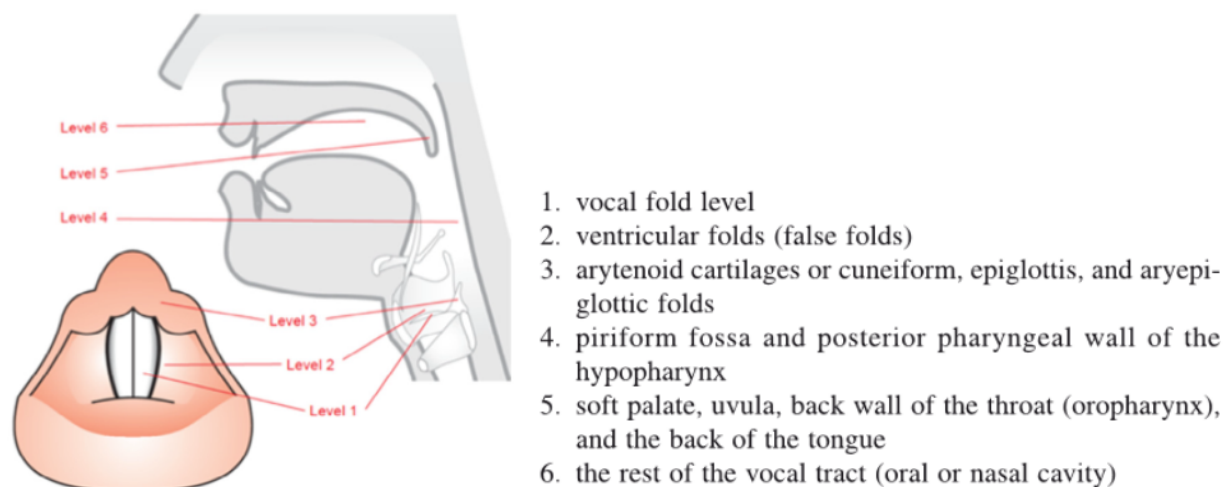


Figure 4. The Levels of the Vocal Tract (Aaen et al., 2020, p. 162.e7). Reprinted from McGlashan et al. (2017): “Overdrive and Edge as Refiners of ‘Belting’”.

The following table gives an overview of the structures that appear to be involved in the production of each effect and the level of the vocal tract at which they were observed, followed by a discussion of each.

Distortion	Vibration of ventricular folds against one another at vocal tract level two.
Growl	Vibration of arytenoid cartilages against epiglottis at vocal tract level three.
Rattle	Vibration of arytenoid cartilages against one another at vocal tract level three.
Grunt	Vibration of the whole supraglottic structure at levels one through four.

Figure 5. Supraglottic Vibratory Patterns During the Performance of Rough Vocal Effects (Aaen et al., 2020, p. 162.e5).

During **Distortion** medial-lateral and anterior-posterior constriction of the ventricular folds was observed in most subjects, allowing these tissues to vibrate together (Aaen et al., 2020). Caffier et al. (2018) also observed medial-lateral constriction and vibration of the ventricular folds in Distortion. The ventricular folds (also called the vestibular or false vocal folds) are located just above the true vocal folds and do not oscillate during normal phonation (Matsumoto et al., 2021). The ventricular folds do not contain enough muscle tissue to contract independently, but “can be constricted by the action of certain intrinsic laryngeal muscles” (Sakakibara et al., 2004,

p. 2). Ventricular fold vibration was accompanied by a raised larynx and constriction of the pharyngeal wall in the majority of Distortion demonstrations (Aaen et al., 2020).

During **Growl** pharyngeal constriction was observed in fewer than half of the subjects, and no change in larynx height was detected. In every case, the base of the tongue pushed the epiglottis back to vibrate against the arytenoid cartilages (Aaen et al., 2020). The researchers postulate that the cuneiform cartilages, paired drumstick-shaped cartilages that sit within the aryepiglottic folds (Saran et al., 2022), may also vibrate against the epiglottis and contribute to the “rolling and rhythmical sound” of Growl, though the position of the epiglottis in this condition prevents such a vibration from being observed (Aaen et al., 2020, p. 162.e8).

During **Rattle** the arytenoid cartilages rotate and vibrate against one another, accompanied by anterior-posterior pharyngeal narrowing and lateral constriction of the posterior pharyngeal wall. The cuneiform cartilages also vibrated in most cases, and the epiglottis was slightly compressed toward the back of the throat (Aaen et al., 2020; Caffier et al., 2018).

During **Grunt**, vibration of the entire supraglottic structure from levels one through four was observed, with no change in larynx height. Grunt featured movement of the aryepiglottic folds in particular, including the cuneiform cartilages embedded within them, and in most subjects the epiglottis and ventricular folds also vibrated (Aaen et al., 2020). Unlike Distortion, Growl, and Rattle, EGG waveforms were interrupted during Grunt. In the place of regular phonation, “low frequency... large amplitude” vibration and/or “a visible increased glottic gap” were observed, “showing reduced tension” of the vocal folds (Aaen et al., 2020, p. 162.e9). In an earlier study, Caffier et al. (2018) also observed “smaller amplitudes and irregular [EGG] waveforms” in Grunt (p. 343). As discussed above, these findings do not reflect the performance of Kargyraa-style pitched Grunt, which involves regular vocal fold phonation.

This distinction has performance and pedagogical consequences, as non-phonatory or pitchless Grunt necessitates a higher level of turbulent airflow to vibrate the multiple supraglottic structures involved (Aaen et al., 2021a). Based on my own experimentation, attempts to achieve a loud or deep sounding Grunt in the pitchless, non-phonatory condition can lead to fatigue and discomfort. The phonatory, Kargyraa-style Grunt requires less air and sounds louder, lower, and more focused than the non-phonatory style.

Each effect has a pitch range where it seems most commonly employed in musical contexts. Grunt, as discussed above, is either performed at a low pitch or in absence of normal vocal fold phonation, in which case the pitch attempted is irrelevant. Distortion (or “fry scream” as it is sometimes called) is more often performed at higher pitches, while Growl is more often heard in mid to low pitch ranges. The study by Aaen et al. (2021a) was limited by the use of single pitches, with male participants singing C4 and females singing B4 for all effects.

Some observed effects also had larger available sample sizes than others. Growl was performed by eighteen participants and Distortion by sixteen, while only seven performed Grunt and six performed Rattle (Aaen et al., 2020). The styles of singing self-reported by participants may have limited the extent to which certain effects could be successfully performed. Though all of the participants were trained in CVT and had experience performing and teaching vocal effects, only three of them reported singing rock music, and none specified that they sang metal. Performers of classical, pop, and soul music are unlikely to have much experience using Grunt or Rattle in musical contexts and may have less practice with other rough sounding effects as well.

“Metallic” Modes, Twang, and RVEs

Over the course of my in-person CVT training and in subsequent practice with vocal effects, questions arose regarding how the four vocal modes interact with RVEs. The “metallic” qualities of the modes Curbing, Overdrive, and Edge are achieved through different types and amounts of supraglottic narrowing (Aaen et al., 2021b).

In voice science, a “bright, ringy, brassy, metallic” sound quality is generally associated with the use of twang, which consists of “lower vocal tract adjustments: epilaryngeal tube narrowing and pharyngeal constriction” (Saldias et al., 2021, p. 807.e1). The following graphic shows a detailed view of the supraglottic structures related to twang.

