

# Investigating Courtship, Display Behaviors, and Personality of Ant-Mimicking Spiders

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## Introduction

The ant-mimicking spider *Myrmarachne formicaria* is a jumping spider (Salticidae) that recently arrived in North America from Eurasia. Like many jumping spiders, they exhibit complex display behavior in male-male interactions. Often this display ends with one of the spiders retreating, perhaps yielding access to females, as males tend to establish shelters next to those of conspecifics. While size is known to contribute to the outcomes of these duels, other factors like personality might play a role as well. In this study we address these three questions:

1. Do ant-mimicking spiders exhibit consistent behaviors that may be identified as personality?
2. What factors, besides size, may contribute to the outcomes of duels?
3. Can males distinguish between shelters built by males vs. females?

## Methods

### Mirror Trials: assessing individual differences in boldness



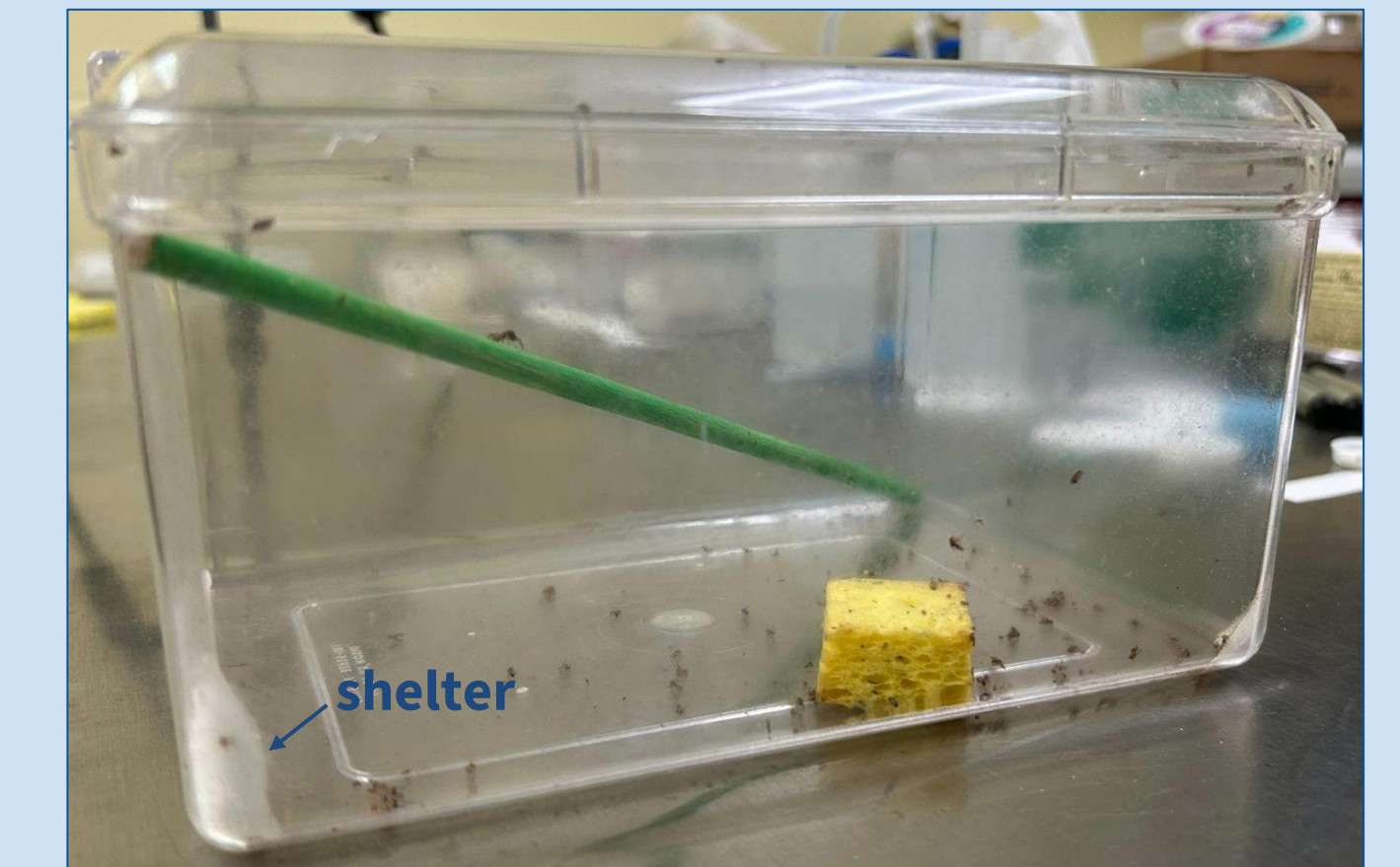
The spiders' boldness was assessed through a mirror assay, in which a spider was released into a runway with a mirror at the end. The time the spider spent engaged in display behavior in front of the mirror over a 5-min trial was calculated as its "boldness" measure. Trials were repeated at least twice for each of 22 spiders.

