

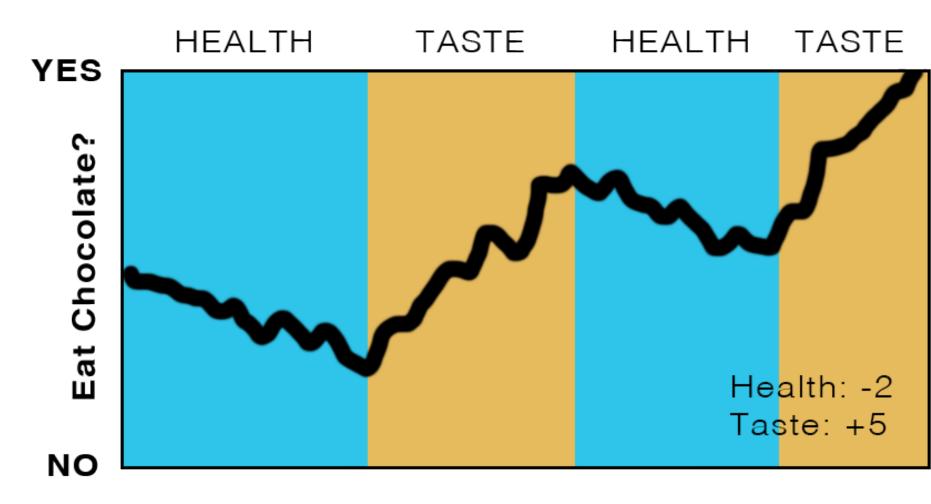
Extending the attentional drift-diffusion model

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// BACKGROUND

- Decisions are often captured as a weighted sum over multiple attributes 1: Summed Value = $w_1 * a_1 + w_2 * a_2 + ... + w_n * a_n$
- The **drift-diffusion model** suggests a biologically plausible mechanism for integrating these weighted attributes through a process of sequential sampling (Reference)
- The attentional drift-diffusion model (aDDM) was developed to capture the intuition that our attention tends to focus on one attribute at a time, and that this (attended) attribute (or option) has a stronger influence on the evidence accumulation process (Krajbich 2010)
- Example: Chocolate bar with health and taste attributes