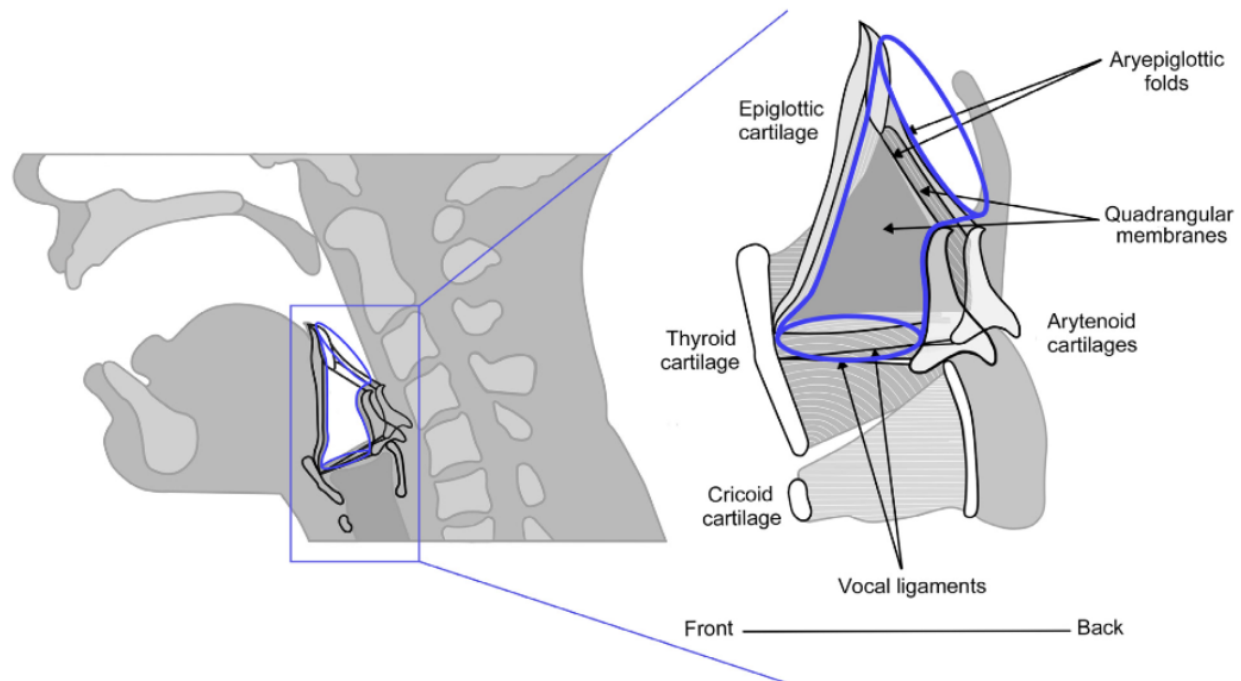


Figure 6. Lower Vocal Tract Structures Related to Twang (Saldias et al., 2021, p. 807.e2).

Complete Vocal Technique makes a distinction between the metallic qualities of Curbing and Overdrive and the use of “distinct twang” in Edge (Complete Vocal Institute, 2023). In a study utilizing Magnetic Resonance Imaging (MRI) to determine the vocal tract dimensions of the four metallic modes, Edge showed the “shortest distance between [the] epiglottis and [the] pharyngeal wall” (Leppavuori et al., 2021, p. 804.e33). Compression of the epiglottis toward the back of the throat was also observed in Growl and, to a lesser extent, Rattle (Aaen et al., 2020). Edge also showed the “most anterior-posterior narrowing just above the arytenoids” (Leppavuori et al., 2021, p. 804.e33), a condition also present in Rattle (Aaen et al., 2020). Edge, then, may be the easiest mode from which to introduce both Growl and Rattle, because of its physiological similarities to those effect conditions. Sakakibara et al. (2004) also note that “there is no significant difference of the laryngeal adjustments between metallic and growl” vocalizations (p. 2). Pedagogically, the ability to produce Edge in clean tone (without effects) may be an important precursor to performing Growl and Rattle.

Curbing is identified by “medium supraglottic narrowing with increased ventricular fold medialization and somewhat anterior-posterior narrowing between the arytenoid complex and petiole [the bottom part of the epiglottis closest to the vocal folds]” (Aaen et al., 2021b, p. 2). Curbing may be an ideal mode from which to introduce Distortion because the ventricular folds

are already approximated in this mode. In my experience at the Complete Vocal Institute, I found that pushing the restrained sound of Curbing to a higher volume easily induced a controlled, consistent Distortion in the middle to high ranges of my voice.

Additional research may uncover more specific detail regarding supraglottic activity and the interaction between supraglottic vibrations and vocal fold phonation (Aaen et al., 2021a). A deeper understanding of these biomechanical and acoustic components will help to shape health protective, evidence informed pedagogies for RVEs (Maxfield and Ragan, 2021).

Relationship to Vocal Health

Since the four rough vocal effects Distortion, Growl, Rattle, and Grunt are “performed, identified, and recognized as particular vibratory patterns of supraglottic structures” (Aaen et al., 2020, p. 162.e5) and can be demonstrated without negatively impacting vocal fold function (Aaen et al., 2021a; Caffier et al., 2018), it is unlikely that the skillful use of vocal effects contributes to vocal fold damage (Unterhofer et al., 2022; Aaen et al., 2022; Guzman et al., 2014; Caffier et al., 2018). In the non-phonatory Grunt condition, where reduced glottal tension and/or a gap between the vocal folds (Aaen et al., 2020) is observed, this “low glottal closure... would decrease the probability of phonotrauma” (Guzman et al., 2019, pp. 803.e10) even further.

The intentional narrowing of the vocal tract was once considered a form of potentially damaging laryngeal hyperfunction but is now gaining clinical acceptance as a strategy that may improve vocal efficiency (Guzman et al., 2014, p. 255), especially during tasks that require high subglottic pressure (Guzman et al., 2019). Encouraging twang has also been investigated as a complementary treatment for voice disorders that cause weak or breathy phonation (Lombard and Steinhauer, 2007).

Some studies question the long-term effects of hyperfunctional laryngeal behaviors (Caffier et al., 2018; Guzman et al. 2014), but a recent longitudinal study of twenty singers who regularly perform and teach RVEs showed no detriment to vocal health over a fourteen-year period (Aaen et al., 2022). All of the participants of this study were CVT authorized teachers, and so had undergone significant training of at least three years. The authors acknowledge the insularity of this study, and assert that “it is not their intention to convey that CVT is the sole technique that can aid singers in using rough vocal effects” (Aaen et al., 2022, p. 10). More specific

comparative research may emerge as new RVE pedagogies are created and refined. One new approach is outlined in the following section.

RVE Pedagogy: Vocal Combat Technique

The second pedagogy-focused study is a pilot investigation into the effectiveness of Vocal Combat Technique (VCT), a new modality used to train voice over actors to safely perform extreme sounds like shouting, screaming, coughing, and crying (Reid et al., 2022). Five actors performed two sessions of “vocally violent” (p. 1) voice over work, receiving a three-hour training in VCT before the second performance session. Perceptual and acoustic evaluations were carried out before and after each session, and actors self-reported vocal symptoms using three different rating scales (Reid et al., 2022).

The Vocal Combat Technique intervention is described as utilizing “upper thoracic expansion to counteract vocal tension, compression, and strain” and “positioning and vibration of supraglottic structures for the addition of roughness or turbulence” (p. 3). No further description of the study protocol was provided. As this was a small-scale pilot study there were a number of limitations, including a lack of formal statistical analysis and no control group (Reid et al., 2022). In addition, the participants were self-reported professional actors with an average of only three years of experience, none of whom had worked in the video game industry prior to the study.

In acting or singing, it is in any vocalist’s best interest to only perform sustainable sounds that do not cause vocal damage or impede future work. In a study about the prevalence of dysphonia among metal singers, Unterhofer et al. (2022) note the possibility “that only singers with a robust voice and adequate technique keep singing in metal bands” (p. 7). In other words, if a vocalist cannot produce RVEs in a sustainable way, they stop performing those sounds. Out of seventy-four metal singers surveyed, the majority of whom were self-taught, this study found no significant connection between education type and incidence of dysphonia, suggesting that formal vocal instruction is helpful but not mandatory for learning healthy technique for RVEs (Unterhofer et al., 2022). Similarly, it is likely that voice over actors with experience performing RVEs would have their own techniques for preventing vocal damage, whether from self-teaching or other sources. As the VCT protocol is only described in general terms, alternate techniques may be the same or similar.