### Male-Male Encounters: does boldness predict outcomes?



Two males of similar body size were placed in a circular arena. Their behavior was recorded for three minutes. We ran a total of 21 trials.

### Shelter Trials: evaluating ability to discriminate among shelters

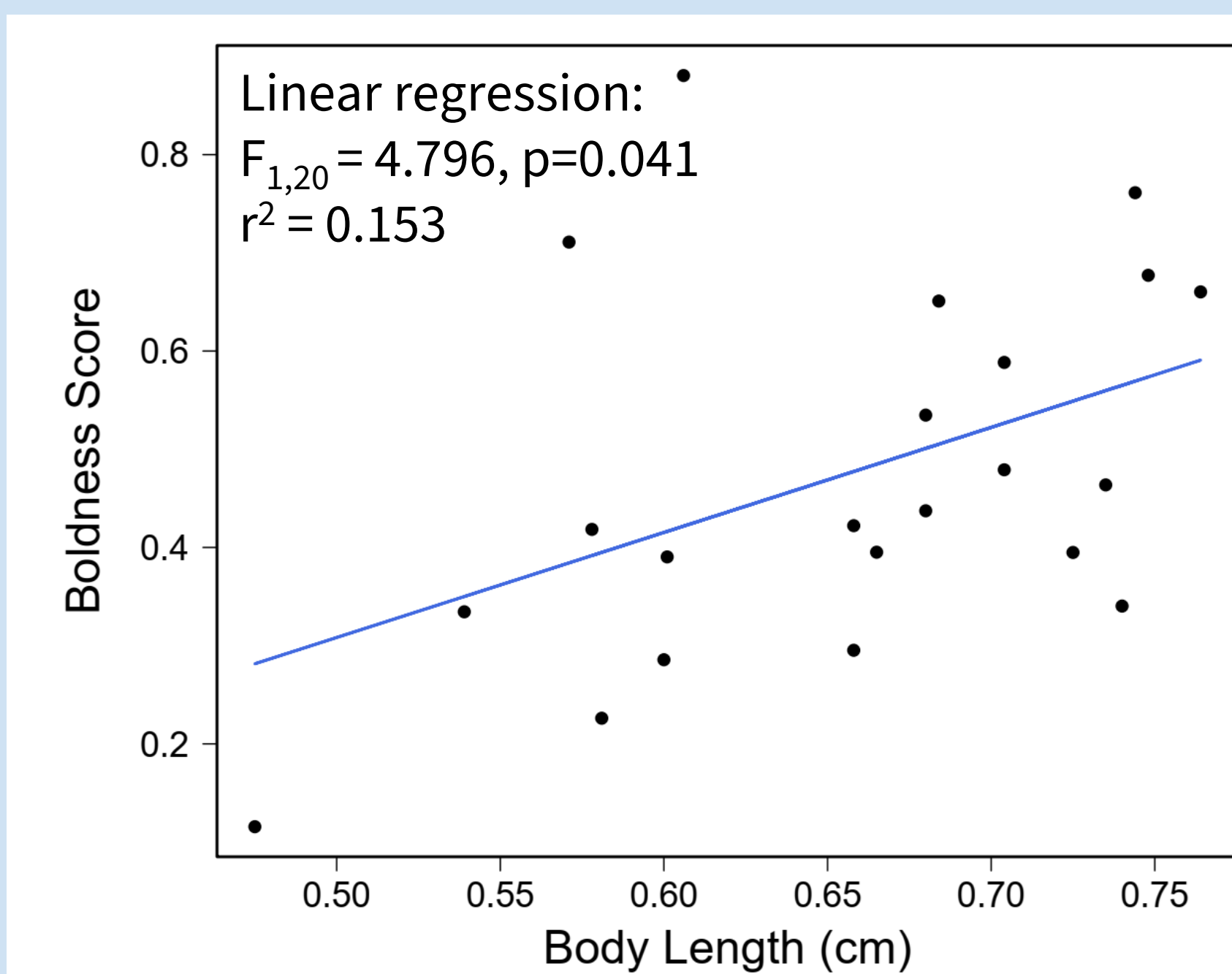