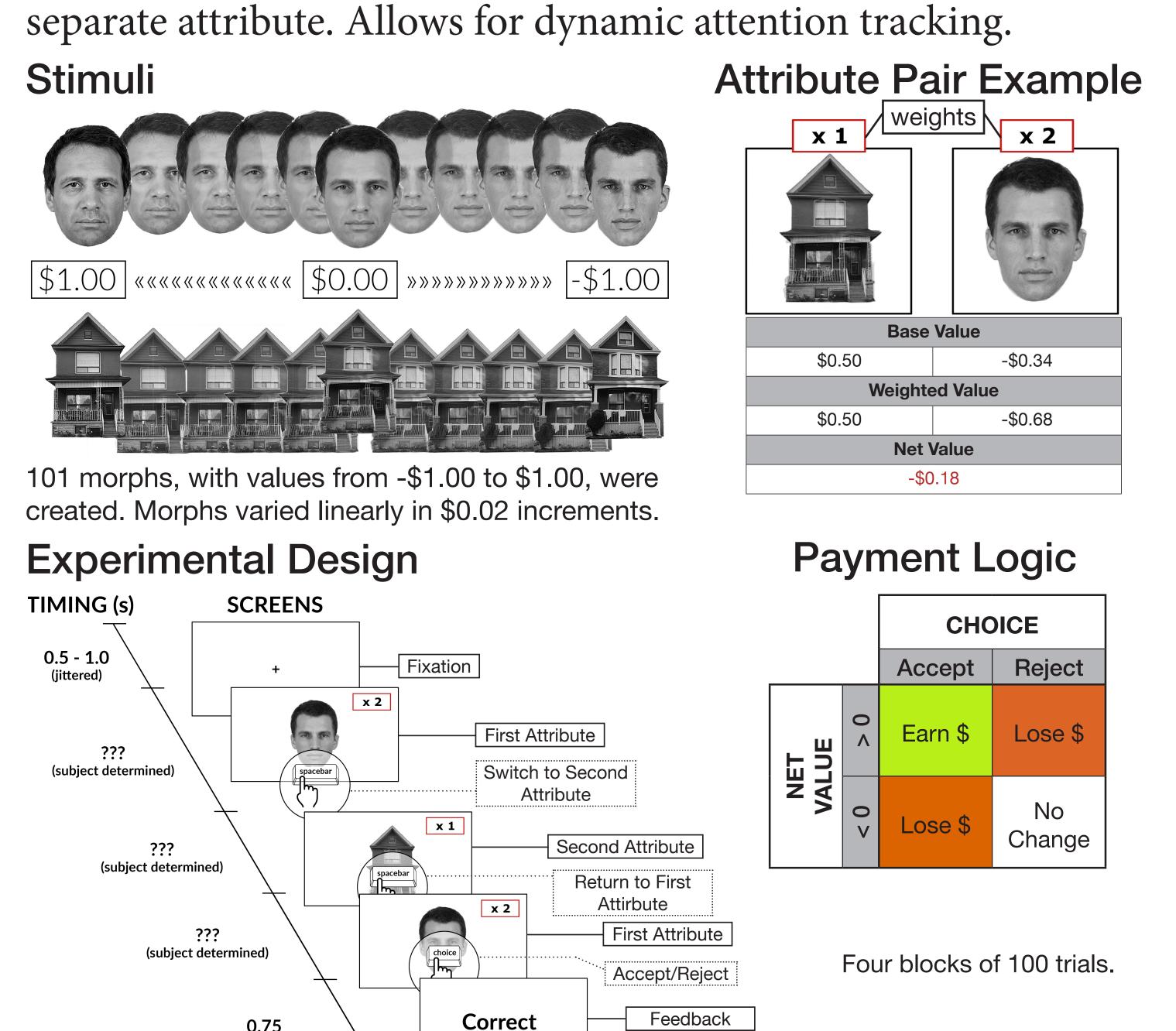
- The aDDM makes a number of assumptions:
- 1. The decision maker instantly knows the value of all attributes
- 2. The fixation distribution of the group can be used for individuals
- 3. Attention is independent of attribute valuation and weighting

// PROPOSED EXTENSIONS

- 1. Discount unattended attributes on the first fixation
- 2. Create sythetic distributions of fixation timings for individuals
- 3. **Incorporate** influence of attribute value and weighting on attention

