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Taxonomic Bias and Underrepresentation of Chemical and Multimodal Communication in the Mate-Choice Literature

This summer, I conducted a follow up of a study by Seth W. Coleman that was published in 2009 in the journal Acta Ethologica and entitled “Taxonomic and sensory biases in the mate-choice literature: there are far too few studies of chemical and multimodal communication.” He conducted a literature search of mate-choice studies that were published between 1966 and 2005 using the database *Web of Science* and focused on 297 of them. His findings indicated the presence of a taxonomic bias, with 40% of the studies focusing on birds. Insects, fishes, and anurans were also well represented. A sensory bias was also present, with studies on visual and acoustic signals dominating the literature at 46% and 30% respectively. One explanation for this bias is that it is significantly easier to design and carry out experiments to study animals that communicate visually and acoustically compared to those that utilize chemical or multimodal signaling. However, since humans primarily communicate visually and acoustically, this skew reveals a human-centric preference in the mate-choice literature. Animals that are most similar to ourselves are viewed as the most worthy of study, which greatly neglects others that may have communication systems just as complex as our own but use a different channel to send information. Mate-choice communication is a specialized animal behavior that is essential for sexual selection, speciation, and inevitably survival, yet it is also vulnerable to anthropogenic interference. Ultimately, a failure to gain a more well-rounded perspective of this behavior will likely exacerbate conservation concerns for many animals in the near future. My main goal for this project was to do a literature search of mate-choice studies that were published from 2006 to the present and examine whether the representation of taxonomic groups and sensory modalities has changed since the publication of Coleman’s paper, to determine if there is still a problematic bias in the field or if researchers have broadened their experiments.

I found a total of 103 relevant mate-choice studies published within the designated years. Birds, insects, fishes, and anurans still remain to be some of the most well-represented taxonomic groups in recent mate-choice literature (14%, 23%, 21%, 10%, respectively), as can be seen in Figure 1. Since I am still currently searching *Web of Science* for acoustic mate-choice experiments, I expect that the number of studies on birds is much higher than what I have right now and closer to matching the bias that Coleman found with his data. Not surprisingly, previously underrepresented groups such as mammals, crustaceans, lizards, tortoises, and non-anuran amphibians are still receiving significantly less attention. Relating back to the ease of study, a possible explanation for the lack of papers on these animals is that it may be more difficult to obtain the rights to use them in experiments, especially for mammals as many species may be endangered or close to extinction. Additionally, the more well-represented groups might be easier to study since many of these animals can be found in large groups in the wild which provides a significant sample size, or more easily kept in a laboratory. My results did reveal a surprising increase in studies being conducted on arachnids in recent years, most of which studied spiders, with 17% of the total papers focusing on this taxa. This is very significant given that Coleman stated, “Of the taxa that represent less than three percent of the studies, spiders seem particularly underrepresented given the widespread occurrence of elaborate courtship displays in several genera.” Since different species of Wolf Spiders are currently the best model system being utilized to conduct novel studies of multimodal signaling in mate choice, this general taxonomic group was probably viewed as the best avenue to expand the scope of mate selection research.

Visual and acoustic studies still make up a large proportion of the contemporary literature (42%, 18%, respectively) as displayed in Figure 2. Even so, I was excited to find that experiments involving chemical and multimodal communication do indeed appear to have increased since the publication of Coleman’s paper. Whereas chemical and multimodal studies each made up only about 3% of his total papers, 31% of my total papers address chemical signaling and 12% address multimodal signaling. Part of this increase is clearly a result of direct responses to Coleman’s commentary. As mentioned before, the animal currently providing the best insight into multimodal communication is the Wolf Spider, and the two researchers conducting the majority of the studies on this species are Eileen Hebets and George Uetz, both of whom are Albion alumni. It is likely that their impactful work has provided a useful model or template for how to go about studying multimodal signaling that can be easily adapted to explore other taxonomic groups as well. Although I am not very familiar with many of the laboratory techniques utilized in the chemical experiments, I did observe that many researchers are using gas chromatography-mass spectrometry (GC-MS) to identify the principal chemical components released and assessed during mate choice in different taxa. I would suspect that GC-MS has likely become more accurate since 2005 or perhaps more easily accessible to researchers at varying levels of education, which would help to accelerate the study of chemical signaling in mate choice.

Throughout this project, I have developed skills that will aid in my continued success towards obtaining my Biology degree such as gaining a more detailed understanding of the scientific process, learning how to work around complicated jargon to discern the major results of a study, and adapting research to overcome unexpected challenges. I have also acquired an increased familiarity with the field of animal behavior beyond what I would have been able to achieve in any of my biology classes. I plan to get my findings published, use them as the basis for my Honors thesis, and present at the Spring 2021 Elkin Isaac Research Symposium. Overall, this experience strengthened my passion for this field and confirmed my desire to possibly pursue a future career in animal behavior and/or conservation.

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