A survey of ground-dwelling members of the genus *Aristolea*

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PHY 420 Writing Intensive Assignment #3, first draft

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Abstract:

While most members of the avian genus *Aristolea* nest in cliffs or trees, three species, being *A. formihaltus, A. beekmanser*, and *A. shakiluiler*, have been observed to make underground nests on the plains of northern Kenya. Observations from a multi-year study have identified two main characteristics that distinguish these species and their dwelling habits. First, these particular species that create ground nests are almost exclusively dependent on the berries of the *R. circormius* bush for sustenance. Second, while ground dwelling habits are not exclusively observed, this behavior is the dominant nesting pattern in drier years when the *R. circormius* berries are fewer. Together these observations suggest that the ground-dwelling behavior is likely a competitive response that enhances these species' ability to compete for limited food resources.

1. Introduction

The remainder of the paper should follow the goals defined in the abstract, which is in essence your template. Notice that the abstract doesn't go into details about how the study was conducted, or how many observations were recorded. Those are details that will be explored in the manuscript. The point is to give the reader the minimal necessary information to decide whether the article is worth reading. The abstract goes on to identify the thing that made this study unique and alluded to a possible conclusion that could be drawn from these studies, the take-away message. Though there are no hard-and-fast rules for what is required in an abstract, you know a well-written one when you see it because it rings of clarity and simplicity. Notice that this abstract, while not perfect (and 100% fabricated) more-or-less accomplishes this goal in five sentences.

The introduction should start with the big picture and address the relevant background. For example, we might here want to comment on prior studies of birds in northern Kenya generally, and almost certainly others that studied the *Aristolea* family, possibly in relation to nesting habits or their relation to the ground squirrel population [1]. That number in square brackets is a citation reference and tells the reader that the important thing you just said came from the first reference in the references list, which is the last page of this manuscript. Your introduction will absolutely be incomplete if you do not cite prior works. You will probably do so many times throughout your

manuscript, but it is inconceivable that you could write an introduction without referencing past work.

How exactly you address the background and context will depend on the lens through which you view the world. As an avian zoologist, one might be focused on the inter-species differences in physical nature and behavior, perhaps as indicators of evolutionary divergence. Viewed through the lens of an ecologist, one might be interested in the genus *Aristolea* as predators or scavengers, and perhaps in relation to the propagation of seeds of a particular plant. To write the introduction you first need to know what your perspective is. This likely indicates that it may be easier to write the introduction after you have done the hard work of the analysis so that you know your conclusions, and therefore where this whole thing is headed.

Your first job in writing this manuscript is to define the context of the question you want to address. This must involve a technical discussion. It is not appropriate to write about the life of a scientist, as that would be more applicable to the study of history than of physics. A good approach to take in a paper like this (in which you are not presenting new research) is to take a stance on an issue by comparing two competing ideas. Perhaps you would like to consider some aspect of electric vehicles. That is a very broad subject, far too broad, so you need to narrow your discussion, which likely means just reading a bit about a subject to get a sense of the important aspects that are being or have been debated. Regarding electric vehicles, for example, you might consider policy models to push the US toward 100% electric vehicle use for personal automobiles. Your analysis could then address questions around total emissions of CO_2 and the economic cost in getting to 100% electric vehicle use. While the answer to the first part seems clear, one could (and probably should) elaborate on concomitant increase in CO_2 emissions that would come with greater demand of electric power from power plants. How you choose to focus your paper is completely up to you, but the key word here is focus.

IMPORTANT: The final paragraph of the introduction needs to clearly identify the path forward for the rest of the paper. This is where you state the main points that you have defined as important in the introduction and specify what specific aspects you will further explore. An introduction in a technical journal may often dryly list the sequence of topics that will be explored in the

subsequent sections. For example, in this template we will proceed to explore manuscript layout by discussing the fictitious methods in Section 2, the main results of the non-existent experiments in Section 3, with concluding remarks and an outlook to future imaginings in Section 4.

