

Reflections on imitation, vocal mimicry, and entrainment

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Much artistic and aesthetic practice requires imitation. The philosophical discussion of this observation can be traced back at least to Plato's *Republic*. In representational life drawing, for instance, an artist's sketch is an imitation – a copy of her perspective of reality. More abstract art forms such as Western classical music, too, are replete with imitation. Debussy's *La Mer* conjures up sonic images of the ocean; Richard Strauss's *An Alpine Symphony* evokes that of the mountains. But less ambiguous or abstract imitations are common also: think of direct musical quotation, such as Puccini's "borrowing" of the American national anthem in *Madama Butterfly*, or that of the French and Russian national anthems in Tchaikovsky's *1812 Overture*.

The practice of imitation underwrites a distinction between 1) that which is copied and 2) the copied object's representation. Cases of mimicry/crypsis, however, can undermine or suspend this distinction. Looking to the natural world can help demonstrate this. In camouflage, for instance, an organism alters its physical appearance (colour, patterning, and so on, mimicking that of its surroundings) in order to fade into its external environment. Metaphorically speaking, it becomes part of the rest of the "landscape" so as not to be detected by other organisms. Whether it does so for predatory stealth or a defensive strategy for safety, the struggle for survival that organisms face is the key to unravelling camouflage as a biological phenomenon. Natural and sexual selection, niche construction, and feedback loops between predator and prey species continue to drive the evolution of phenotypes such as camouflage in the natural world.

Here I shall focus on a particular natural phenomenon: vocal mimicry. Vocal mimics, also called vocal learning species, are species capable of mimicking sounds heard in their external environment: think of lyrebirds, or humpback whales. Moreover, vocal mimicry is a basic human capacity that, in part, enables the (ontogenetic) development of language

and musical behaviours and traditions. We learn to speak and sing, in large part, by copying heard speakers and singers. And exploring this capacity may be crucial to understanding the origins and evolution of human language and musicality (Merker et al. [2015]), as well as to inform theories of natural and evolutionary aesthetics, generally.

More precisely, vocal mimics are able to «convert heard sound patterns that are not in the species-specific innate vocal repertoire into vocal output, using feedback from one's own voice to achieve the match» (Merker et al. [2015]: 4; see also Konishi [2004]). This includes some birds (oscine songbirds, hummingbirds, parrots), cetaceans and pinnipeds (dolphins, whales, seals), bats, elephants, and humans (see Fitch [2015]; Fitch and Jarvis [2013]). Vocal mimicry is an understudied phenomenon in aesthetic circles – even in environmental and evolutionary aesthetics – although it is increasingly discussed in comparative biology and psychology. I draw upon this latter literature to stimulate future aesthetic theorising. Thus, as I present vocal mimicry here as a potential case study for aesthetics, albeit briefly, I ask: does this new research agenda give rise to a useful perspective for understanding notions of mimesis, or for aesthetic theory generally? How is «mimesis» and «mimicry» best defined, and what are their extensions? These questions, although not settled herein, loom in the background, framing much of the following discussion. The extent of the overlap between the study of vocal mimicry and aesthetics is an open question, and here my hope is to expose this overlap for future philosophical theorising.

Mimicry is, in an important sense (not least, phylogenetically), prior to representational imitation. The lyrebird, of course, does not recognize its replication of a chainsaw whirr or cell-phone ringtone *as* a representation of that sound object, and there is no significant distinction between the “real” and the “mere image” here; it is fruitless to think of the lyrebird's vocal mimicry as producing semblances of reality. A mimicked sound is simply a sound to mimic (and perhaps theories of sexual selection or honest signalling might account for the evolution of the phenomenon, if in fact lyrebirds are indexing their quality to conspecifics in a hard-to-fake manner, as a brilliant peacock's tail might index the individual's genetic quality to peahens; see e.g. Zahavi and Zahavi [1997]).

Nonetheless, given that vocal mimicry is found scattered in species so phylogenetically distant from one another, it is surely a case of convergent evolution («analogy», or «homoplasy»). The last common ancestor of any two, let alone all five, of birds, cetaceans/pinnipeds, bats, elephants, and humans is incredibly ancient; moreover, no great ape or other primate – our closest relatives – are vocal mimics, suggesting that our own vocal mimicking ability evolved after our ancestors diverged

from last common ancestors with chimpanzees¹. This implies that vocal mimicry has evolved independently in distinct lineages, several times: perhaps an evolutionary «Good Trick», to borrow the term of philosopher Daniel Dennett (think of the independent evolution of wings in insects, birds, and bats. For a number of obvious reasons, flight is a «Good Trick», and vocal mimicry may be so too).

Studying vocal mimicry in nonhumans is thus incredibly valuable. The comparative study of unrelated species that have converged on some observable phenotype can shed light on underlying mechanisms, for example (for a discussion of the role of convergences see Currie [2013]), and as humans are vocal mimics, this has implications for understanding contemporary human cognition and the cognitive evolution of our lineage. It may reveal «deep homologies» (Shubin et al. [2009]), for instance the *FOXP2* gene's role in vocal mimicry in birds and humans (Fisher and Scharff [2009]), and the role of neural mechanisms in vocal mimicry that are homologous in birds and humans (Feenders et al. [2008]). It is thus plausible that, despite vocal mimicry's distinct evolutionary origins across lineages, mechanisms that underlie bird and human vocal mimicry are deep in evolutionary history (Fitch [2009]; Fitch and Mietchen [2013]; Scharff and Petri [2011]).

