Dear Editor:

I would like to ask that you consider our manuscript “Friends aren’t food: pinyon jays show context-dependent numerical cognition” for review and publication in *Biology Letters*. Animals must often discriminate different quantities of objects in their environment, from food items to conspecifics. Yet we know little about how numerical cognitive abilities compare across different object types. Species, and individuals within a species, vary in their numerical cognitive abilities, leading researchers to investigate the mechanisms that underlie context dependent decision making under controlled experimental settings.

We conducted experiments to investigate quantification of both food and conspecifics. Each experiment was replicated with two sets of birds, where most birds experienced both the food and social experiment. This within subject repeated measure design is the first experiment of its kind to directly measure across contexts. In the food experimental task, subjects chose which of two food options they would prefer and then ate their choice (Food replicate 1). This was then replicated with a second set of birds, most of which had just been through the social experiment (Food replicate 2). Based on past research, we would expect individuals to use both the ratio and difference between items offered. In this study---numerical ratio predicted Pinyon Jay choices in both replicates while numerical difference predicted choice in only the first replicate. Indicating, that ratio might be a more salient numerical cue for Pinyon Jays than numerical difference. In this paper we used mixed effect modeling to examine whether animals were using ratio and difference independently of each other or if they were being conflated together in the literature due to the kinds of statistical tests being used. We found that ratio and difference were not independent and therefore that choices at the same ratio but different differences would not have strong preferences by the birds. More work should be done to tease apart the relationship between ratio and difference in nonhuman numerical cognition work with complex mathematical models.

To investigate quantification of conspecifics Pinyon Jays were placed in a Y maze with different number pairs of conspecifics at the end of each arm of the maze (Social experiment 1). Upon completion of the experiment the birds from food replicate 1 were transferred to social and completed that experiment (Social experiment replicate 2). Neither ratio nor difference predicted choices in either replication of the social experiment. Though quantity is important for selecting food items, other factors such as flock mate identity may be more important for selecting social groups to join. Thus, in quantification situations, the type of objects to be quantified may drive the cognitive processes that animals use. Furthermore, many adaptive problems beyond foraging require sensitivity to quantities, and we encourage further exploration of numerical cognition of non-food objects.

This study is the first experimental corvid study showing that in numerical preference situations, the type of objects offered drive the numerical strategies that animals use. Given the robust literature on nonhuman numerical cognitive abilities and the fact that many adaptive problems beyond foraging require sensitivity to quantities, we encourage further exploration of numerical cognition of non-food objects and believe this study will be of great interest to the readership of *Biology Letters*.

Attached you will find the manuscript in .docx format, figures, and supplementary materials. Additionally, I have included the preregistration, raw data and R code needed to replicate all our findings and figures. This work is original and has not been previously published or submitted elsewhere. This research is the culmination of my master’s work and I would appreciate this paper to be considered for the early career researcher competition.

Sincerely,

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