



Cultural Confusion: Parsimony, Social Learning, and Humpback Whales

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Abstract – In his viewpoint against the general zeitgeist of humpback whale song analyses, Mercado (2022) makes several problematic arguments. Although minimized, his arguments are based in parsimony; Mercado is assuming that the most efficient answers are the most likely to be true – an argument not always supported by evolutionary data. Parsimony in Mercado’s arguments can be divided into parsimony of mechanism (which mechanism is “simplest”) and parsimony of explanation (one mechanism is better than two). Both of these arguments are flawed. The first because social learning is not as rare or complex as has been previously claimed and the second because complex systems, particularly vocal systems, frequently utilize more than one mechanism of change. Mercado’s data do provide interesting contrasts to the assumptions made by humpback whale researchers, but his use of rhetoric and straw man arguments undermine the potential impact of those data.

Keywords – Humpback whales, Culture, Social learning, Songs

Related Articles – This article is part of an Opposing Viewpoints series on the topic of vocal culture in whales. See also:

Mercado III, E. (2022). The humpback’s new songs: Diverse and convergent evidence against vocal culture via copying in humpback whales. *Animal Behavior and Cognition*, 9(2), 196-206. <https://doi.org/10.26451/abc.09.02.03.2022>

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In no case may we interpret an action as the outcome of the exercise of a higher psychological faculty, if it can be interpreted as the exercise of one which stands lower in the psychological scale. (Morgan 1894, p. 53)

Every time I teach Animal Behavior, I spend at least twenty minutes talking about Morgan’s Canon (above), as I think most professors do. I specifically talk about the relationship between Morgan’s canon, Occam’s Razor (entities should not be multiplied unnecessarily) (Webster, n.d.), and the rule of parsimony (the principle that the simplest explanation of an event or observation is the preferred explanation) (APA, n.d.), although all of these are similar and argue that in all instances of science, the simplest interpretation is preferred (see Thomas, 2001, for a more extensive discussion of distinctions between these principles). In other words, KISS (Keep it simple, Stupid). Morgan’s Canon was created specifically for interpreting behavior of animals, and as such, has a number of assumptions “baked in.” The most important is that we

can arrange psychological abilities in a line from lowest to highest in complexity and determine the most appropriate “faculty” to assume from a complete display of possibilities.

As Morgan himself noted, the principle is easily over-applied. In the second edition to his textbook, Morgan added a rider to his Canon, “To this [Morgan's canon] it may be added – lest the range of the principle be misunderstood – that the canon by no means excludes the interpretation of a particular act as the outcome of the higher mental processes if we already have independent evidence of their occurrence in the agent.” (Morgan, 1985). Or, to paraphrase Albert Einstein, “Everything should be made as simple as possible, but not simpler.” There have been an ongoing series of discussions throughout the scientific literature on the over application and potential application of Morgan’s Canon/Occam’s Razor/Parsimony (Allen-Hermanson, 2005; Newbury, 1954; Thomas, 2001), including one by my counterpart in this opposing viewpoint article (Mercado, 2016, 2022). Of particular importance is the line of argument that clarifies that simple does not equal truth and that the most efficient solution is often not at all the one that was followed by evolution (Ball, 2016).

Given that phrase morphing across songs is acoustically similar to phrase morphing within songs, it stands to reason that similar production mechanisms could potentially account for both transformations. This account is more parsimonious than cultural explanations for song change because it attributes both transformational phenomena to a single mechanism that does not require social learning. (Mercado, 2021, p. 6)

Mercado’s argument for parsimony in humpback whale song (see quote above) can be taken to argue parsimony in two ways. One, an argument of parsimonious explanation: One mechanism is better than two. A reasonable argument, no question, but not always true (more below). The other is an argument of parsimonious mechanism: Social learning is less parsimonious than a vague, undescribed mechanism yet to be determined. Mercado’s arguments hearken back to the general scientific tendency to assume that social learning is necessarily more complex, and therefore rarer, than individual (or environmental) learning processes (e.g., Byrne, 1995; Herrmann et al., 2007; Tomasello & Call, 1997). I argue that it is not necessarily either of those things.

Parsimony of Mechanism: Social Learning, Imitation, Culture?

