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Educational Strategies in Critical Listening: Interviews with Instructors.

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ABSTRACT

This paper presents the findings from interviews with ten educators in the field of critical listening. The purpose of this investigation is to establish strategies for pedagogues in the field as there is currently limited information available for curriculum and lesson planning. The interviews uncovered agreed upon critical listening processes which could form the basis of a taxonomy for educational purposes. They also offered numerous teaching methods, tools, assessments, and learner-centered considerations. This research provides the basis for subsequent studies regarding the effectiveness of educational strategies in critical listening.

1 Introduction

Critical listening is a skill that is often considered central to audio education [1], with both recruiting professionals and students valuing this skill highly within the realm of music technology [2]. Despite a push towards making critical listening the focal point of instruction in some audio production and sound technology curriculum [3], it is often viewed as an auxiliary learning outcome to more technical aspects of audio engineering in study modules that go beyond simple perceptual skills development [4]. Further complicating the matter, the information available to pedagogues when developing and delivering curricula that focus specifically on this skill is somewhat limited [5], as studies on technical ear training generally dominate the research in critical listening education [e.g. 6]. While some studies provide guidelines for conducting specific critical listening exercises with students [e.g. 7] and broader instructional design guidelines applied to this topic [e.g. 8], there is a need to add information to this body of knowledge.

As a direct continuation of a survey of critical listening study modules, including some emphasis placed on the concept of mental representations [4], this paper aims to further explore the topic of critical listening pedagogy through interviews with instructors. Given the potential for ambiguity that the terms "critical listening" and "mental representations" offer [4], it is first necessary to gain insights into how educators define these terms. This paper subsequently aims to add to the corpus of pedagogical practices in critical listening.

2 Background

2.1 Critical Listening

Inherently linked to sonic perception, the term critical listening can hold different meanings depending on the field of study. As a simple definition for this paper, listening beyond passive hearing provides a general sense of the *critical* part of the term, with sound quality being the general area of *listening* interest in audio engineering. However, different listening functions can provide

further distinctions regarding specific aspects of sound quality which can be focused on within a critical listening exercise. As perhaps the most widespread model, Schaeffer's four listening modes provide a framework that may help further define critical listening in this paper. According to Schaeffer's model [9], listening modes belong to two categories, each containing a pair of descriptors:

- Objective (focused on the object of perception), or Subjective (activity of the perceiving subject).
- Abstract (stemming from form and customs), or Concrete (immutably belonging to the sound).

He then proposes four listening modes making use of the different possible combinations of these pairs:

- Perceiving (subjective/concrete): Passive perception of raw sound.
- Hearing (subjective/abstract): Selective perception of sonic structures.
- Listening (objective/concrete): Perception of the cause of sound.
- Comprehending (objective/abstract): Perception of the meaning of sonic entities.

Beyond the mechanics of perceptual ability, a process discussed at length by Schaeffer and others [e.g. 10], critical listening requires an output (communication) to confirm input (perception). Exemplified by the many different frameworks developed to describe timbral qualities [e.g. 9], communication about this aspect of sound generally uses some form of objective or subjective language, often relying on metaphorical tenets for the latter. As such, our definition of critical listening includes two components: the act of perception and communication about the perceptual object.

2.2 Mental Representations

Due to their inherently intangible nature, mental representations cannot be defined with full certainty. Nevertheless, the research concerned with this topic can provide some valuable insights [e.g. 4, 11, 12]. Emerging from both the embodied and information processing cognitive models, mental representations are said to contribute to an interaction cycle between perception and action in the mind [13]. However, a model-building process can also complement this view. With critical listening primarily rooted in perception, an ecological approach is deemed appropriate as it proposes timbre perception as the direct scanning of the invariant properties of sound and their associated affordances [14]. This notion allows the listener to create links between what is heard and what is known based on experience [15].