// SUPPORTING STUDIES

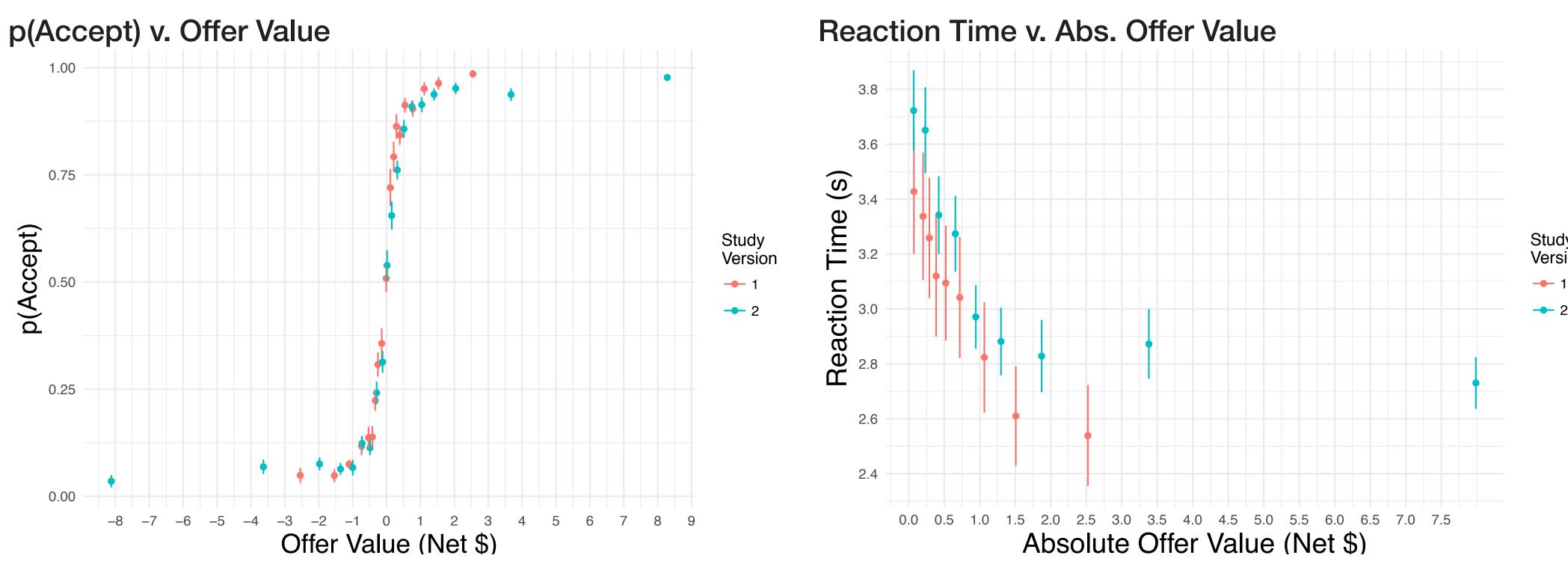
- 1. Subjects (Study 1: n=23, Study 2: n=31) accepted or rejected a proposed combination of 2 attributes (1 face and 1 house) based on the summed value.
- 2. Participants used a button to alternate between display of each separate attribute. Allows for dynamic attention tracking.