After the initial research phase of this project, a randomized controlled trial investigating the use of Vocal Combat Technique to reduce vocal fatigue became available. Twenty-four voice over actors participated, with the experimental group participating in a three-hour interactive VCT workshop and the control group only receiving basic vocal health information. The contents of the three-hour VCT training were described in more detail, including specialized vocal health information “to maximize stamina and expedite recovery after vocal exertion”, “direct physiologic and motor learning instruction to target respiratory-phonatory support”, “onsets and forward focus resonance techniques”, and “in-depth instruction on the production of aggressive vocalizations... that utilizes supraglottic phonation techniques and reduces phonotraumatic behaviors” (Reid et al., 2023, p. 2). Outside of this last category, all of these topics might be expected to appear in other forms of professional voice education for singing or speech.

Participants who “had any prior experience in similar vocal combat training” were excluded from the trial (Reid et al., 2023, p. 2). This distinction, as well as the prominent claim on the VCT website that it is “the only *proven* voice method for vocal extremes for actors” (D’Arcy Smith Voice Services LLC, 2023), indicate that there are other, similar modalities for training actors to perform RVEs. Given the specificity of technical skill required to sustainably perform vocal effects (Unterhofer et al., 2022), a study comparing different RVE-specific instructional modalities would be more useful in determining the efficacy of any one model.

The same can be said of the research opportunities yet to be taken by the Complete Vocal Technique community. As five distinct rough vocal effects have been well defined in CVT research (Aaen et al., 2021a), a study comparing CVT-trained vocalists with self-taught vocalists performing the same effects would be a fascinating contribution to the research landscape.

Analysis of YouTube Videos

Of the fourteen YouTube videos I selected for my analysis, every creator used different terminology for the vocal effects they demonstrated, often relying on general terms like “screaming” and “harsh vocals”. In order to attempt a fair comparison, I cataloged the RVEs demonstrated in each video using definitions from Complete Vocal Technique. Having read several relevant papers and attended a five-day intensive in CVT, I felt confident identifying RVEs based on this framework.

Overall, six videos demonstrated Grunt, three Growl, five Rattle, four Distortion, and five Creaking. The following table presents an overview of which effects appeared in each video and what types of teaching approaches the instructors used.

Video Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14
effects demonstrated (CVT definitions)	grunt	X				X		X		X		X			X
	growl	X	X		X										
	rattle		X	X		X						X		X	
	distortion	X	X	X									X		
	creaking	X					X		X		X		X		
teaching approaches	felt / kinesthetic cues	X		X		X		X	X	X	X			X	X
	mimicry / auditory cues	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	metaphor / visualization					X		X				X		X	
	anatomy / physiology		X	X		X		X			X	X	X	X	

Figure 7. YouTube Video Coding Table

Effects Demonstrated

As illustrated above, several videos featured demonstrations of more than one effect, with two videos demonstrating more than two effects. Video 1, which presented an overview of how to use vocal effects in general, included every RVE except Rattle. That creator used vocal fry and Creaking as an access point to feel and encourage instability in the voice, then performed the remaining three effects in a descending phrase, using Growl and Distortion on higher pitches and Grunt in the lower range. Video 2 included demonstrations of Growl, Rattle, and Distortion, but did not differentiate between these sounds, calling them all “distortion”. Several creators used general terms to describe multiple effects without giving specific instructions for how to perform them (videos 2, 5, 11, and 12).

While the instructor in video 1 confirmed the safety and health of the demonstrated effects and used incremental instructions to build comfort with each sound, the instructor in video 2 treated vocal effects as vocal abuse, warning viewers of vocal health dangers. Several creators stated that vocal effects were inherently damaging or fatiguing and encouraged vocalists to use effects rarely (videos 2, 4, 6, 10, and 13).

While the instructor in video 1 asserted that vocal fry alone is not loud enough to be used as a vocal effect in performance, other creators offered a “fry only” approach, stating that other vocal effects are unsafe (videos 6, 8, and 10). These creators demonstrated quiet, breathy, intermittent vocalizations, which in my view confirmed the claim that the use of fry alone is not a sustainable approach.

Teaching Approaches

All fourteen videos included **auditory cues**, with instructors demonstrating and describing sounds for learners to mimic. Demonstration is commonly used in voice instruction, and while it is viewed as an efficient way to introduce new sounds or techniques, some teachers argue that this approach “does not foster independence, as mimicry does not necessarily involve a comprehension of function” (Angell, 2019, p. 129). Some sound cues and targets were used in multiple videos, such as an exasperated sigh (videos 3, 4, 7, 9, and 11), polite throat clearing (videos 3 and 7), and a barking dog or “woof” sound (videos 5, 7, and 9). Some videos encouraged learners to listen for general sound qualities, including noise breaking up or interfering with the pitch (video 1) or a compressed, restrained, metallic, or twangy sound (videos 2 and 3).

Kinesthetic cues were often used to verify that new sounds were induced safely, with instructors encouraging learners to feel vibration or activity in a specific area of the body (videos 5, 8, 12, and 13). The instructor in video 1 encouraged learners to experiment with vocal fry and the vocal break or yodel, exploring and then exploiting the feeling of vocal instability to help create noisy sounds. Contrary to many voice teaching approaches that center on the use of imagery (Nafisi, 2010), **visualization and metaphor** were not often used and mostly served to reinforce kinesthetic cues, asking learners to imagine the structures contributing to a sensation. General reminders to relax the body and throat were also given.

Of the eight creators who included **anatomical background** in their teaching approaches, three used inaccurate terminology (videos 2, 12, and 13) that may confuse learners, especially those with prior vocal training. Conflicting opinions about airflow and breath support were also common in the sample, with one creator saying to inhale as frequently and deeply as possible (video 14). This instructor taught only Grunt in the pitchless condition, where a larger volume of turbulent airflow is needed to vibrate supraglottic structures (Aaen et al., 2021a). Three other creators instructed learners to limit airflow in order to prevent tickling, coughing, or vocal strain (videos 5, 8, and 11). Two of these instructors demonstrated pitched Grunt and Rattle, while the third used a “fry only” approach to vocal effects, as mentioned above. Over half of the videos included mentions of support or breath resistance (videos 1, 2, 3, 5, 8, 11, 12, and 13), with some specifying a need to “squeeze” or “push” from the abdomen (videos 2, 11, 12, and 13). Some underscored the importance of using glottal onsets to produce an efficient sound (videos 3, 4, 8, 11, and 13).

Discussion

I found technical specificity lacking in most of these videos and would only recommend one or two of them to curious vocalists looking to experiment with RVEs. Beginning singers may find vague or conflicting instructions confusing, while warnings of fatigue or injury may cause apprehension. Singers with more training or experience may also be frustrated by inaccurate physiological information.

Many creators use YouTube content to advertise paid courses or lessons, influencing the amount and type of instruction they offer for free. Still, I was surprised by the amount of videos created by vocalists who do not specialize in RVEs, and who did not seem confident or proficient in performing them. In many cases, creators seemed driven to offer a video about RVEs for the express purpose of expanding the reach of their brand on the platform. In retrospect, I might have found more useful materials by choosing a few specialist creators and selecting a sample of videos from each.

A pronounced gender gap was also present in this sample, with only four videos featuring instruction from female creators. Of these, two promoted vocal fry as the only safe way to incorporate noise into vocal production and did not perform or encourage any other effects. The other two female creators were performing metal vocalists and offered short video tutorials about the techniques they use. Though some videos offered in-depth instruction for RVEs none

of these were from female creators, indicating that there is room for wider gender representation in this space. Interestingly, there is not much difference between genders when it comes to the acoustic presentation of vocal effects. In the study by Aaen et al. (2021a) that defines the five vocal effects taught in the CVT model, the researchers noticed “a similar frequency region being affected by the vocal effect conditions across genders, despite the... difference between the male and female sung pitch” (p. 12).

Performance of live rock music is still a male-dominated activity, and some vocal behaviors such as Grunt have “particularly strong masculine connotations, making it a less conventional form of female participation” (Schaap and Berkers, 2014, p. 102). In extreme metal, however, more women and non-binary vocalists have emerged in recent years, and it may be these “masculine” vocal sounds that help them gain acceptance. As one researcher explains, “because of its sound qualities and usage of extended techniques... [the] voice does not reveal the gender or other identity traits of the vocalist” (Radovanovic, 2023, p. 153). Schaap and Berkers (2014) note that online culture may be helping to change the landscape of metal performance, creating opportunities for non-male vocalists to express themselves in genres where they have been historically underrepresented and tokenized, while inspiring other vocalists to do the same.