However, strictly speaking, Gibsonian ecological perception rejects the idea of mental representations as he argues that a representation (such as a picture) records information rather than sense data and therefore cannot be an accurate portrayal of the perceived situation [16]. On the other hand, mental representations are internal to the mind and said to be computational as they align with the information processing models of cognition. The ecological and information processing perspectives may, however, be reconciled through the use of perhaps better labelled "ecological representations" in place of "mental representations" [17]. Such representations can then be deemed informational rather than wholly accurate sensory renditions of perception. They allow for re-instantiations of mental activity which may have taken place during a perceptual event. This view can reconcile the two perspectives and answer the perceptual bottleneck problem in ecological perception by closing the stimulus gap between *what is* and *what is perceived*. Furthermore, ecological representations allow for mental activities such as guided imagery to occur in the absence of perceptual stimulus. When considering mental representations as being internal activations of ecological information, it is possible to link the perception/action ecological aspect of the term with its more informational essence.

2.3 Education

As this paper focuses on the educational context for critical listening, a taxonomy of learning outcomes in this field may be useful to classify the stages of skills development. Derived from Bloom's notion of the psychomotor domain presented in his well-established taxonomy of educational objectives [18], Moore develops a five-level taxonomy of perception with an intended use in educational settings [19]. The proposed levels are:

- Sensation:
  Awareness of stimulus as information.
- Figure perception:
  Awareness of entity.
- Symbol perception:
  Awareness of figures as denotative signs.
- Perception of meaning:
  Awareness of associated significance.
- Perceptive performance:
  Ability to make complex reactive decisions.

After testing it in different contexts [e.g. 20], she suggests that her taxonomy may relate particularly well to auditory perception. As such, it will be reviewed later in this paper, alongside the previously presented key components of critical listening.

3 Method

This exploratory study adopts a constructivist approach to knowledge production and as such, uses semi-structured interviews with educators in the field of critical listening. Participants were initially chosen based on their experience in teaching study modules that view critical listening as the focal point of instruction, somewhat emphasizing their use of notions related to mental representations, as identified in a previous study [4]. However, as the project scope grew into a broader study on teaching best-practice, the sampling method evolved. Beyond some snowball sampling, it principally turned into stratified sampling in order to provide an even representation of educators in the areas of composition/sound design, music production, and audio engineering. These three groups were chosen due to their affiliation to the most common subject matter areas containing critical listening as a learning outcome: audio engineering and music production [4]. The assignment of participants to each category was determined both by self-allocation and examining their curriculum vitae. Although there is some degree of overlap between these categories, they are somewhat equally represented in the participant sample: 3 for composition/sound design, 3 for music production, and 4 for audio engineering.

The number of participants (n=10) is based on teaching experience and information power (defined by study aim, sample specificity, use of established theory, quality of dialogue, and analysis strategy). With all participants having approximately a decade of experience in tertiary education contexts, obtaining meaningful results with a relatively small sample size is possible [21]. Furthermore, with information power providing a deeper insight into sample size appropriateness than mere data saturation for qualitative research, a lower-than-average number of participants is warranted in this study [22]. This conclusion is derived from the study aim being very narrow (educational strategies in critical listening), the sample specificity being dense (educators delivering critical listening focused modules within audio/music fields), and the quality of the dialogue between researcher and participants being strong (both with approximately a decade of experience).

Based on a desire to explore pedagogical practices in critical listening with some emphasis placed on the concept of mental representations, the following questions sparked discussions during interviews:

- What is your definition of critical listening?
- How did you develop your critical listening skills?
- What strategies do you think work well in teaching and assessing critical listening?
- Have you ever considered the concept of mental representations within instruction?

The interview transcripts were coded using themes arising from these questions: definitions and educational strategies. The data was then split into both predetermined and emerging codes. For definitions, the predetermined codes were “critical listening” and “mental representations”. By writing one-sentence summaries of presented ideas and subsequent joining of equivalent categories, sub-codes emerged to classify key concepts provided by each participant. For pedagogical considerations, codes emerged directly from the data. Beyond getting a sense of the whole through reading transcripts, each topic was first individually labelled before being organized by similarity into larger codes for the presentation of findings.