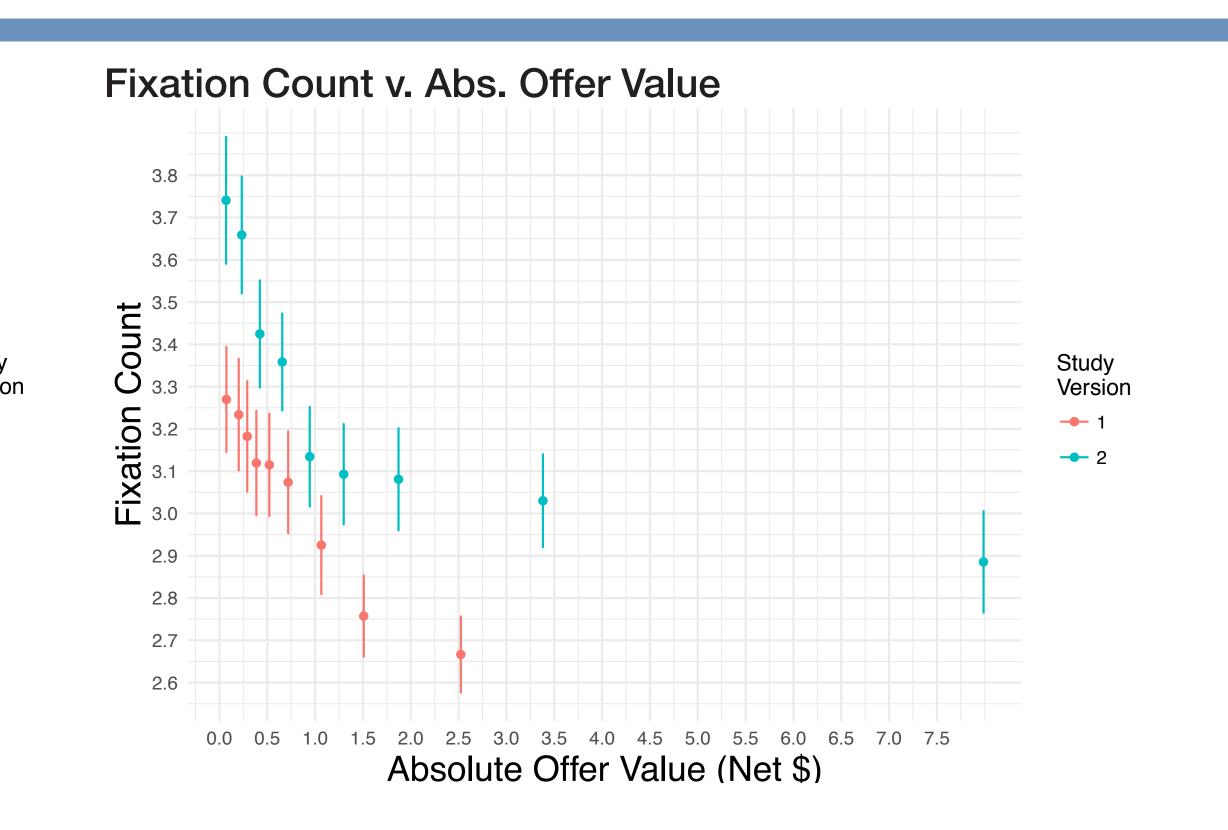


+ \$0.16

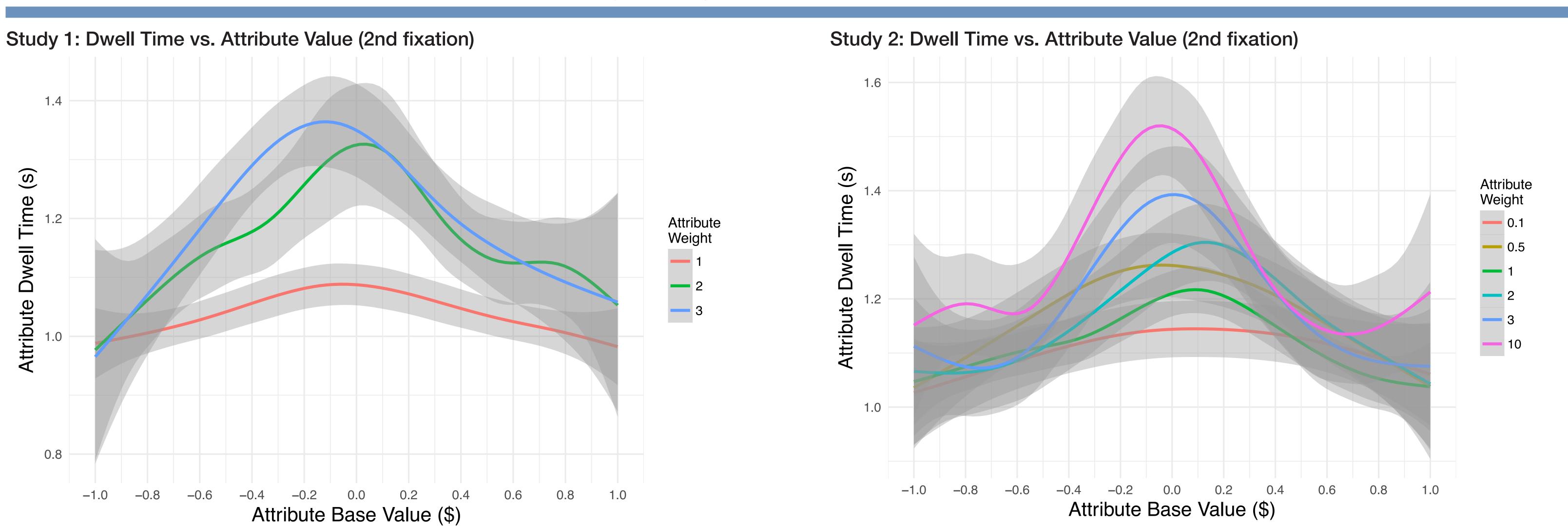
// RESULTS

// Basic Psychometrics





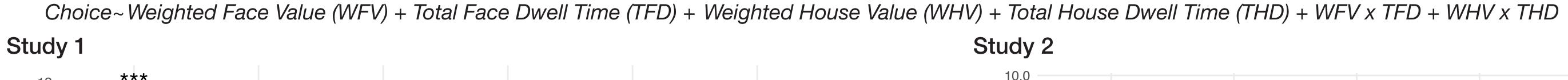
// Effects of Attribute Value & Weighting on Attention

