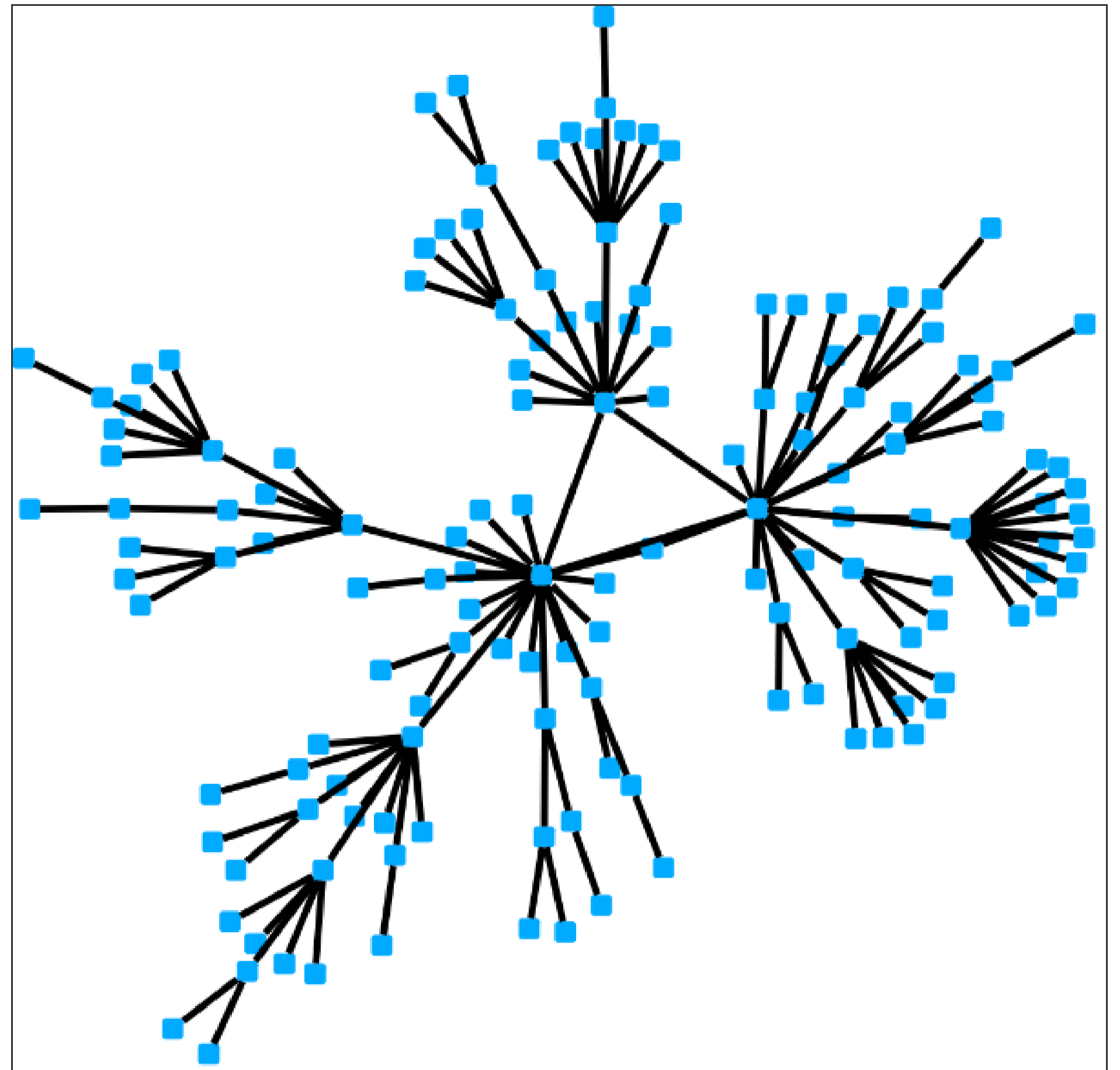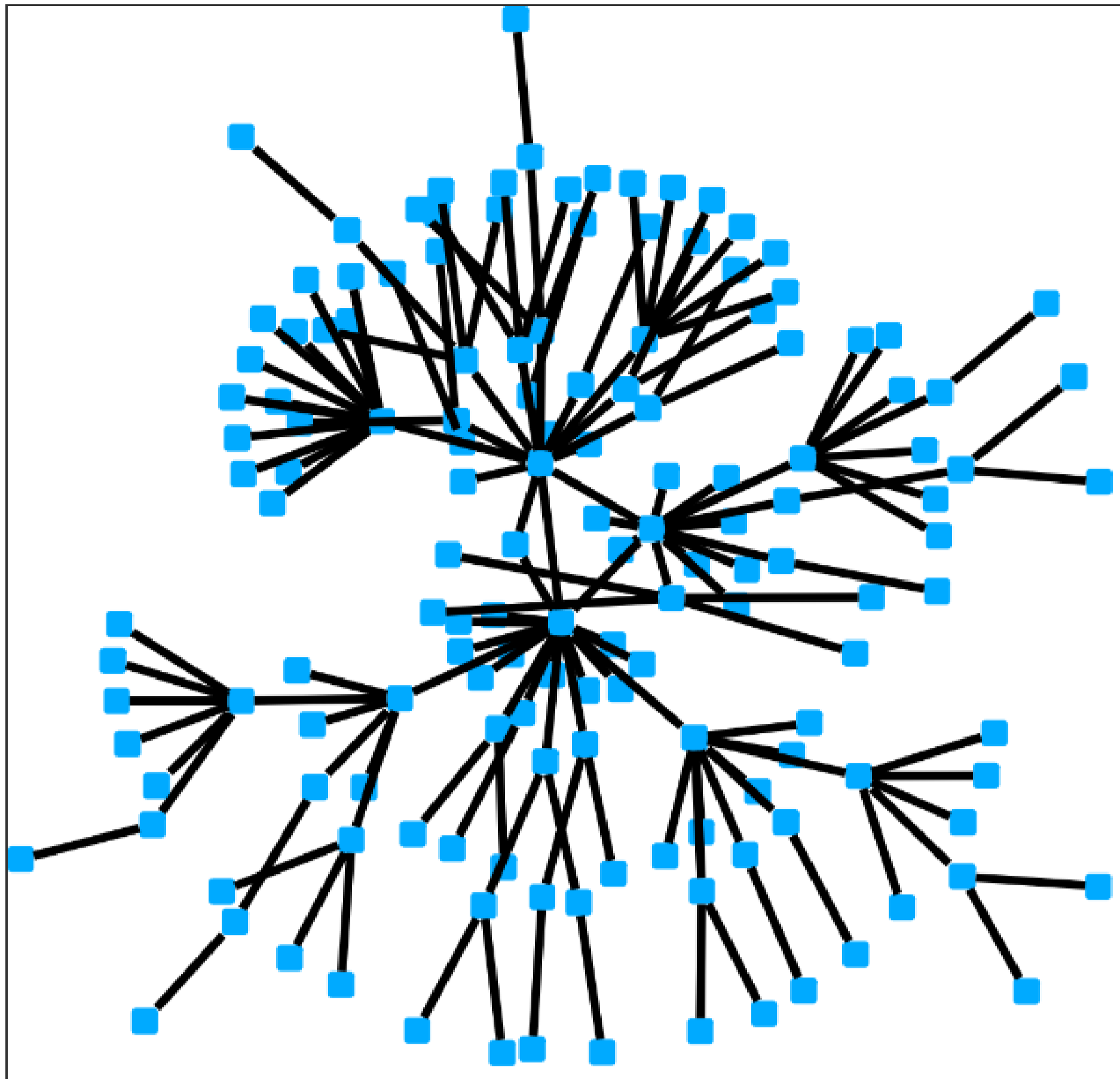# Which picture do you prefer?