Social learning provides huge evolutionary advantages (not having to learn from scratch increases the likelihood of survival) and therefore, we might assume it would be widespread. Indeed, social learning is found across many species, and even the most complex social learning is found more often than we first thought. Imitation (direct physical mimicry) is often considered the highest level of social learning, and therefore the rarest (Byrne, 1995; Tomasello & Call, 1997; Whiten et al., 1996). However, direct physical mimicry has been found in primates (e.g., Whiten et al., 1996), in parrots (Pepperberg, 1994), and bottlenose dolphins have shown remarkable imitative abilities through both physical (Jaakkola, 2012) and vocal mimicry (Reiss & McCowan, 1993; Richards et al., 1984). Social learning more broadly is found widely in mammals, fish, birds, etc.; for example, ants (Franks & Richardson, 2006).

The true difficulty of evaluating Mercado’s claims is his tendency to conflate the terms “social learning” and “culture.” The question of culture is even more heavily debated than social learning, and one that is mired in anthropocentrism. Some of the most well-known definitions of culture would require human language and therefore a priori exclude nonhuman animals for cultural behaviors (see Rendell & Whitehead, 2001, and Whiten et al., 1999, for discussion and examples). Other definitions, most notably those in Rendell and Whitehead (2001, p. 310) are indistinguishable from social learning more generally.

Mercado is correct that these are not equivalent processes and the definitions must be clarified although he himself frequently uses the terms culture, social learning, and imitation (i.e., song copying) interchangeably. These distinctions are important because evidence against culture may not be evidence against social learning. For example, the coordinated adjustment hypothesis mentioned by Mercado would not support cultural learning but would still be a social learning process. Social learning can be as simple

as an animal changing their behavior by watching another – social facilitation is the name for such learning, which may not produce long-term learning per se, but only immediate behavioral change (e.g., rats choosing food based on food they smell on a conspecific's breath, Galef, 1996). Culture, in contrast, is often considered to require large groups changing behaviors together and maintaining those behaviors over time – a more complex phenomenon. Whiten et al. used a definition that has become popular: A cultural behavior “is one that is transmitted repeatedly through social or observational learning to become a population-level characteristic” (Whiten et al., 1999, p. 682).

I remain agnostic to the presence or absence of cultural transmission in humpback whale song, although I do believe that some level of social learning is present. However, I am extremely sympathetic to some of the arguments Mercado presents. Mainly, that all of the humpback whale studies presume social learning but fail to test for it. While hurdles exist to performing playback experiments with humpbacks, these are clearly not insurmountable as some studies have been published (Deecke, 2007). Humpback whale song research is far behind for example, bird song research, which has spent decades delineating the processes by which birds learn songs (e.g., Beecher & Akçay, 2021) and seems to base many conclusions on assumptions of social learning – field experiments would go a long way in moving the research forward (see Mercado's suggestions for future research, 2021, p. 11).

In contrast, I am at odds with Mercado's dismissal of social learning – particularly because he fails to suggest what mechanism, if social learning is excluded, exists that can morph complex vocal signals across a population and maintain that vocal signal in common over the course of days, weeks, or months. He does point out examples of noncultural processes changing behaviors in other animals, but fails to present any data suggesting which, if any, of those mechanisms could produce the humpback data. Mercado argues that researchers have settled on social learning because they have not thought of another mechanism that could maintain this behavior, and that is true. Not only was it true, it remains true.

All of these arguments currently are based on the absence of direct evidence for any mechanism for song changes that fit all of the available data. In this case, answering Mercado's call for Parsimony (still not a line of argument I will agree with), I would argue the most parsimonious explanation is social learning, due to the flexible vocal nature of other cetaceans, and the conformity of complex, hierarchical vocal productions. I imagine this is a stance on which Mercado and I will continue to disagree.

Parsimony of Explanation: One Mechanism is Better than Two

Given the arguments made in his viewpoint, Mercado's quote (above) is most likely to have been speaking to Parsimony of Explanation – that is the argument that all forms of vocal change in humpbacks should be most parsimoniously ascribed to the same mechanism. Mercado argues for rejecting social learning because of his findings that units of humpback song change not just across songs, but within songs. He argues that social learning might account for changes across songs only and therefore social learning is not supported for either kind of unit change. However, these types of unit changes and systematic patterns are not unprecedented in socially-learned communication systems.