2.2 Developing a Working Model for Teaching RVEs

Expert pedagogues and researchers in motor learning theory agree that knowing how a vocal sound is made is not the same as making it (Angell, 2019). From the perspective of Kolb’s learning cycle, a balance must be struck between abstract conceptualization and concrete sense experience in order to motivate learning, as “hyper-activity or withdrawal into reflection both inhibit learning” (Kolb and Kolb, 2018, p. 11). In developing my working model, I balanced my reflections on the literature with my own experience in practice, using theoretical concepts and instruction from video media to guide my experimentation. I video recorded and reviewed my practice sessions as an additional feedback tool. This iterative process proved essential, as gaps persisted in my initial teaching framework that could only be filled by anecdotal observations. My working model for teaching RVEs, included in Appendix B (p. 38), lists the physical mechanics and perceptual descriptions of each of the five rough vocal effects, as well as possible teaching targets and approaches.

2.3 Ethical Considerations

Some ethical considerations arise in teaching RVEs. Teachers must remain aware of implicit bias and separate the technical goals of the student from their own personal taste. Sherwood (2023) describes the responsibility of contemporary voice teachers to welcome “a polycultural vocal aesthetic and a multiplicity of musical genres” by using “aesthetically non-binary vocabulary... that embraces the infinite shades of beauty the human voice can create” (p. 19). There is a difference, however, between embracing a vocal sound and being able to effectively teach it. In order to proceed ethically, the American Academy of Teachers of Singing (2021) states that voice teachers must clearly understand and communicate the boundaries of their abilities and their areas of expertise, and understand when referral to another professional is in the student’s best interest. Teaching RVEs requires specialized skills that contemporary voice teachers may need to acquire.

First, it is important for teachers to possess and for students to develop an adequate knowledge of live sound system and studio recording technology, as well as microphone techniques appropriate to the style of effects being performed (Caffier et al., 2018). Specific recording techniques are often used in rock and metal music to create vocal textures that the unamplified voice cannot approximate (Radovanovic, 2023), and attempting to recreate electronically manipulated sounds can lead to frustration and potentially to vocal strain and damage.

Teachers must also possess a certain level of acuity in how they listen, assess, and respond. Hearing, recognizing, and working with “specific phonation at the source, specific adjustments of the filter, and controlled vibratory patterns in supraglottic structures is advanced vocal pedagogy” (Aaen et al., 2022, p.10) that requires the same or greater commitment to active listening and individualized problem solving as any student-centered approach (Angell, 2019). Open and honest communication is important, as teachers need to frequently confirm the students’ physical comfort and ease (Aaen et al., 2022) and remain open to student feedback.

Finally, humility and a commitment to continued learning will benefit teachers interested in RVE pedagogy. Just as CCM pedagogy still strives to escape the Eurocentric aesthetic ideals handed down from Western classical singing traditions (Sherwood, 2023), the acceptance of rough vocal effects as a safe and valid part of vocal expression worthy of research and pedagogical attention will take time, effort, and curiosity on the part of those who value these sounds.

References

- Aaen, M., McGlashan, J., Christoph, N., and Sadolin, C. (2021a) 'Extreme Vocal Effects Distortion, Growl, Grunt, Rattle, and Creaking as Measured by Electroglottography and Acoustics in 32 Healthy Professional Singers', *Journal of Voice*, (online only, article in press).
- Aaen, M., McGlashan, J., Christoph, N., and Sadolin, C. (2021b) 'Deconstructing Timbre into 5 Physiological Parameters: Vocal Mode, Amount of Metal, Degree of Density, Size of Larynx, and Sound Coloring', *Journal of Voice*, (online only, article in press).
- Aaen, M., McGlashan, J., and Sadolin, C. (2020) 'Laryngostroboscopic Exploration of Rough Vocal Effects in Singing and their Statistical Recognizability: An Anatomical and Physiological Description and Visual Recognizability Study of Distortion, Growl, Rattle, and Grunt using Laryngostroboscopic Imaging and Panel Assessment', *Journal of Voice*, 34(1), pp. 162.e5-162.e14.
- Aaen, M., Sadolin, C., White, A., Nouraei, R., and McGlashan, J. (2022) 'Extreme Vocals – A Retrospective Longitudinal Study of Vocal Health in 20 Professional Singers Performing and Teaching Rough Vocal Effects', *Journal of Voice*, (online only, article in press).
- American Academy of Teachers of Singing (2021) 'Ethical Behavior Within the Voice Teaching Profession 2021', *Journal of Singing*, 78(1), pp. 7-9.
- Angell, H.C. (2019) 'How Do You Teach Voice? Six Vital Nonmusical Teaching Principles', *Journal of Singing*, 76(2), pp. 127-135.
- Arnold, D. M. (2023) 'Two Remarkable Octavists From Serge Jaroff's Don Cossack Choir: Glib Chandrowsky and Paul Myhalik'. Unpublished paper. University of North Texas Libraries, UNT Digital Library. Available at: <https://digital.library.unt.edu/ark:/67531/metadc2178701/m1/1/> (Accessed: 3rd November 2023).
- Bartlett, I. and Wilson, P.H. (2017) 'Working 9-5: Causal Relationships Between Singers' "Day Jobs" and Their Performance Work, With Implications for Vocal Health', *Journal of Voice*, 31(2), pp. 243.e27-243.e34.

Bartlett, I. and Naismith, M.L. (2020) 'An Investigation of Contemporary Commercial Music (CCM) Voice Pedagogy: A Class of its Own?', *Journal of Singing*, 76(3), pp. 273-282.

Burnard, P., Gill, P., Stewart, K., Treasure, E., and Chadwick, B. (2008) 'Analysing and Presenting Qualitative Data', *British Dental Journal*, 204(8), pp. 429-432.

Caffier, P.P., Nasr, A.I., del Mar Ropero Rendon, M., Wienhausen, S., Forbes, E., Seidner, W., and Nawka, T. (2018) 'Common Vocal Effects and Partial Glottal Vibration in Professional Nonclassical Singers', *Journal of Voice*, 32(3), pp. 340-346.

Complete Vocal Institute (2023) *Find an Updated Authorised CVT Teacher*. Available at: <https://completevocal.institute/find-a-teacher/> (Accessed: 12th September 2023).

Complete Vocal Institute (2023) *Complete Vocal Technique*. Available at: <https://completevocal.institute/complete-vocal-technique/> (Accessed: 11th November 2023).

Constantinou, C.S., Georgiou, M., and Perdikogianni, M. (2017) 'A Comparative Method for Themes Saturation (CoMeTS) in Qualitative Interviews', *Qualitative Research*, 17(5), pp. 571-588.

Cooper, H.M. (1988) 'Organizing Knowledge Syntheses: A Taxonomy of Literature Reviews', *Knowledge in Society*, 1, pp. 104-126.

Crocco, L. and Meyer, D. (2021) 'Motor Learning and Teaching Singing: An Overview', *Journal of Singing*, 77(5), pp. 693-702.

D'Arcy Smith Voice Services LLC (2023) *Vocal Combat Technique*. Available at: <https://www.vocalcombat.com/> (Accessed: 5th November 2023).

Edwards, M., Zito-Edwards, J., and Meyer, D. (2023) 'The Emerging Future of Collegiate Voice Instruction: Updated SWOT Analysis of Current Practice and Implications for the Next Generation', *Journal of Singing*, 76(3), pp. 273-282.

Finfgeld, D.L. (2003) 'Metasynthesis: The State of the Art – So Far', *Qualitative Health Research*, 13(7), pp. 893-904.

Guzman, M., Acevedo, K., Leiva, F., Ortiz, V., Hormazabal, N., and Quezada, C. (2019) 'Aerodynamic Characteristics of Growl Voice and Reinforced Falsetto in Metal Singing', *Journal of Voice*, 33(5), pp. 803.e7-803.e13.