4 Results

4.1 Definitions

Critical Listening

When asked for a definition of critical listening, participants provided examples of processes undertaken during a listening exercise. Overall, four distinct processes were put forward as defining the term. Each process was put forward at least four times, with six participants mentioning at least two in their definition. The suggested critical listening processes are:

- Identify sounds through perceptual ability.
- Deconstruct sounds into production components.
- Critique technical/aesthetic sonic characteristics.
- Imagine possible sound improvement actions.

Mental Representations

When asked about the concept of mental representations of sound, participants had either no opinion on the subject or assertively provided a definition. Overall, two definitions were advanced, seemingly influenced by participants' predominant field of work (composition/sound design or production/engineering).

Two participants with backgrounds in sound design and music composition seemed to view mental representations as the vehicle for modal transduction between sound and other senses. The examples provided reference heavy footstep sounds to indicate that a large person is walking, and a slow swelling rhythm being reminiscent of the sea.

In contrast, four participants with backgrounds in audio engineering or production referred to mental representation as the internal process of imagining sounds. This idea was further separated between recalling sounds in the absence of sonic stimuli for one participant and imagining new combinations or transformations of currently presented sounds for three participants. The latter definition was further described as "mixing sounds in one's head" and developing "the producer's vision" while listening to raw sounds or music.

4.2 Educational Strategies

Participants generally agreed that the aim of critical listening is to deliver a high-quality sonic end-product. However, each interview revealed several practices related to the development of specific aspects of this skill, provided from both pedagogical experience and personal development standpoints.

General Considerations

All participants referred, in some form, to the adage that "practice makes perfect". The type of practice suggested included listening to music for hours each day, attending concerts weekly, and undertaking daily recording, mixing, or mastering tasks for multiple years. Benefits of university courses in the field were also presented as a means of improvement through reflective practice.

For educators coming from a professional audio engineering background, the apprenticeship model of learning by observing seasoned professionals in a studio setting seemed helpful. Educators coming from sound design or composition backgrounds suggested that recreation exercises are an excellent way of learning by assimilation. Suggested activities included undertaking movie or advertisement sound replacements and creating song soundalikes.

Theoretical knowledge was also mentioned as being part of critical listening pedagogy if the theory is presented alongside sound examples. This notion was also suggested as part of alternative activities such as researching the techniques used on specific recordings or considering how a recording medium and listening environment may impact perception. One participant illustrated the close relationship between theory and perception by referring to an "ear-to-brain connection".

Multiple participants mentioned the importance of a proper monitoring environment for critical listening. One participant stated that in order to build a reference point and standardize their listening environment, students should use the same pair of headphones to undertake critical listening exercises. This process was said to reduce the number of variables when repeating exercises over time.

However, with the understanding that working on speakers is a necessity in audio engineering and that students tend to move between studios during their course of study, the same participant suggested building a bank of reference sounds (a "reference CD") to learn new monitoring environments.

Attention Regulation & Vigilance

As an extension to their critical listening definitions, and with a mention that listening exercises should be undertaken early in a student's learning journey, participants proposed guiding strategies to develop attention regulation. Suggestions related to the recording stage of a project included memorizing the sonic characteristics of various microphones and carefully listening to instruments in the room before placing microphones. In relation to mixing and mastering, suggestions generally revolved around pre/post-processing comparisons. Guiding questions were offered to enhance learning during such comparisons: "has the track been improved (technically and aesthetically)?", "what other elements have been affected by this change?", "how are you able to tell that there is a difference?". A participant further clarified this last prompting question as providing insights into how each individual perceives sounds, therefore potentially helping others focus their attention differently. The examples provided were that one person might "hear something higher", and another might feel that "the space containing the instrument has changed".

In line with this idea of comparisons, the use of reference material was put forward as an essential aspect of critical listening, with guided listening tasks also suggested in this context. For example, students could list the instruments heard on a recording and review this list upon being given the answers and a second listen. Prompting questions such as "what processing has been applied?" or "how is the instrument being played?" were suggested as ways to help focus attention. Reference tracks were also mentioned in order to "reset one's ears" in a mixing/mastering context. However, one participant mentioned that such tracks should not be absolute references to copy but "inspirational maps" for technical and aesthetic sonic qualities.