Please click the picture you prefer.

We want to know geometric properties of graph drawings that predict human preference choices, over a range of graph sizes and types.
In particular: what is the impact on preference of edge crossings and stress in straight-line drawings?

In our first Experiment, 79 subjects are shown a sequence of 10 "instances". Each instance chooses one of a pair $D1$, $D2$ of drawings of a graph, like the pair above. We recorded their choice, and measured the number of edge crossings and the stress (scaled by the average edge length) for each drawing.

The answers
⇒ **Less stress** preferred in **57%** of the 790 instances
⇒ **Fewer crossings** preferred **65%** of the 790 instances

Previous experiments:
(Purchase et al. (1995+) and her followers):
⇒ Task oriented
⇒ Almost all small graphs
This experiment:
⇒ Test preference, not tasks
⇒ Up to 8000 nodes

Stress and crossing ratios: definitions
For a specific instance with two drawings D_1 and D_2 of the same graph, we define $stress(D_i)$ for each of D_1 and D_2 to be stress scaled by average edge length.

Then we define:
$$Stress\ ratio = \frac{\min(stress(D_1), stress(D_2))}{\max(stress(D_1), stress(D_2))}$$
and
$$crossing\ ratio = \frac{\min(crossings(D_1), crossings(D_2))}{\max(crossings(D_1), crossings(D_2))},$$
where $crossings(D_i)$ is the number of edge crossings in D_i.