Guzman, M., Barros, M., Espinoza, F., Herrera, A., Parra, D., Munoz, D., and Lloyd, A. (2014) 'Laryngoscopic, Acoustic, Perceptual, and Functional Assessment of Voice in Rock Singers', *Folia Phoniatrica et Logopaedica*, 65, pp. 248-256.

Heidemann, K. (2016) 'A System for Describing Vocal Timbre in Popular Song', *Music Theory Online*, 22(1), pp. 1-13.

Hoch, M. (2023) 'Singing Redefined', *Journal of Singing*, 80(1), pp. 43-50.

Kolb, A. and Kolb, D. (2018) 'Eight Important Things to Know About The Experiential Learning Cycle', *Proceedings of the Australian Council for Educational Leaders National Conference*, Melbourne, Australia, 3rd-5th October. Available at:
<https://learningfromexperience.com/downloads/research-library/eight-important-things-to-know-about-the-experiential-learning-cycle.pdf> (Accessed: 16 October 2023).

Lemon-McMahon, B. and Hughes, D. (2018) 'Toward Defining "Vocal Constriction": Practitioner Perspectives', *Journal of Voice*, 32(1), pp. 70-78.

Leppavuori, M., Lammentausta, E., Peuna, A., Bode, M.K., Jokelainen, J., Ojala, J., and Nieminen, M.T. (2021) 'Characterizing Vocal Tract Dimensions in the Vocal Modes Using Magnetic Resonance Imaging', *Journal of Voice*, 35(5), pp. 804.e27-804.e42.

Lindestad, P-A., Sodersten, M., Merker, B., and Granqvist, S. (2001) 'Voice Source Characteristics in Mongolian "Throat Singing" Studied with High-Speed Imaging Technique, Acoustic Spectra, and Inverse Filtering', *Journal of Voice*, 15(1), pp. 78-85.

Lombard, L.E. and Steinhauer, K.M. (2007) 'A Novel Treatment for Hypophonic Voice: Twang Therapy', *Journal of Voice*, 21(3), pp. 294-299.

Matsumoto, T., Kanaya, M., Matsushima, D., Han, C., and Tokuda, I.T. (2021) 'Synchronized and Desynchronized Dynamics Observed from Physical Models of the Vocal and Ventricular Folds', *Journal of Voice*, (online only, article in press).

Maxfield, L. and Ragan, K. (2021) 'Evidence-Based Voice Pedagogy (EBVP), Part 1: Voice Research Component', *Journal of Singing*, 77(4), pp. 543-547.

McGlashan, J., Thuesen, M.A., and Sadolin, C. (2017) 'Overdrive and Edge as Refiners of "Belting"?', *Journal of Voice*, 31(3), pp. 385.e11-385.e22.

Nafisi, J. (2010) 'Gesture as a Tool of Communication in the Teaching of Singing', *Australian Journal of Music Education*, 2, pp. 103-116.

Noble, C. (2019) *Extended From What?: Tracing the Construction, Flexible Meaning, and Cultural Discourses of 'Extended Vocal Techniques'*. Unpublished PhD Thesis. University of California, Santa Cruz.

Oskan, M. (2023) *Vocal training experiences and perceptions among adult Professional Contemporary Gig Singers (PCGS)*. Unpublished MA paper. Voice Study Centre, University of Wales Trinity Saint David.

Pinto, C.M. (2023) 'Listeners' Perception of Vocal Effects During Singing', *Journal of Voice*, (online only, article in press).

Radovanovic, B. (2016) 'Ideologies and Discourses: Extreme Narratives in Extreme Metal Music', *Journal of Art and Media Studies*, 10, pp. 51-58.

Radovanovic, B. (2023) 'Voice and Body in Extreme Metal Music', *Musik und Klangkultur*, 55, pp. 153-162.

Ragan, K. (2018) 'Defining Evidence-Based Voice Pedagogy: A New Framework', *Journal of Singing*, 75(2), pp. 157-160.

Reid, K., McKenna, V.S., Lee, C.A., Giliberto, J.P., and Smith, D. (2023) 'Reducing Vocal Fatigue While Preserving Realism During Video Game Voice-Overs Using the Vocal Combat Technique: A Randomized Controlled Trial', *Journal of Voice*, (online only, article in press).

Reid, K., McKenna, V.S., and Smith, D. (2022) 'Mitigating Dysphonia, Pain, and Vocal Handicap after Violent Video Game Voice Overs: A Pilot Investigation into Vocal Combat Technique Training', *Journal of Voice*, (online only, article in press).

Sakakibara, K-I., Fuks, L., Imagawa, H., and Tayama, N. (2004) 'Growl Voice in Ethnic and Pop Styles', *Proceedings of the International Symposium on Musical Acoustics*, Nara, Japan, 31st March - 3rd April. Available at:
https://www.researchgate.net/publication/228485036_Growl_voice_in_ethnic_and_pop_styles
(Accessed: 15 October 2023).

Saldias, M., Laukkanen, A-M., Guzman, M., Miranda, G., Stoney, J., Alku, P., and Sundberg, J. (2021) 'The Vocal Tract in Loud Twang-Like Singing While Producing High and Low Pitches', *Journal of Voice*, 35(5), pp. 807.e1-807.e23.

Saran, M., Georgakopoulos, B., and Bordoni, B. (2022) *Anatomy: Head and Neck, Larynx, Vocal Cords*. Treasure Island (FL): StatPearls Publishing.

Schaap, J. and Berkers, P. (2014) 'Grunting Alone? Online Gender Inequality in Extreme Metal Music', *Journal of the International Association for the Study of Popular Music*, 4(1), pp. 101-116.

Sherwood, T. (2023) 'Evolving the Master-Apprentice Tradition: A Pathway Back to a Student-Centered Pedagogy', *Journal of Singing*, 80(1), pp. 13-22.

Sui, W., Sui, A., and Rhodes, R.E. (2022) 'What to Watch: Practical Considerations and Strategies for using YouTube for Research', *Digital Health*, 8, pp. 1-13.

Suri, H. (2011) 'Purposeful Sampling in Qualitative Research Synthesis', *Qualitative Research Journal*, 11(2), pp. 63-75.

Torraco, R.J. (2016) 'Writing Integrative Literature Reviews: Using the Past and Present to Explore the Future', *Human Resource Development Review*, pp. 1-25.

Tsai, C-G., Wang, L-C., Wang, S.F., Shau, Y-W., Hsiao, T-Y., and Auhagen, W. (2010) 'Aggressiveness of the Growl-Like Timbre: Acoustic Characteristics, Musical Implications, and Biomechanical Mechanisms', *Music Perception*, 27(3), pp. 209-221.

Unterhofer, C., Marscheider, J., Auer, S., Jeleff-Wolfler, O., and Graf, S. (2022) 'Prevalence of Dysphonia in Metal Singers and the Impact of Vocal Education: A Subjective Analysis', *Journal of Voice*, (online only, article in press).

Vince, R. (1998) 'Behind and Beyond Kolb's Learning Cycle', *Journal of Management Education*, 22(3), pp. 304-319.

Vince, R. (2022) 'Reflections on "Behind and Beyond Kolb's Learning Cycle"', *Journal of Management Education*, 46(6), pp. 983-989.

Ziegler, J.B. (2018) *A Pedagogical Guide for Extended and Extreme Vocal Techniques used in Contemporary Classical Vocal Music*. Unpublished DMA Thesis. University of Iowa.

YouTube Video References

Benites, D. (2020) How to scream: Unlocking your high screams [video]. Available at: https://www.youtube.com/watch?v=VwrhD8la_VM (Accessed: 10 October 2023).

Casey, F. (2016) Freya's Singing Tips: How to sing RASPY without KILLING your VOICE [video]. Available at: https://youtu.be/8l_XW5l-oPI?si=A-82ZwTTYkCBI4Dv (Accessed: 10 October 2023).

Chandler, J. (2021) How To Sing With A Raspy Voice The SAFE Way! Sing RASPY without KILLING your voice! [video]. Available at: <https://www.youtube.com/watch?v=-HXRvGwl2vc> (Accessed: 10 October 2023).