2. Methods (The titles of the sections and subsections need not be as given here, but will depend on how you choose to construct your paper, at least you had better not include all of these words in parentheses)

If you are reporting on an experimental paper then a methods, or apparatus, or experimental design section (you could give it a different name) is essential. It need not go into gory detail, and shouldn't do so at the cost of getting to the critical conversation about the results or controversy. It should, however, provide further context for understanding the situation that defines the relevant parameters of the experiment. It may also describe limitations on the results or experimental range that are imposed by the physical system being used. If you are reporting on a theoretical subject you might have a similar section which described the particular details of the theory or approximation method (perhaps in a simulation) that is being employed to study a particular problem.

It is likely that you will want to include an equation to describe your subject. If this equation is something simple, like the area of a circle that does not need a lot of explanation, then you can write the equation inline in the paragraph as $A = \pi r^2$. If, however, it is something much more important or just way to awkward to fit in the sentence then you can give it its own line, such as the following equation that describes a particular solution to the Theory of Nothing as defined by Emam *et al*. [2],

$$G^{\infty}(\theta) = \prod_{\epsilon=\omega_0}^{\theta_n} \frac{e^{i\epsilon}}{\epsilon!\theta^{\epsilon}} \oiint_{C_{int}}^{C_{ext}} g(\epsilon,\theta)\, J_n(\epsilon)\, d^n\epsilon. \tag{1}$$

There are a few things to note about the equation here. Beyond being incomprehensible to any mortal being, this equation has two important relational attribute to the rest of the text: it is part of a sentence and it has a reference hanging off the end of it. Equations are always part of the

discussion and the equals symbol should be interpreted as a verb, that is, you are stating that something is equal to (or approximately equal to, perhaps under some limit) something else. Equations don't just dangle amidst a sea of other words, they are part of the narrative. The number off to the right is our internal reference for that equation, so that when it comes time to refer to an equation we can do so by referencing Eq. 1, rather than rewriting it or writing out a cumbersome name like the solution of Emam *et al*. to the Theory of Nothing, and many equations don't have or deserve proper names like that. By the way, the formula shown in Eq. 1 is most likely not a proper solution to a Theory of Nothing as it was entirely fabricated. Note that when used in the middle of a sentence we abbreviate Equation to Eq. and Figure to Fig., but when used at the start of a sentence we write things out in full. Figure 1 is a picture of a pretty bird, whereas Fig. 2 is a picture of a pretty equation. Also, for this manuscript we will follow the formatting requirement that all figures come at the end of the manuscript, but before the references, as is done here.

Note: Formatting an equation in Word and referencing it is, unfortunately, an art unto itself. If you get the chance, learn how to use Latex, which is a much better environment for writing scientific documents with lots of symbolic content. It also automatically does all of the reference numbering and other magic, which is wonderful when you change the order in which things are presented as you edit (meaning that you don't have to go back and re-number things yourself). This document is short enough that you can update things manually, but note that as you proceed you will want to learn Latex and ditch Word as soon as possible. When you need to include an equation in your manuscript the easiest thing to do is to copy the structure above and modify it. If, however, you want to create this structure yourself, please note that this format was created by placing the equation in a 3x1 table structure (the borders are invisible here, but can be observed if you highlight the equation). The first entry of the table is blank and used to provide some padding, the second contains the equation, and the third the equation number. This is done to keep the equation centered and the equation number on the right side of the page.

2.1 This is a subsection in which you can examine a specific aspect of your device or theory

It may be appropriate to break up a particular section into multiple subsections to help organize the structure in a way that is more coherent.

2.2 This is a second subsection in which you can place other details

Details about a system or model to which you are comparing the first one could go here. Of course, this is not the only reason to use subsections. Their use should follow an orderly logic and should seem natural.

3. Results, or perhaps something like, Model Comparison

Now we get to the meat of the manuscript, the place where you get into the real argument of the paper. This is where you lay out all the evidence and analyze it, compare it against prior known results, against models, simulations, other data, and attempt to make sense of it all. In essence, you are playing lawyer here. The basis of your case has been established in the prior sections, but here is where you make your money. You now have to prove something. Because your critics are scientists, and scientists like things that are logically self-consistent, it is best to prove/establish something that is logically consistent with the data. Sometimes (often) you will be able to go only so far, and will be left having to state that your data could support multiple models. Rather than being a disappointment, this is the kind of thing that is great for you because it means that there is more work to be done and you get to write another paper on the subject or request additional funding to secure your position for the next decade.