The stress ratio and crossing ratio indicate the amount by which the two drawings in an instance differ in stress and crossings.
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Stress and crossing ratios: results
⇒ Preference for lower stress drawings increases slowly with stress ratio. For 70% of drawings with stress ratio greater than 4, the human preferred the lower stress drawing.
⇒ Preference for lower crossings increases from crossing ratio 1 to 1.5, but then remains steady. For 76% of instances where the crossing ratio was at least 2, the human preferred fewer crossings.
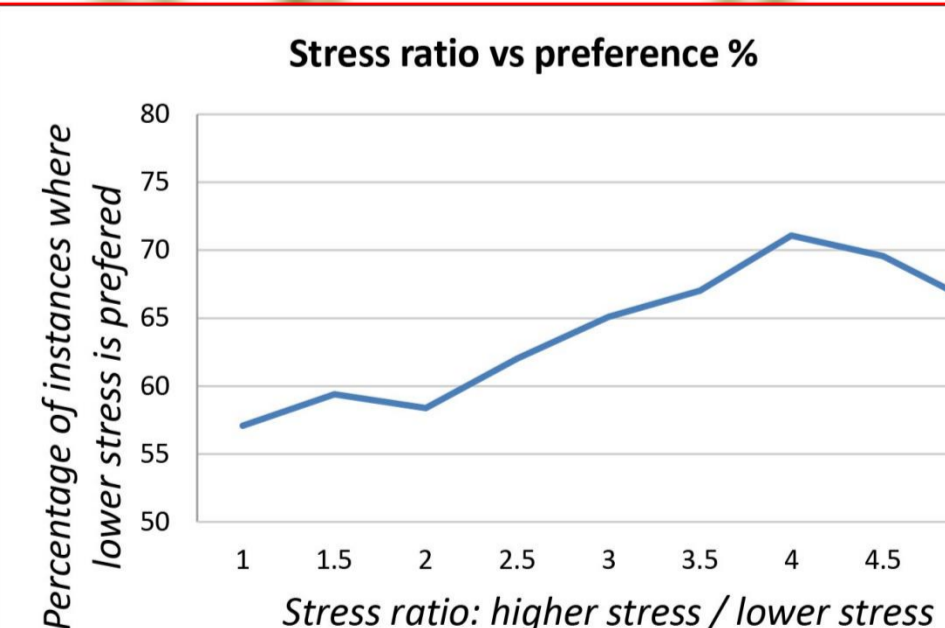

This chart shows how the percentage of instances where the subject chose lower stress changes with stress ratio.

This chart shows how the percentage of instances where the subject chose fewer crossing changes with crossing ratio.

The future
Our experimental software is web-deployable, and we intend to experiment with a variety of data sets and configurations, aiming to show some light on the long-term questions above.

We welcome collaboration from more researchers in this project.
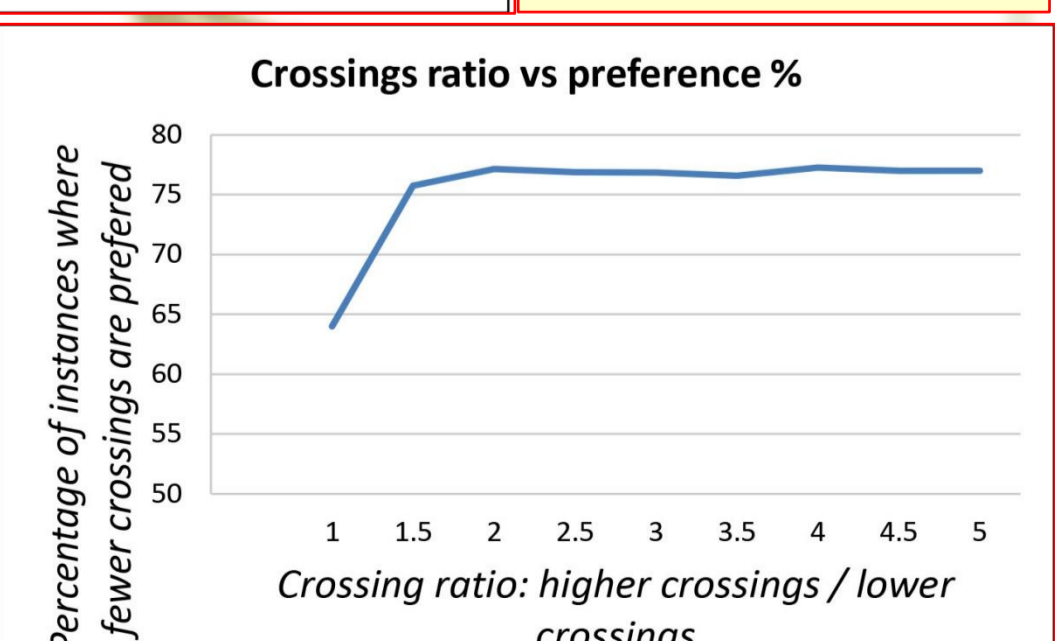
Markus Chimani (University of Osnabrück); Peter Eades, Patrick Eades, Seok-Hee Hong (University of Sydney); Weidong Huang (University of Tasmania); Karsten Klein (Monash University); Michael Marner, Ross Smith, Bruce H. Thomas (University of South Australia).