Within the realm of attention vigilance, participants suggested that learners focus on their sense of hearing through turning lights off, reducing haptic distractions, closing their eyes, or listening to low frequencies through their body. Within a mixing or mastering exercise, the use of haptic controllers and reduction of visual feedback (e.g. turning computer screens off) was suggested to help focus the listener's attention to what they are hearing. Some participants also suggested improving attention vigilance and well-being through deep listening exercises [e.g. 23].

Creating visual sound maps was also suggested by multiple participants to develop critical listening skills for azimuth, depth, loudness, bandwidth, or any other "graph-able" sonic element perception. One participant added that comparisons between these various graphs can further develop students' critical listening skills by looking at interactions between elements.

Technical Ear Training

The topic of technical ear training came up in most interviews as helpful in developing critical listening skills. One participant mentioned that the aim of such exercises might not be about specific topics such as identifying frequencies but instead about refining perceptual skills through increased attention regulation and vigilance. Similarly, another participant proposed that one type of technical ear training exercise may foster perceptual abilities in another.

Participants mentioned numerous technical ear training resources [e.g. 24], with one participant suggesting that students begin such exercises with simpler and less intimidating software. For example, using the iTunes graphic equalizer to experiment with tonal changes on audio materials was said to be an excellent way to build confidence in this type of training. Further to this point, a participant commented on the linear nature of grades in technical ear training software. Despite being a way to measure progress within a given environment, the grade itself was said to carry little bearings on audio engineering skills: it is the motivating prospect of subsequently scoring better which is beneficial.

Multiple participants mentioned that technical ear training could be a very "dry" method of skills development. As such, suggestions were made to limit this type of training, use gamification, or use alternative equivalent activities. Examples provided for the latter included experimenting with frequency boosts/cuts on tracks in a mix, changing monitoring systems, or even turning individual speaker cones off to hear how different frequencies translate.

Mental Representations

When discussing mental representations for use within instruction, participants had views accompanying their definition of the term. Complementing the modal transduction definition, one participant suggested that, aside from the idea that "writing about music is like dancing about architecture", mental representations can facilitate the verbalization of perception through subjective language. Another participant suggested that sound and vision may need to be associated in the mind, quoting Chion's notion of synchresis [25]. The same participant also suggested that visual representations of emotions evoked by sound may also be appropriate in critical listening training, quoting Russell's circumplex model of affect [26].

Revolving around the idea of recalling sounds, one participant suggested that students need to memorize frequency anchors. However, they mentioned that it is unclear what sonic stimuli are being memorized and recalled. Except for sound reinforcement engineers who train to recognize pure tones to tune a public address system and quickly remove feedback, they added that pure tones are unlikely to form mental representations of specific frequencies. They also suggested that linking frequency anchors to specific instrument timbres may be more appropriate.

Within the realm of guided imagery, one participant suggested an activity to cultivate imagination for sound processing, labelling it "the two-minutes mix". In this activity, the same unmixed song is played multiple times while students mentally mix it. After this initial step, students are given two minutes to mix the song. The interview participant suggested that this process generally results in better mixes for students compared to those done over multiple hours due to the reduced amount of distraction that technology or knowledge of "the latest and greatest technique" offer.

Learner Differences and Considerations

Multiple participants pointed out that physiological differences and neurodiversity may affect the critical listening process. It was suggested that hearing impairments or differences in skull and ear size and shape could radically influence the way sounds are perceived. Two participants also mentioned that listeners with some form of auditory synaesthesia might perceive sounds fundamentally differently, which could influence their critical listening experience. Similarly, prior knowledge was said to influence skills. For example, two participants mentioned that musicians tend to identify more instruments within a recording than non-musicians. A third participant pointed out that being a musician was a motivating factor in developing their own critical listening skills.