3.1 You might have a subsection about a group of experiments, for example, the observations that the only members of genus *Atistolea* that dwell in the ground are those that eat seeds of the *A. circormius* plant (with a much briefer section heading)

You would put those details here.

3.2 Another subsection, as needed

Also filling up this page with more details.

3.3 And yet another subsection

And yet more details

3.4 And possibly yet another subsection, all depending on the details of your work

Eventually, you will say all that needs to be said and you can move on to the conclusions.

4. Conclusions

Remember all that stuff that you claimed was relevant context? You should reflect on that now that you have added to the story. You should in a sense try to answer the following question: how does your data modify, influence, refute, and in a small way contribute to that larger understanding of a particular sub-field of physics? The adage of scientific writing is: tell them what you're going to tell them (the abstract and introduction), tell them (the body of the work), and then tell them what you told them (the conclusions). Note as well that this is a good format for scientific talks. We learn by repetition, and this is your place where you get to emphasize again the importance of this work. You are in no way copying what you wrote before - that is very bad style. Use new words.

You should be slightly more reflective here, thinking back to the connections between your work and the larger field in which this work is situated. However, you shouldn't feel obliged to be so grand so to make sense of the entire universe in a concluding statement, focus on the immediate connections. Nor should you ever, ever, ever mention anything trivial like human error being responsible for the error bars in the experiment. If your work is worth reading then it is so because you took your time to do good work. No one wants to hear how you could have done it better. Rather, the conclusion is your place where you put to rest one question and close the book on a small chapter in science. If you don't have a good conclusion that may mean that you didn't start with a good question.

Your analysis sections may or may not have come to a definitive conclusion that unambiguously identified a correct model or interpretative framework. If it didn't, this is a great place to comment on what next steps might be needed to make that happen. If it did, you could comment on what new doors were opened and where you see the research going from here.

Figures

Comment about figures: We will place all figures at the end of our manuscript, starting on a new page following the conclusions, and refer to them by number in the text. This is done so that you all get more experience referencing things that are not immediately present in your paper. You can dump all of your figures here to keep things simple in the manuscript.

Figure 1: A bird of prey native to Africa.

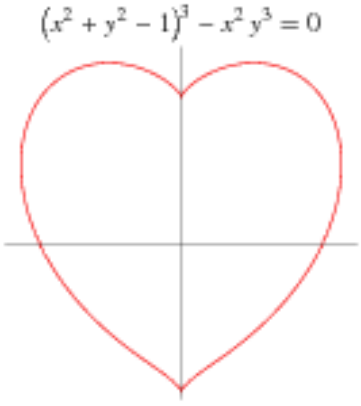

Figure 2: A fun curve to send to your special someone on Valentine's Day, taken from mathworld.wolfram.com.

References

1. E. Bitterbaum, M. Prus, B. Mattingly, "Avian predators of the genus *Aristolea* and relation to the ground squirrel population in northern Kenya," Avian Ecology **39**(4), 481-496 (2012).

2. M. Emam, D. Armstead, E. Edlund, D. Kornreich, "A theory of nothing: on the probability that the solution to the universe is identically zero," Phys. Rev. Lett. **498**, 11205 (2019).

Comment about references:

- Every journal has its own style of formatting references, so there is not one "right" way to do this. We will use here the style used by the American Journal of Physics.
- In a full reference list, we should provide all names of coauthors on a paper. However, some articles have a huge author list, so a good rule is that you should provide at least the first five authors then write *et al*. (Latin for "and others") to indicate that the author list continues.
- The title of the article follows the author list, in quotes, separated by commas.
- The name of the journal follows the article title. The volume number should immediately follow the journal title and be in bold font. If you have the issue number (typically it is the month in which that issue was published) then you can place that in parentheses after the volume, but you can also just leave it out as was done in the second case.
- Lastly, you place the starting page or page range after a comma, and then follow this with the year of publication in parentheses.
- You can find more info for citing books and other things at the section titled "Endnotes and Citations" at the following link: https://www.aapt.org/Publications/AJPManFormat.cfm