Cowan, A. (2021) Easy and Safe Metal Screaming Tutorial (Beginner Level) [video]. Available at: <https://www.youtube.com/watch?v=Qv5t2ITnW1s> (Accessed: 10 October 2023).

E, V. (2022) Singing With A Vocal Growl [video]. Available at:
<https://youtu.be/eRUwiYOYBAw?si=Prkb2vw2vlzw0IYC> (Accessed: 10 October 2023).

Evans, C. (2016) Screaming Without Doing Damage | Free Singing Lesson [video]. Available at:
<https://www.youtube.com/watch?v=JNOPCUoC0-E> (Accessed: 10 October 2023).

Liepe, C. (2019) How to Scream, Add Distortion, Yell and Sing Aggressively WITHOUT Hurting Your Voice! (3 Steps) [video]. Available at:
https://youtu.be/wOueNQy6MZk?si=lkwDXG4_xLA9N1Su (Accessed: 10 October 2023).

Linke, T. (2020) Rough Vocal Effects 101 | #3 False Fold Distortion (3 different techniques!) [video]. Available at: https://youtu.be/n_EIC9T2sR4?si=fKt1PUtZYwRM0330 (Accessed: 10 October 2023).

Lisenko, M. (2020) 'How To Growl' Basics: 3 Safe Ways To Learn False Cord Technique [video]. Available at: <https://www.youtube.com/watch?v=Yrugh0Il8Nk> (Accessed: 10 October 2023).

Robinson, D. (2018) How to develop a RASPY SINGING VOICE: exercise included [video]. Available at: https://www.youtube.com/watch?v=7h_1uuU5rWA (Accessed: 10 October 2023).

Sibila, M. (2023) How To Growl Tutorial - The Most Simple Way [video]. Available at:
<https://www.youtube.com/watch?v=fBH8DzEuZQs> (Accessed: 10 October 2023).

Stallworth, J. (2021) How to Sing Extreme Metal Without Damaging Your Voice [video]. Available at: <https://www.youtube.com/watch?v=1ova4e2uMjg> (Accessed: 10 October 2023).

Tamplin, K. (2019) How To Sing With Distortion and Rasp Or Grit - Ken Tamplin Vocal Academy Tutorial [video]. Available at: https://youtu.be/YGSnbHraAtQ?si=5VtRlpXY_aQ-UUxM (Accessed: 10 October 2023).

Zeigenbein, D. (2017) How To Scream: 4 Simple Steps for Complete Beginners [video]. <https://www.youtube.com/watch?v=z8vP-NzsIMI> (Accessed: 10 October 2023).