We placed a male in a cage with an empty shelter built by a female ( $n=7$ ) or a male ( $n=7$ ) and observed its behavior for 30 minutes, recording the duration of time spent near or inside the shelter.

## Results

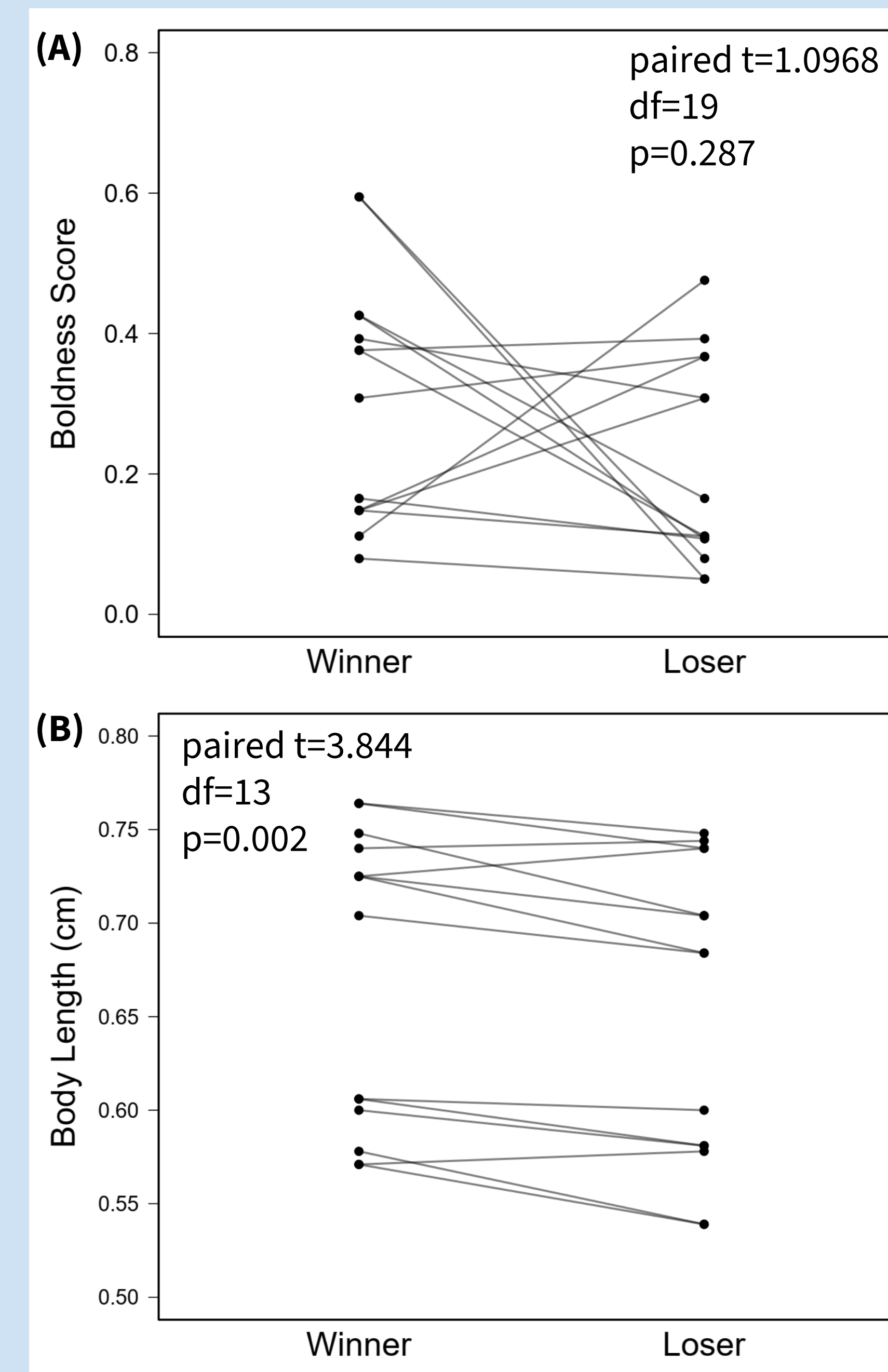
### Mirror Trials: males show consistent variation in boldness

