

Elyse McCormick

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ECO 602

Weekly Reading Questions 2

**Questions discussed with Kato Csanadi-Schwartz*

1. In 1 - 2 short paragraphs, explain the dichotomy in your own words and briefly describe how you might approach one of your research interests from each of the dichotomy endpoints.

As posed by Bolker, there are three dichotomies of statistical analyses. First, there are dichotomies related to the scope and approach of your research. There are multiple aspects to this “dichotomy” but it is essentially characterized by either a theoretical or strategic approach versus an applied or tactical approach. This is how you want to approach your problem, and influences whether you’d like your model to be quantitative or qualitative, based in patterns or processes, or mechanistic, descriptive, predictive, or phenomenological. The second dichotomy focuses on the technical details of your model. This can indicate whether your model will be analytical (math-based) or computational (computer-based), if you’ve decided to make a deterministic or stochastic model, if you want to incorporate population or individual-based data, and more. Third, you can determine the sophistication of your model by deciding if it should be simple, complex, crude, or sophisticated. These are determined both by the inherent simplicity or complexity of the code involved to run the model, but they also are determined by the amount of hidden complexity of the model.

I’m very interested in disease communities, so I might decide to approach the scope of my research by creating a transmission model within communities, showing the mechanism of bee disease dispersal in floral communities. I could then decide to have a computational model, something that allows me to run computer simulations of disease transmission within the bee community to predict how something like diet influences transmission. Finally, I could decide that I would first like to get a simple, general model to determine a baseline, and possibly run multiple iterations of my model to add sophistication.

***2. Identify at least one source of bias or assumption (cultural, scientific, other). Hypothesize a practical impact these biases or assumptions might have on scientific communication and the effectiveness of management efforts? (1 - 3 paragraphs)**

Cultural bias can have a major impact on how we perceive the biology occurring, as well as how we communicate and understand our science. As noted in the Bang et al. paper, Indigenous groups tended to see instances labeled “competition” in Western science as cooperation. Indigenous groups noted that most things have a vital ecosystem role (even things Western Scientists would consider not alive) and did so more frequently than their Western counterparts. This typically leads Western audiences to focus on what an ecosystem can do for them, instead of how we fit into nature. These biases can have big impacts on how we frame our grant writing narratives, how we define questions to answer, and how we design management efforts, not to mention what ultimately gets funded. For example, if we consider managing birds in a forest setting, many Western managers would look at the birds and organisms with direct impacts, but it may be more beneficial to focus on holistic management to improve the health of the ecosystem if we shift our management focus. But it also sets apart science communication, it

“others” nature as a separate space, which can lead us to treating it like a commodity rather than our home.

***3. In 1 - 2 short paragraphs, describe the following:**

- **Identify and briefly define the two primary components of a model constructed in the dual model paradigm.**
- **Give an example of the two components in the context of a system you are interested in studying.**

A model constructed in the dual-model paradigm includes both deterministic functions and probability distributions for a holistic view of your model. This allows for a stochastic model to account for environmental noise and a deterministic model to account for things like behavior. For example, in class we discussed a model where you’re interested in the effects of watering plants. In this case, a model of the average amount of water given to plants would be a linear regression, which is deterministic. However, you should also model the variability present, which requires a stochastic model.

I am interested in pollinator disease, so I could design a study to understand how bumble bee diet impacts *Nosema bombi* resistance (a fungal parasite). In this case, I could perform a regression between an overall measure of host health after consuming a particular diet and the overall parasite load present in the body of the bees. But I would also want to account for variation in virulence, susceptibility, and other factors, so I would want to add some sort of stochasticity to the model to understand how this influences the outcome.

4. In 1 - 2 short paragraphs, describe the difference between a statistical and biological or ecological population.

- **Which of these populations may vary depending on the spatial or temporal scale of the research question?**

An ecological population is the entire population of interest in your study, covering its entire geographic range. This could be something in a relatively small range, or it could have a global distribution. A statistical population is simply a subset of the population of interest, determined by what you’re able to measure, ideally at or greater than 30 sampling units. The ecological population doesn’t change (well, it does over long-scale time) unless you’re outside the range and scale of the entire population. Statistical populations can vary with spatial and temporal scales because they’re dependent on you as the researcher setting your sampling bounds.

5. For each of your chosen variable type/scale types:

- **Propose an entity and/or variable in your scenario that you could measure using the data type/scale.**
- **Explain why the data type or scale is appropriate for the entity/variable you chose.**

In the white pine blister rust example, I could quantify number of fungal spores as an infection load for the trees, and use this as a continuous variable on a ratio scale. A value of zero spores is a meaningful piece of data, and I can thus use a ratio scale in this instance. I could also use the

number of gooseberry species as a discrete, countable data that may inform some aspect of disease transmission.