Vocal mimicry provides also a context for examining cultural evolution in nonhuman animals. Culture is not the exclusive domain of humans, if it is, roughly, information accumulated and transmitted through an individual's lifetime. Researchers have studied the changes in humpback whale song in individual whales living in the Pacific Ocean upon contact with whale song from a population coming from the Indian Ocean, suggesting a role for novelty in the sounds that individual whales mimic in their vocal displays (Noad et al. [2000]). Indeed, cultural transmission is a process of a more general phenomenon – both within – and cross-generational *social learning* (Cavalli-Sforza and Feldman [1981]; Boyd and Richerson [1985]) – of which vocal mimicry in certain species is but a special case. Its study will surely elucidate the study of social learning more generally, including the evolution of cultural “traditions” that determine, to a large extent, the song of a vocal mimic (Payne and Payne [1993]; see also Wiggins et al. [2015] on the evolution of creativity).

Comparative study also provides a framework for testing hypotheses against a number of independent data points:

¹ The famous vervet monkey alarm calls, for example, are innate, “unlearned” responses to stimuli, not requiring vocal mimicry (see Janik and Slater [1997, 2000]).

Only a set of convergently evolved traits provides an adequate database for statistically valid tests of evolutionary hypotheses [...] Fortunately, for many cases of convergent evolution, such as [...] vocal learning, a trait has evolved independently enough times to provide a rich source of evidence to test hypotheses concerning both evolution and mechanistic function. Thus, for example, we can test mechanistic hypotheses about the requirements of vocal learning by examining its neural correlates in the many species that have evolved this ability convergently (Fitch [2015]: 4).

Let me demonstrate with the example of vocal mimicry and “musical” entrainment. Musical entrainment, in this context, is the ability to synchronise movement with a heard, external pulse. This ability is necessary for even very simple human music: even most non-musician humans can clap or foot-tap along to a beat, sing or hum «Happy Birthday» in time with one another, and dance or sway to the rhythms heard in a nightclub or ballroom. Musical entrainment, however, is not unique to humans, and many vocal mimics have demonstrated this ability. Infamously, Snowball, a sulphur-crested cockatoo (*Cacatua galerita leonora*) is a YouTube sensation, demonstrating the ability to entrain to recorded pop music (Patel et al. [2009]; Schachner [2013]). Snowball’s entrainment is purportedly spontaneous, not the result of intervention or teaching by human experimenters. This has spurred scientific investigation into nonhuman entrainment, and at first researchers found evidence of entrainment in a number of vocal learning species, but not in any other species (Schachner [2013]). Some theorists suggest entrainment is best conceived as a by-product of vocal mimicry (Patel et al. [2009]): the idea is that entrainment does not appear to require any additional genetic change to the suite of mechanisms underlying vocal mimicry.

However, one exception may be a Californian sea lion (Cook et al. [2013]). Although other pinnipeds are known to be vocal mimics (seals), sea lions are not. However, as Hoeschele and colleagues point out, it is possible that sea lion vocal mimicking abilities are simply hitherto unknown; another possibility is that entrainment requires only part of the machinery underlying vocal mimicry (Hoeschele et al. [2015]). Perhaps more problematic counterexamples to the by-product hypothesis is the entrainment to a beat witnessed in a captive chimpanzee during a tapping task, after being taught to tap illuminated keyboard keys (Hattori et al. [2013]), and the short patterns of regularity observed in another captive chimpanzee’s bucket-drumming (Dufour et al. [2015]). Merchant and Honing (2014) distinguish interval-based timing from beat-based timing, and propose the *gradual audiomotor evolution* hypothesis: musical entrainment, peaking in humans, is present in a limited sense in our great ape cousins, and since no

other apes are vocal mimics, it is thus not a by-product of vocal mimicry (at least, in the hominin lineage).

So obviously, further research is required to settle the connection between vocal mimicry and entrainment, yet by identifying and comparing the two, a dependency relationship may well be revealed (Currie and Killin [2016]). If so, by this relationship's lights, insight can be gained into the development and underlying mechanisms of vocal mimicry and entrainment, even if the gradual audiomotor evolution hypothesis is true for the hominin lineage. In short, the jury is still out on many particulars, though the empirical research literature is both growing and making headway (Merker et al. [2015]).

In sum, in this short commentary I have brought vocal mimicry to the fore. My proposal is methodological: while the empirical literature on vocal mimicry is growing, there is certainly scope for a complementary research project that fleshes out conceptual and aesthetic issues surrounding this real-world phenomenon. In my view, aesthetic theorists analysing notions of mimesis, or distinguishing mimicry from imitation, or distinguishing imitation, emulation and simulation, should have an adequate answer for the status of vocal mimicry. Any satisfactory analysis of mimicry (cfr. Vane-Wright [1980]; Robinson [1981]) ought to say something satisfactory about this natural phenomenon. And, presumably, theories of natural aesthetics, evolutionary aesthetics, and so on, would do well to take this convergent phenomenon as a case in point (for instance it is very briefly considered in Prum [2013], in which "art" is conceived as a form of communication that coevolves with its own evaluation). Moreover, the capacity for vocal mimicry seems to be linked in some respect to entrainment with a heard, external beat. Entrainment and dance, theories of which are perhaps understudied in the philosophical literature on imitation and mimesis (though see Cohen [1953]), should thus play a larger role in the general discussion.

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