All trials were scored using BORIS event logging software (Friard and Gamba, 2016) and data were analyzed using R. The proportion of time a male spent engaged in dueling behavior in the mirror trials had a repeatability of 0.477 (standard error = 0.169,  $p = 0.0149$ ) as estimated with the 'rptR' package in R (Stoffel et al., 2017). We used this proportion as a boldness score.

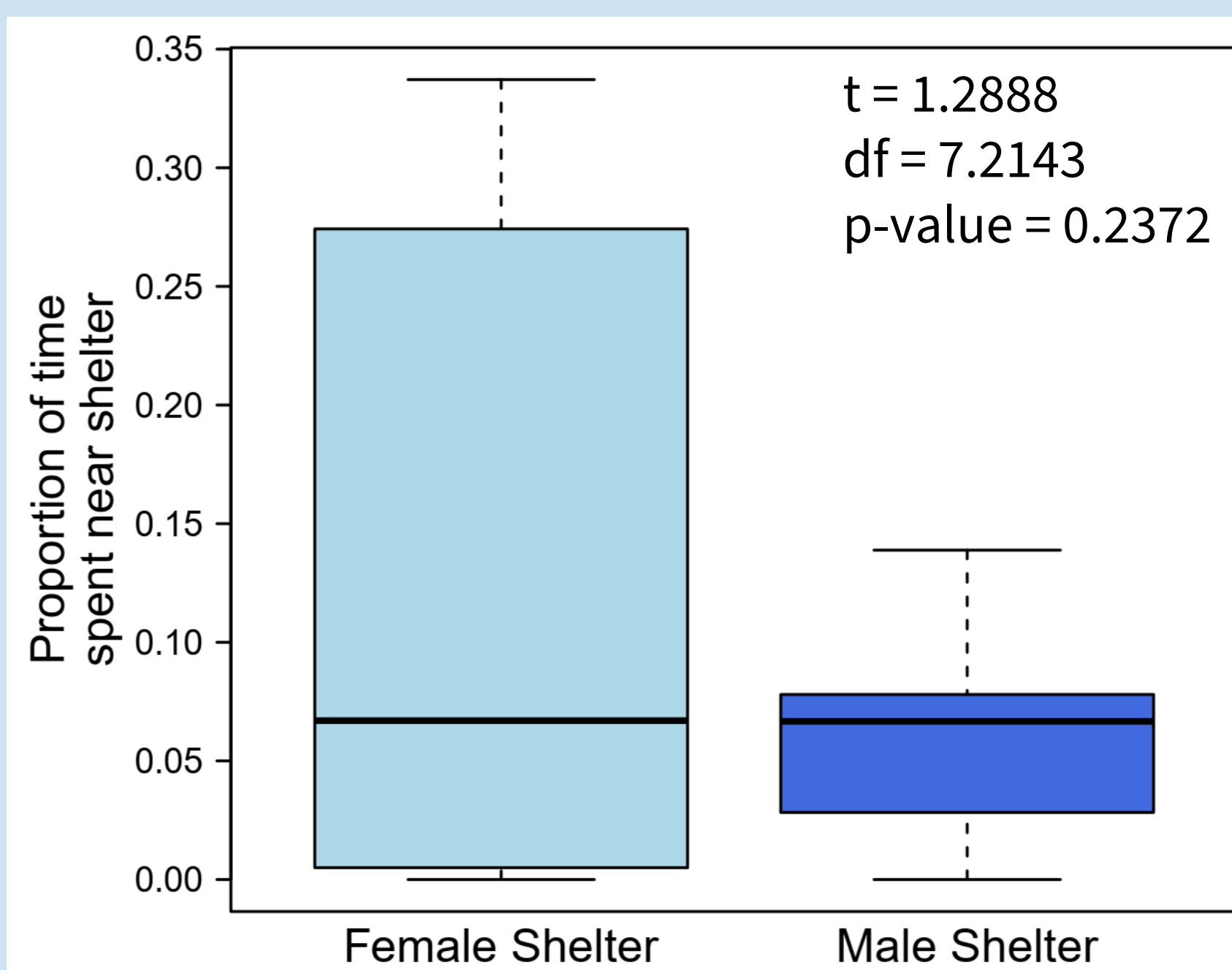


**Figure 1.** Ant-mimicking spiders with longer bodies tend to be more bold than their smaller counterparts. These data also demonstrate the wide interindividual variability of the boldness measure. (Proportions used as the boldness measure were arcsine-square-root transformed.)

### Male-Male Encounters: boldness does not predict outcomes of interactions between males



**Figure 3.** (A) The male in each pair with the higher boldness score was not necessarily more likely to win the duel. (B) The winners of the male-male duels were significantly larger than the losers. Winners of male-male duels were determined by which spider retreated fewer times than its opponent. Trials in which there was only one or no difference in the number of retreats were not included in these analyses.



### Shelter Trials: males do not treat female shelters differently

**Figure 2.** There is no significant difference between the time males spent near a female shelter as opposed to a male shelter. The time spent near a female shelter is more variable than the time spent near a male shelter.

## Discussion

### Mirror Trials

Our study revealed repeatable interindividual variation in boldness as measured through the mirror assay, suggesting that *M. formicaria* exhibit personalities. Our data also indicate that these personalities are variable among individuals. We found a significant relationship between boldness and body size of these spiders.

### Male-Male Encounters

The boldness measure from the mirror trials did not predict a spider's tendency to retreat in its encounter with another male. Instead, we found that males that do retreat tend to be smaller than their opponents. This result is consistent with previous findings (Zhou and Apple 2019), but surprising since we intentionally matched males of similar, though not identical, body size.

### Shelter Trials

Our study found that male spiders did not show significant difference in their behavior toward male shelters compared to female shelters.



### Future Work

In the future, we could investigate the existence of other personality traits besides boldness such as exploratory behavior. Additionally, we could examine other contexts in which the measure of boldness may play a role, such as male interactions with females.

## References

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- Stoffel, M. A., Nakagawa, S., & Schielzeth, H. (2017). rptR: Repeatability estimation and variance decomposition by generalized linear mixed-effects models. *Methods in Ecology and Evolution*, 8(11), 1639-1644.
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