Appendix A: Literature Review Process Spreadsheet

Authors	Year	Title	Methods	Goals	Limitations	Conclusions	Topic	Notes
Aaen, M., McGlashan, J., Christoph, N., and Sadolin, C.	2021	Deconstructing Timbre into 5 Physiological Parameters: Vocal Mode, Amount of Metal, Degree of Density, Size of Larynx, and Sound Coloring.	Laryngostroboscopy and electroglottography, sustained vowels. 17 singers.	Timbre as a combination of phonation mode AND color. Systematic assessment of laryngeal adjustments necessary for lightest and darkest extremes of four phonation types.	All singers were CVT trained, though various styles were represented. Didn't measure facial gestures, tongue postures, or image the pharyngeal space.	By separating mode gestures and color gestures, "this study demonstrates a more nuanced perspective on the choices available to singers for varied expression for performance" (p. 14). Modes do not have equal ability for sound coloring.	SUPPORTING	
Leppavuori, M., Lammelausta, E., Peuna, A., Bode, M.K., Jokela, J., Ojala, J., and Nieminen, M.T.	2021	Characterizing Vocal Tract Dimensions in the Vocal Modes Using Magnetic Resonance Imaging.	Four singers, sustained variety of vowels in all four modes on single pitches (different pitches for men and women). Audio signals simultaneously recorded. Successful production confirmed in real time by four CVT trained teachers. Repeatability testing was conducted for all measurements.	To study the four CVT vocal modes with MRI and test the viability of this method for assessing modes.	Small sample size, single pitch. Vowels varied in Curbing depending on singer preference, making those images harder to compare. More thoughtful examination with comparisons between modes on the same vowel would be helpful, rather than using the "practice vowels" recommended for each mode. "uh" (as in up) or "eh" (as in every) are common vowels that can be used in any mode. Imaging done in midsagittal plane only, which does not show other important dimensions of vocal tract shaping.	Vocal tract differences were apparent in all singers between the vocal modes. MRI found to be a good method for evaluating modes in future research. Edge had the most pharyngeal narrowing, laryngeal elevation, and shortest vocal tract. Neutral had the least mouth opening and the shortest distance between the tongue and palate, showing a relaxed and thick tongue and a gently dropped jaw. Loud sounds correlate with an increase in high frequency energy.	SUPPORTING	Resonance strategies are also somewhat individual, so finding the best vowel for each student might mean trying a few. This paper presents a brief overview of which vowels are necessary or best for various modes, so this is a good resource to tap when developing my at-glance working model. Curbing is associated with reduced density and laryngeal tilt, a reduction of higher spectral energy. That's why I find it the easiest on-ramp for finding distortion at lower volumes. Edge has the most narrowing, so the most high frequency partials. It sounds much louder than curbing, and so distortion from Edge feels much louder and sharper. Measurements for Curbing and Neutral seem hardest to pin down, as these modes are not vowel dependent.
Saldias, M., Laakkonen, A.-M., Guzman, M., Miranda, G., Stony, J., Aiku, P., and Sundberg, J.	2021	The Vocal Tract in Loud Twang-Like Singing While Producing High and Low Pitches.	One male CCM singer on a single vowel at different pitches. Endoscopic assessment and CT scan.	To investigate the contribution of upper and lower vocal tract configurations on twang singing at different pitches.	A single male subject on a single vowel. Subject is American English speaker, and vowel cues were given by Chilean Spanish speakers. Chilean Spanish does not include "ae" – so there is some question about the preservation of the intended vowel "ah" – how it was heard and produced by the subject, and how it was assessed by the researchers. Singer was also performing inside a noisy CT scan machine, so he was lying down, and didn't have absolute control over volume.	This paper has a great graphic of the pharynx and epilaryngeal tube. These would be great to include alongside the CVT graphic of the six vocal tract levels. Also a great graphic of the actions that contribute to twang – I could pair this with thoughts about how certain modes are easier bridges into RVEs because they approximate the right tissues. References CVT – Overdrive and Edge as types of belting. CVT folks identified the high twangy sound in this study as reduced Overdrive – Overdrive with Curbing added.	SUPPORTING	
Aaen, M., Sadolin, C., White, A., Nouraei, R., and McGlashan, J.	2022	Extreme Vocals – A Retrospective Longitudinal Study of Vocal Health in 20 Professional Singers Performing and Teaching Rough Vocal Effects.	17 singers (from an initial group of 20) assessed over a 14 year interval (2007 - 2021)	Determining long-term vocal health impacts of RVE use. Longitudinal studies are important because phonotrauma is often the result of continuous misuse rather than an acute event. Longitudinal studies are often of students, rather than professionals, because pros are harder to continuously recruit.	All participants are trained in CVT.	Vocal health improved over the 14 year period. "Demonstrates the benefits of a unified terminology in voice pedagogy" (p. 9). Supraglottic narrowing and other movements to facilitate approximation of tissues and structures to vibrate is not damaging to vocal health. These gestures are necessary for producing RVE.	RVE HEALTH	
Unterhofer, C., Marschieder, J., Auer, S., Jeleff-Wolfer, O., and Graf, S.	2022	Prevalence of Dysphonia in Metal Singers and the Impact of Vocal Education: A Subjective Analysis.	74 participants.	Determining the impact of dysphonia and links between level of professionalism and/or education.	Singers who experience strain or injury while using RVEs are unlikely to keep singing that way.	Prevalence of dysphonia was low, contrary to expectations. No significant connection between education/pro level and incidence of dysphonia. Vocal education for metal techniques is helpful but not mandatory for preserving vocal health. Voice lessons are one way to learn a healthy technique, not the only way.	RVE HEALTH	
Guzman, M., Barros, M., Espinoza, F., Herrera, A., Parra, D., and Munoz, D.	2014	Laryngoscopic, Acoustic, Perceptual, and Functional Assessment of Voice in Rock Singers.	21 rock singers, control group of 18 pop singers. Singing and speaking voice assessed via acoustic, perceptual, functional, and laryngoscopic analysis.	Assess a group of rock singers who use "growl" and "reinforced falsetto".	All young singers (19 to 34, average age of 26). Only two women. Recruited through personal associations from amateur rock bands. Only had to practice these techniques 4+ times per month in performance or rehearsal to be included.	Though the use of these techniques represents hyperfunctional gestures, RVEs didn't seem to contribute to any vocal fold problems. Singers who use these sounds for longer durations or more often may have different results.	RVE HEALTH	
Aaen, M., McGlashan, J., Christoph, N., and Sadolin, C.	2021	Extreme Vocal Effects Distortion, Growl, Grunt, Rattle, and Creaking as Measured by Electroglossography and Acoustics in 32 Healthy Professional Singers.	32 pro singers and teachers, sustained vowels. VHI also measured.	Systematic measurement of the acoustic impacts of these gestures when combined with different types of phonation. "This study proposes to adopt a physiologically delineated terminology for vocal effects for specificity, pedagogical precision, and to ensure reliability and validity in future research, as opposed to viewing all rough sounding effects as "vocal distortions" (p. 12).	Study limited in terms of using single pitches and vowels, as the acoustic and perceptual profiles of these effects as applied to the modes may differ over a singer's range. More research needed in terms of pitch dependence or independence, as well as the impact of different vowels on results.	Defines five "rough-sounding" vocal effects. Each vocal effect impacted the acoustic spectrum in particular frequency bands with statistical significance. Supraglottic sound sources can be controlled independent of vocal folds, so effects can be added to any phonation type.	RVE PED	
Reid, K., McKenna, V.S., and Smith, D.	2022	Mitigating Dysphonia, Pain, and Vocal Handicap after Violent Video Game Voice Overs: A Pilot Investigation into Vocal Combat Technique Training	5 voice over actors. Two performance sessions. First was control, second was after three hours of VCT training.	Investigate how VCT training can help mitigate negative symptoms after violent voice over performance.	One of the researchers is the founder of VCT training and has investment in proving the efficacy of this technique. Acoustic pretraining measures, but also heavily reliant on self-reported results. Very small sample size. The "control" is also a bit faulty – actors can "warm up" to the task, and can also have been experiencing testing jitters in the first instance that led to vocal tension and poorer outcomes.	Acoustic pretraining, self-reported comfort and readiness, and percentage of useable utterances (according to a single dictionary) all improved after training. Auditory-perceptual ratings (an SLP listening to potential dysphonia) had no change. No control and no blind in the study. None of the performers were actively working in the video game industry. There was significant attrition after the first session because the performers didn't want to do it again.	RVE PED	Voice over artists also tend to use violent sounds "instinctively," as "open track" training techniques do not address the reality of these sounds. VCT utilized "upper thoracic expansion to counteract vocal tension" and "positioning and vibration of supraglottic structures for the addition of roughness or turbulence" (p. 3).
Guzman, M., Acevedo, K., Leiva, F., Ortiz, V., Hormazabal, N., and Quezada, C.	2019	Aerodynamic Characteristics of Growl Voice and Reinforced Falsetto in Metal Singing.	23 healthy metal singers, performing either technique. Confirmed absence of voice pathology and then assessed aerodynamically while performing effects.	Measure glottal airflow rate, subglottic pressure, and sound pressure level during effects. Hypothesized that phonatory effort would be low, even though these effects sound stressful.	Small sample size. General term "growl" includes soul-type growling and death metal grunt – seeing them as different versions of the same sound. CVT separates these based on physiological events.	Growl = higher subglottic pressure and glottal airflow. Low glottal resistance, indicating low glottal closure during growl, which would reduce the risk of phonotrauma. Agrees with Caffier that the closed phase is decreased, vocal folds making less contact. High subglottic pressure used as a way to vibrate various supraglottic structures that are approximated via pharyngeal narrowing – not the vocal folds themselves. Mentions further research on Rattle by Caffier. Results for "reinforced falsetto" (as opposed to naive, or untrained, falsetto) = high subglottic pressure AND high glottal resistance, which at first might be worrisome. Singers utilize resonance strategies to keep vocal folds from working too hard. Adequate vocal tract configuration is essential to the sustainability of this sound. Singers spontaneously use the vowel /a/ (apple) – this is the same vowel that singers choose for high-belt necessities. This would translate to "edge" in the CVT parlance, which according to CVT is not the only option – "curbing" is also a functional setting for high, loud, reinforced pitches, and can also lead easily into distortion and other effects.	RVE PHYS	References Sakakibara and Caffier physiology research. Can translate findings to teaching strategies for growl. Loose and relaxed tissue, lots of airflow but very tight vocal fold contact. Important to start quietly, to prevent vocal folds from making too much contact and straining under the load of high subglottic pressure. Growl = decrease adduction and increase subglottic pressure, which then increases airflow rate. Reinforced falsetto = increase adduction, increased subglottic pressure, which does not increase airflow rate (vocal folds are resisting the air). Needs an appropriate vocal tract shape, would be most health protective to practice the needed vowel adjustments at lower pitches and volumes first, then gradually add resistance.
Aaen, M., McGlashan, J., and Sadolin, C.	2020	Laryngostroboscopic Exploration of Rough Vocal Effects in Singing and their Statistical Recognizability: An Anatomical and Physiological Description and Visual Recognizability Study of Distortion, Growl, Rattle, and Grunt using Laryngostroboscopic Imaging and Panel Assessment.	20 singers performed all four vocal effects. Stroboscopic (MUTED – no sound) were assessed with two blind panels, (5 voice clinicians and 49 singing teachers), to determine recognizability of the effects in the supraglottic structures.	To determine whether these effects can be recognized as discrete vibration patterns of supraglottic structures, even by singing teachers who are familiar with CVT but not accustomed to assessing imaging.	Varying years of experience in singers, voice teachers, and SLPs.	"Vocal effects can be performed, identified, and recognized as particular vibratory patterns of supraglottic structures with no visible pathology in subjects performing the effects" (p. 162.e5). "There is consensus in the literature that supraglottic constriction is a necessary condition for vocal effects" (p. 162.e6). Voice clinicians experienced a learning curve, the first half of their samples were far less accurate. Singing teachers did not experience a learning curve, indicating that "knowledge of how to produce and identify the sounds by ear provides a good framework on which to apply image interpretations" (p. 162.e12). Demonstrated the importance of adopting discrete language for effects based on the specific gestures of supraglottic structures, for ease of assessment, research, and teaching. Especially important to clarify terms as these sounds can be used in conjunction with each other, and they are more helpful than general terminology. Singers were able to perform effects consistently and at a variety of volumes.	RVE PHYS	Divides the vocal tract into six levels in order to define the area in which supraglottic vibration is occurring. This may be a helpful graphic to include in my working model, as kinesthetic cues may be helpful to students as they learn. Could use sighs, yawns, swallows, coughs to feel different levels of the vocal tract? Kind of amazing that the panels involved were given a 15-minute introduction to CVT and the definitions of the vocal effects, and the rate of successful identification was extremely high. It's promising that it doesn't take long for teachers and clinicians to solidly grasp these concepts and be able to differentiate effects. This study gives a physiological breakdown of the vocal effects one by one, which will be helpful to cross reference with other studies.
Tsai, C.-G., Wang, L.-C., Wang, S.-F., Shau, Y.-W., Hsiao, T.-Y., and Auhagen, W.	2010	Aggressiveness of the Growl-Like Timbre: Acoustic Characteristics, Musical Implications, and Biomechanical Mechanisms.	Mostly a lit review, also encompasses an experiment measuring the action of a deep abdominal muscle under resting, singing, and growling behaviors. Takes a biomechanical, psychological, and evolutionary perspective.	Investigating the links between the production of growls and the physical preparation for aggressive behaviors. Looks for psychological and musical meaning correlates, also describes acoustic and physiological parameters of growling.	Used a single external ultrasound transducer to measure the action of the transverse abdominal muscle during growling. Links additional movement to intensity of growl, but didn't have the subjects sing clean tone intensely to compare. Makes a leap about the reasoning – because spine stabilization protects animals during attack, we growl when we're being aggressive. Doesn't consider that growl takes much higher airflow because the supraglottic structures need to vibrate and the vocal folds are not as strongly adducted. Really weird study, I can't make any sense of their reasoning.	Interesting perspective regarding the physical action that might induce a growl – including the activation of abdominal muscles to stabilize the spine when under attack. Touches on the "re-enactment" that humans experience when we hear a sound we like. It's as if we are also making the sound. Apparently throat singing has the vocal folds and supraglottic structures vibrating acoustically, while distorted rock singing has these two sets of oscillators vibrating at different frequencies. Maybe why throat singing is more limited in the pitches that can be used? Over all there wasn't much new material in terms of the psychoacoustic notes were interesting.	RVE PHYS	