One such socially-learned system is human language. It is well established that languages change systematically over historical time – that is – all changes, even changes that affect only small units of language (word order, phoneme acoustics) change across the entire language (Crowley, 1997; Murray, 1996). When English established a regular Subject-Verb-Object ordering, that change affected every sentence spoken in modern English. Similarly, when the old English vowel sound *ā* shifted – every *ā* shifted in the same way.

This systematicity is not limited to changes within a language but applies equally to changes across languages as well. Languages trend toward “simplified articulation” – adding vowels or deleting consonants across multiple different words that have the same difficult sound type (Crowley, 1997). Some phonemic changes are so well-established, they have become their own sub-field of historical linguistics. For example, lenition is the change that described the tendency for consonants to become more sonorous. One example is the tendency of voiceless sounds (t, p) to become voiced (d, b) – think how the t in wait is pronounced in English when we say waiting. Another example is dubucalization – s sounds changing to h or a glottal

stop – example in many Spanish dialects when *mas* is pronounced “mah,” and *estamos* is “estamoh” (Crowley, 1997).

Some of these changes will depend on the units that precede or follow them, leading to segmental change. These known tendencies of language change are so widespread, they are necessary guideposts when linguists reconstruct an historical language – the posited old forms must be phonetically plausible given these known rules of language change (Murray, 1996). These systematic changes in language are analogous to the changes in units that Mercado has highlighted in whale song. These unit changes do provide evidence that not all change within humpback whale song is socially learned. However, regardless of the environmental aspects of certain kinds of language change, one would never argue that language does not have socially learned components, and I am similarly unconvinced that Mercado’s evidence precludes social learning in humpback whales.

These mixed asocial/socially learned communication systems are not limited to humans. Bird song across 15 species show an organizational pattern (Menzerath’s law) that is also found in human speech, music, and other animal communication (James et al., 2021). While this structure was hypothesized to be socially learned, this recent study suggested that it is due to performance, or even physiological constraints. So, an asocial pattern within a socially (and likely culturally) learned communication system (James et al., 2021).

Rhetoric and Hypothesis Conflation

I find several of Mercado’s arguments to be suspect because, in my opinion, he utilizes rhetorical tricks that over-state his findings, tricks that instead undermine his most interesting data. In particular, he conflates separate hypotheses and sets up straw man arguments so he can knock them down. For example, the assumption that songs function as mate attraction is not at all the consensus as I have heard it. Indeed, several of the same arguments Mercado presents have been used to call the mate-attraction hypothesis into question (see Herman, 2017 for a review of alternate functional hypotheses). Therefore, the argument Mercado makes that avoidance/nonimitation of a playback is evidence against social learning is flawed at the start.

Similarly, he states, “In particular, if songs change through an accumulation of copying errors and/or imitated innovations, then regressions to phrases or songs produced in the past should be rare. On the contrary, many phrase “types” are abandoned only to reappear at a later date.” I am unclear why the first part of this statement should be true. Humans return to turns of phrases years after they go out of style. Songs from the past regain new life, even accents, phonemes, and grammatical parts of speech disappear and return (e.g., Winters, 2020).

Mercado’s dismissal of social learning seems to rely heavily on one observation of one population in Puerto Rico whose song was acoustically similar to another song in Hawaii (4 decades apart). Mercado stated as fact that “The chances that two innovative populations of imitative singers randomly converged on the same patterns and timing of 100+ acoustically complex units after centuries of independent cultural transmission are infinitesimal given that singers annually vary their unit repertoires and arrangements of units,” but I would like to see the math on this; particularly because humpbacks almost certainly have biological preferences and constraints on vocal range, timing, and other pieces of the song-production process. It is also possible that the unit types themselves are innate, even if the variation and arrangement of those units is socially learned. It seems that over 40 years and hundreds of thousands of hours of humpback whale song recorded, two songs that are similar could absolutely be produced by chance. Then, given a tendency for systematic change, they would change in similar ways, at least until the next innovation.

Conclusion

I am in agreement with Mercado that humpback whale researchers have failed to produce convincing direct evidence for social learning (let alone culture) in humpback whale song, although I believe social learning remains the most likely explanation of the overall phenomenon, even considering Mercado's evidence. While it may be likely that several types of shifts within humpback song are asocial, the potential presence of these mechanisms does not automatically refute the likelihood that song is socially learned. Social learning and culture are conflated in both the original culture hypothesis and Mercado's response to it. Playback experiments that are carefully controlled to test specific hypotheses would go far toward clarifying the processes involved.

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