Crossmodal language and onomatopoeia in descriptions of bird vocalization

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Introduction

Timbre is often described using a rich inventory of words to express qualities of sound (e.g., onomatopoeia), as well as crossmodal language borrowed from senses of touch, vision and taste (e.g., Saitis et al., 2020; Wallmark & Kendall, 2018). In this study, we look at the use of onomatopoeia and other sensory language in texts describing bird vocalizations. Birders and ornithologists frequently engage in field trips to "spot" particular birds, where they often cannot see the birds, but have to rely on sound to identify the species. This practice has resulted in a long-lasting tradition of field guides which provide detailed descriptions of bird vocalizations. For example, the Harris's Hawk (*Parabuteo unicinctus*) is described in one guide as having a call that is a *harsh, grating "eeaarr"*, combining onomatopoeia (*eeaarr*) with words denoting its timbre (*harsh, grating*). The current study looks at the description of timbre in bird vocalizations in a corpus of bird field guides, drawing parallels to the description of timbre in music.

Method

We transcribed the 'voice' sections for 14 field guides, resulting in a corpus of 4,184 voice descriptions for 2159 bird species from all around the world, totaling 44,966 word tokens. To analyze the crossmodal nature of timbre descriptors, we used data from Lynott and Connell (2009), who asked native British English speakers to rate 423 property descriptors for visual, auditory, tactile/haptic, gustatory and olfactory content.

Results

Figure 1 shows a word cloud of the most frequent adjectives in our dataset. Many of these adjectives also occur frequently in studies of musical timbre. 73% of the instrument descriptors from Zacharakis et al. (2014) were attested in our corpus, such as *rough* and *dull*; 70% of the violin timbre descriptors from Fritz et al. (2012), such as *hard* and *raspy*; and 66% of the descriptors from Wallmark's (2019) analysis of orchestration pieces, such as *mellow* and *rich*. However, there are also differences to musical language. A comparison with the corpus frequencies of Wallmark (2019) shows that the words *sharp, soft, shrill, deep, thin, nasal, sweet, metallic*, and *hard* are significantly over-represented in descriptions of bird vocalizations compared to musical instrument descriptions (standardized Pearson's residuals > 2). On the other hand, *brilliant, dark, full, bright, sonorous, penetrating, clear, warm, dry,* and *piercing* are significantly under-represented.

Figure 1: Word cloud of the most frequent adjectives in the bird vocalization corpus.

Besides the overlap in timbre descriptors, the parallels between bird vocalization descriptions and musical language run deep. Bird vocalizations are described as *song*, *carols*, *duets*, and *chorus*; there are references to scales and major/minor chords, as well as direct comparisons to musical instruments (*flute-like, trumpeting*). Also, the same way that the timbre features of instruments are commonly compared to human voices (what Wallmark, 2014, calls the INSTRUMENTS ARE VOICES conceptual metaphor), we find rampant comparison of bird vocalizations to human vocal production (*throaty, ventriloquial, nasal*).

Matching the words in our corpus to the sensory modality ratings shows that, predictably, auditory language is significantly over-represented (Pearson's residual = +19.4), but so is tactile language (+10.5) and visual language (+14.7). Taste (-20.56) and smell words (-24.05) were significantly under-represented, with the only frequent taste word being *sweet*. Lynott and Connell (2009) also provide a measure of 'modality exclusivity' that quantifies how crossmodal a word is. The language used to describe bird vocalizations is overall more crossmodal than the general list of sensory descriptors from their study ($t(2733) = 5.7$, $p < 0.001$), although this difference was not stark (40% 'exclusive' for our corpus, compared to 46% baseline, Cohen's $d = 0.3$).

Finally, we observed that 2,608 out of the 4,184 entries (62%) contained onomatopoeias, which are often combined with timbre words to describe a particular call or song, e.g., *a sharp "twissi-vit", a crisp "pik"*, and *a ringing "krrit"*. We suggest that in this context, timbre words make up for the absence of voice quality, which is a crucial feature of direct imitations, but which cannot be rendered easily in the written form without these words. Thus, onomatopoeias and timbre descriptors work together to signal different aspects of the complex multidimensional nature of bird vocalizations.

Discussion

Whereas most investigations of timbre have focused on music or environmental sounds, here we show that the language of bird vocalizations is a fruitful domain for studying the crossmodal and metaphorical nature of timbre descriptions. We show that the description of bird vocalizations has much overlap with descriptions of music. We furthermore advance the study of timbre semantics by borrowing methods from psycholinguistics, specifically, the use of modality rating studies to quantify the crossmodal nature of timbre language. Our analysis of how timbre descriptors are combined with onomatopoeia suggest that different linguistic strategies in this domain may communicate different aspects of the complex sound of birds, thus demonstrating the potential for trade-offs between different communicative practices.

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