Sakakibara, K-I., Fuks, L., Imagawa, H., and Tayama, N.	2004	Growl Voice in Ethnic and Pop Styles.	Videofluoroscopy and high speed imaging, as well as spectral analysis and model simulation to explore acoustics.	Examining the growl mechanism in depth.	Very muddy and general imaging, not finding a difference in laryngeal adjustment between "metallic" and "growl" -- though clearly there is one, because the sounds are very different. The subjects were two of the researchers who learned how to make these sounds by listening to them -- they didn't conduct the study on experienced users of these sounds.	Supraglottic structures vibrating along with vocal folds, either harmonically or subharmonically. Aryepiglottic constriction and vibration (is this possible?) -- larynx usually high. In throat singing, it's ventricular folds vibrating along with vocal folds. Ventricular folds have very little muscle tissue so they cannot become tense. Differentiation between growl and grunt -- compare this to CVT research. Gives a three-tiered model of the larynx.	RVE PHYS	Gives background on several styles of music around the world that employ growl. Mentions that there is "no clear evidence of its production mechanism" (p.1) -- likely because this paper is too old to consider the imaging that has now been done. Acoustic findings are more compelling, drawing distinctions between growl and grunt (which is interpreted in this case as kargyraa or throat singing). Grunt/Kargyraa incorporates ventricular fold vibration AND vocal fry -- something that Chris Liepe incorporates very well in his video (saved in research journal). This is an important distinction -- that grunt happens much closer to the vocal folds, but they are in fry mode while it is happening, and so they need to stay very relaxed. This is more specific than some of the other videos I randomly perused -- but we'll get to those later.
Pinto, C.M.	2023	Listeners' Perception of Vocal Effects During Singing.	Classical ToS, Contemporary ToS, SLPs, and NPL (non-professional listener) -- identifying effects, analyzing performance based on their preferences, and interpreting whether the singers' voice sounded unhealthy. If unhealthy, asked whether they would send them to a teacher, an SLP, or an MD. Distortion and Growl were the effects studied. Referencing Sadoin (CVT) for definitions. 100 listeners divided into 4 categories. Used a training and identification task and a judgment task.	Investigating the perception of vocal effects by different voice professionals. Gives physiological and acoustic overviews of both effects and thorough overview/ lit review regarding historical vocal health concerns.	Only measured growl. Training model could be improved to help participants better understand effects before undertaking the judgment task. Results are too narrow to be generalizable.	NPLs had a lower rate of concern. No biases in referral of care between occupations. ToS received the most referrals, then MDs, then SLPs. Ability to identify vocal effects was impacted by occupation.	RVE PHYS	Gives an outline of the concerns of different musical styles and voice clinicians, underlining the need for a common language surrounding vocal quality (as differentiated from timbre, which itself is confusing -- maybe use the word texture instead to be clearer?) in order for interdisciplinary work to be possible and to avoid miscommunication. Talks about bias toward vocal effects from clinical and musical perspectives. I LOVE the use of the term "Eurocentric classical music". Says that "research focused on the safe implementation of these vocal effects is needed to ensure the vocal health and longevity of a singer's voice" (p.2). Importance of bias in the impacts of teaching or clinical interventions -- if a singer thinks a piece of advice is rooted in negative bias, they are unlikely to heed that advice, and may end up aggravating an existing vocal injury. Stigma surrounding vocal injury among performers is also a barrier to best practice in terms of vocal health, and stigma could be reduced by clinicians and teachers better understanding vocal effects. Nice graphic about the cycle of stigma.
Caffier, P.P., Nasr, A.I., Romero Rendon, M.M., Wienhausen, S., Forbes, E., Siedner, W., and Nawka, T.	2018	Common Vocal Effects and Partial Glottal Vibration in Professional Nonclassical Singers.	Perceptual assessment, videolaryngostroboscopy, electroglottography, and voice function diagnostics. Cohort of ten male singers from a few different nonclassical genres.	Multidimensional investigation into common vocal effects as used by professional nonclassical singers, examining production, reproducibility, demonstrate partial glottal vibration, and assess potential vocal health impacts.	Small sample size, all men.	Wide variety of effects tested, all were easily distinguishable from one another. Produced reliably in each individual, consistently repeatable. No negative impact on trained singers. Possibility of long-term damage depends upon a number of other variables. Incidence of partial glottal vibration needs further study. Gives thorough review of findings for each effect, with photos. Supports the legitimacy of RVE techniques and terminology.	RVE PHYS	The long-term study by CVI answers this paper in terms of the potential for long-term damage in trained singers. This paper supports the CVT framework and findings. Also mentions the importance of microphone technique and knowledge of amplification in order to successfully perform RVEs.

Appendix B: Working Model for Teaching Rough Vocal Effects

VOCAL EFFECT	PERCEPTUAL DESCRIPTION	PHYSICAL MECHANICS	TEACHING TARGETS AND APPROACHES
Creaking	- Vocal fry or “pulse” / M0 register - No discernible pitch - Often used on onsets	Relaxed vocal folds vibrating together without regular phonation.	- Sigh to bottom of vocal range to find fry - Sustain fry at bottom of vocal range - Sustain fry with different vowel shapes - Transition to a sung note from sustained fry - Use Creaking in musical contexts
Grunt	- Consistently rough texture - No discernible pitch in non-phonatory condition - Includes low pitch and pronounced subharmonics in phonatory condition	Vibration of the entire supraglottic structure, accompanied by low frequency vibration of vocal folds, or in absence of vocal fold phonation.	- Exasperated sigh, then sustain effect noise - Polite throat clear, then sustain effect noise with pitch - Toggle between clean tone hum and polite throat clear on the same pitch - Toggle between sighing (non-phonatory) grunt and throat clearing (phonatory) grunt, noticing the difference in airflow - Use Grunt on vowels, words, and phrases
Growl	- Rolling, rhythmic noise added to pitch - Large “grain”, pitch clearly discernible - Often used on onsets	Vibration of arytenoid cartilages against epiglottis. Epiglottis pushed back by tongue.	- Practice Edge, twang / metallic sounds - Exaggerate twang until approximation of cartilages induce growl - Mimic sounds: revving motorcycle, animal growling, certain cartoon voices - Practice growl onsets on different pitches
Rattle	- Rhythmic noise added to pitch - Medium “grain”, pitch clearly discernible - Can sound wet or choked	Vibration of arytenoid cartilages against one another, accompanied by pharyngeal narrowing.	- Practice Edge, twang / metallic sounds - Practice Growl, then increase compression until almost no air is passing through - Physical cue: feel something closing in the back of the throat - Mimic sounds: a small frog ribbit, a cartoonish choking sound effect - Practice sustaining Rattle on different pitches
Distortion	- Consistently rough texture added to pitch - Fine “grain”, like static or white noise, pitch clearly discernible	Vibration of ventricular folds against one another. Likely performed with an elevated larynx.	- Practice Curbing, crying / whiny sounds in the middle and upper vocal range - Add compression / resistance to limit airflow, and / or add volume until Distortion begins - Alternately, sustain Creaking at middle / upper vocal range, then add compression and pitch to turn Creaking into Distortion