Multiple participants mentioned that a student's state of mind could influence their critical listening skills. As such, it was suggested to start with simple tasks for beginners to foster motivation. One participant described a possible multi-year implementation of this concept: students first delve into individual processors and parameters on short audio segments, then move to the interactions between processors in full productions, and finally generate new workflows through experimentation. In order to reduce distractions and build confidence, one participant suggested that technical ear training exercises not be graded, adding that hearing is so malleable that being self-conscious of one's scoring ability could affect listening skills. Another participant suggested showing students that "they can do it" to foster confidence. They proposed taking a commercially available song and further processing it to demonstrate that even students can improve material already deemed industry standard.

5 Discussion

5.1 Refining a Taxonomy of Critical Listening

The processes proposed as defining a critical listening activity involve identifying, deconstructing, critiquing, and imagining sounds. These steps fluidly merge from purely technical listening (identify and deconstruct) to more integrative listening associated with both technical and aesthetic judgements (critique and imagine). As such, there may not be a need to separate critical and analytical listening, commonly defined as listening out of context or in context (respectively) [1]. Indeed, it could be argued that there cannot be a critique of technical characteristics without understanding aesthetic intentions. Similarly, the imagination of sound-refining actions can be undertaken for both technical and aesthetic reasons. We may, therefore, suggest that critical listening can be undertaken for technical or aesthetic reasons rather than separate the listening process into critical and analytical subdomains.

To reconcile these processes with established literature, it can be useful to examine Schaeffer's notion of "hearing intention" as it links specialist listening, such as critical listening for audio engineers, with the four modes of ordinary listening. Such a relationship is said to be co-constructive rather than one of opposition [27]. Therefore, if according to Schaeffer, "hearing" is concerned with sonic structures with a view to subsequently describe them, then the subjective process of identifying abstract sound entities seems a fitting match. On the other hand, Schaeffer's "listening" aims to determine the cause of the sound, a concept similar to deconstructing sound objects into their concrete production components. Finally, Schaeffer's "comprehending" involves delving into the meaning of sounds, which links back to the critiquing process through understanding abstract aesthetic intentions. Keeping Schaeffer's original view of "perceiving", the correlations between his listening modes and the participants' critical listening processes are:

- Perceiving → Perceive.
- Hearing → Identify.
- Listening → Deconstruct.
- Comprehending → Critique.

To classify these processes within an educational context and provide a means for segregating training experiences, connecting them to Moore's taxonomic levels could also prove useful [19]. Within the taxonomy, "sensation" can be associated with raw perception as it is merely an awareness of the informational aspects of stimulus. After this initial step, "figure perception" is an awareness of entities, where the process of identifying sounds belongs, bearing ties with Schaeffer's "hearing". The next level, "symbol perception", is an awareness of figures in the form of denotative signs, a concept aligning perfectly with Schaeffer's "listening" mode as it treats sound as a sign of its source. The process of deconstructing sounds into their production components also aligns well with this level. "Perception of meaning" follows as being an awareness of the significance commonly associated with sounds. This level coincides with Schaeffer's "comprehending" mode as it is interested in the meaning of sound, and therefore with the critique process suggested by participants. Within Moore's taxonomy, the mental manipulation of perceptual stimuli also belongs to this category. As such, the imagination of possible sound processing actions suggested by participants may be considered an extension of the proposed critique. Finally, echoing Schaeffer's central concern regarding the link between hearing and making, "perceptive performance" refers to an ability to make complex decisions reactive to their effectiveness where many factors are involved. Participants' suggestion that a high-quality sonic end-product is the aim of critical listening coincides well with this highest level as it involves complex decision making and reactive interaction with stimulus, integrating all previous levels into a coherent whole. Overall, the suggested correlations between Moore's taxonomy and participants' critical listening processes are:

- Sensation → Perceive.
- Figure perception → Identify.
- Symbol perception → Deconstruct.
- Perception of meaning → Critique/Imagine.
- Perceptive performance → Act.

Although there is a bottom-up hierarchical organization of these critical listening processes implying gradual complexity for the perceiver, the proposed taxonomical classification does not suggest increasing difficulty in learning and development. It is merely intended as a way to categorize listening processes in educational settings. However, as Schaeffer has done, it may be argued that each new listening function uses all previous levels. For example, the imagination process requires the identification, deconstruction, and critique of sound to manipulate it mentally. Finally, given the inherent link between perception and action in the highest level proposed, a connection to the notion of affordances ever-present in Gibson's ecological perception is possible [16], reinforcing the use of this model as a broad theoretical lens for the study of sound, as suggested by many scholars [e.g. 14].

Within both the critical listening processes proposed and as separate discussion points during interviews, the duality between perception and communication is reinforced. Theoretical knowledge provides an objective language for deconstructing sound, but there are currently few accepted standards for its subjective critique. Closely related to the concept of modal transduction, metaphors are often the basis of subjective language, reinforcing the earlier presented link between critique and imagination. Wherever possible, it may be beneficial to follow current trends and commonly used language [e.g. 28].

5.2 Consistent and Varied Critical Listening

Interviews suggest that critical listening is developed through consistent and varied listening. This point takes numerous forms in the data presented. Within general considerations, the idea of repetition points to the development of a critical listening curriculum as a structured continual development element rather than a single study module. The apprenticeship model was also a suggested pathway for audio engineers and producers to continuously develop their skills. Sound design and composition students can mimic this experience through sound replacements and soundalike (pastiche) composition exercises. Multiple participants suggested providing sound examples alongside theory as a necessity for critical listening development. This practice is an instructional design method employed in many textbooks [e.g. 29] and should be replicated in class.

Specifically related to sound analysis, various suggestions were provided that can be expanded upon to build a more extensive repertoire of classroom practices. For example, the suggested microphone shootouts can take the form of reflective reports with the addition of technical information, pre-production documentation for a recording, or software-based exercises. Similarly, careful listening to instruments in the recording room can be encouraged through a one-microphone ensemble recording or a project where the use of post-processing is limited. Finally, written sound analysis exercises often use recorded materials, but other contexts such as live concerts, sound walks, or moving speakers within a room can also provide adequate exercises for students.

Although insights were provided for both the modal transduction and imagination definitions of mental representations, no information beyond recognizing pure tones was suggested for recalling sounds. However, a relevant question was raised regarding the nature of the memorized frequency anchors. As such, it may be necessary to build a repertoire of frequency anchors using appropriate sound stimuli. For example, it could be argued that a bass guitar would accurately represent low frequencies. Furthermore, guided imagery techniques could be used in refining such anchors [30].

5.3 Learner Considerations

As perhaps the starting point for any discussion around pedagogy, learners need to be carefully considered. Establishing that individuals may perceive sounds differently and uncovering what those differences are early in students' learning journey can help ensure that they are provided with the best possible experience. Similarly, each student's prior experience should be taken into consideration when designing critical listening exercises. For example, pairing musicians with non-musicians for group exercises could enable peer teaching in instrument recognition.

As a more general pedagogical practice suggested by multiple participants, reducing barriers related to technology, lack of theoretical knowledge, or the requirement of more refined critical listening skills can help students feel empowered at the start of their learning journey. For example, recording an ensemble with a single microphone could reduce technological needs; mixing on an analog console could reduce theoretical knowledge needs; undertaking frequency recognition training using a low number of bands and high amounts of boosts/cuts would require less refined skills.

6 Conclusion

Overall, it is clear that critical listening is an important topic for music and sound production educators. Its definition, embodied by four processes (identify, deconstruct, critique, imagine), seems consistent. Furthermore, the findings in this paper reinforce the duality between perception and communication within critical listening. From an educational perspective, these concepts pave the way for the development of a taxonomy of critical listening.

Although differing definitions of mental representations seemingly depend on the field of study, the interpretations provided suggest a utility for this concept in critical listening pedagogy. From both a modal transduction perspective and as an imaginative process, mental representations can be reconciled with embodied cognition and ecological perception as theoretical constructs through ties with the subjective language used in sound critique and as an intermediate stage to perceptive performance.

Finally, participants in the study provided numerous instructional methods deemed helpful in their practice as educators. These preliminary findings can form part of educational strategies in critical listening to be evaluated in subsequent studies.

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