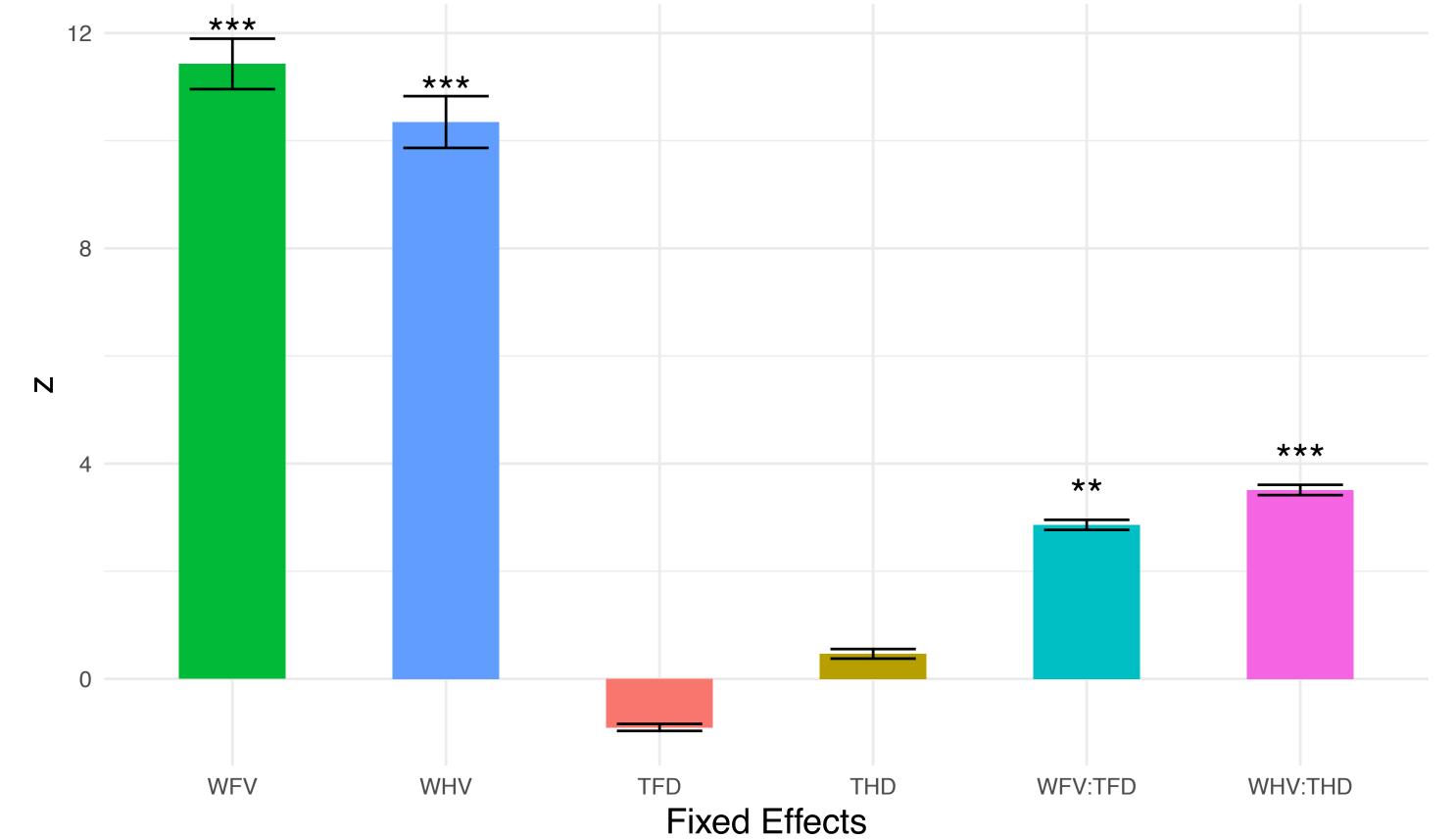


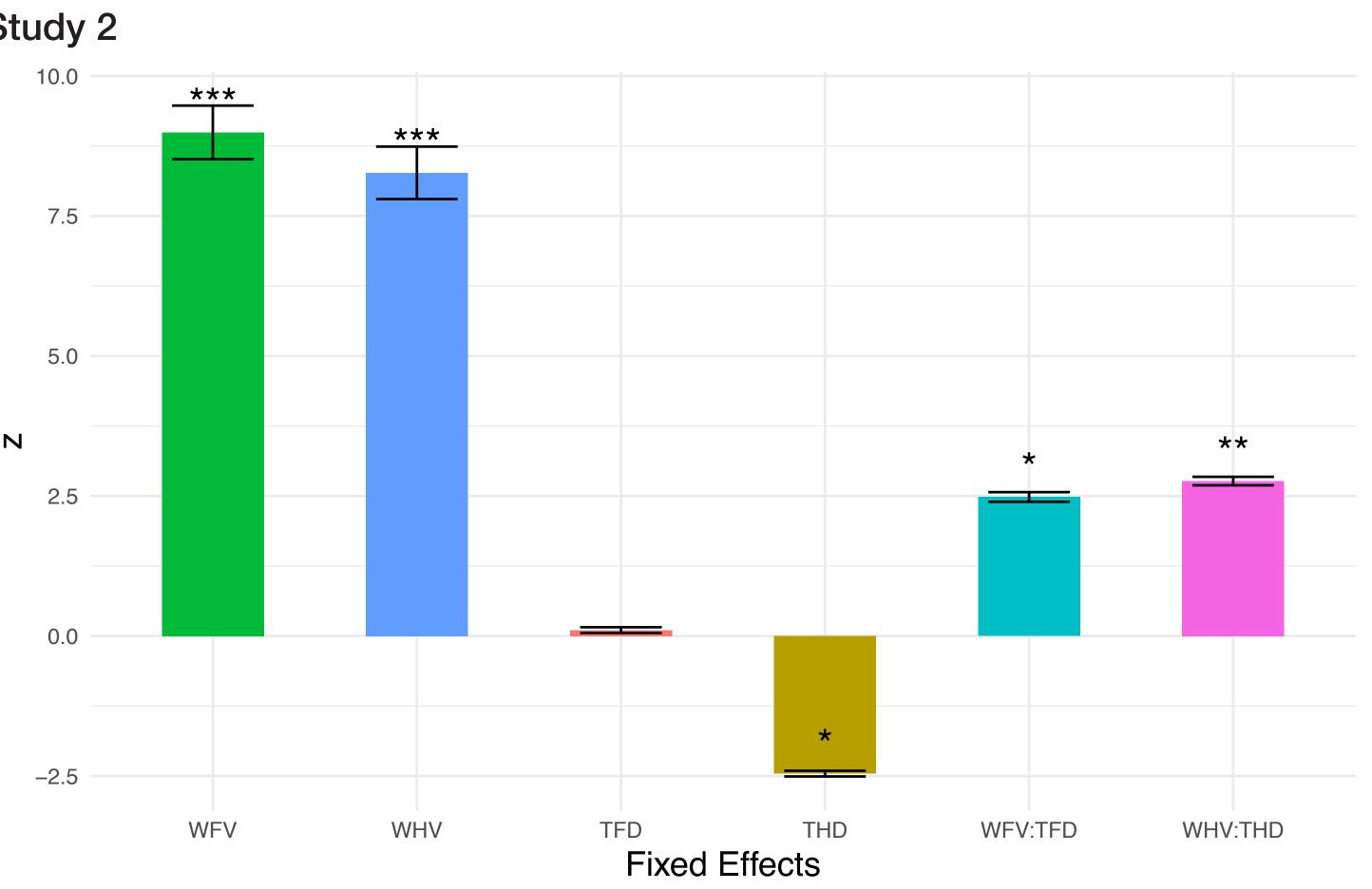
Attribute **attention** is **influenced by weighting** and **value**, but only for the second fixation (once all decision information is known). The initial fixation duration is unaffected by weighting.

// Attention, Value and Choice

Mixed Effects Logistic Regression on Difficult* Trials



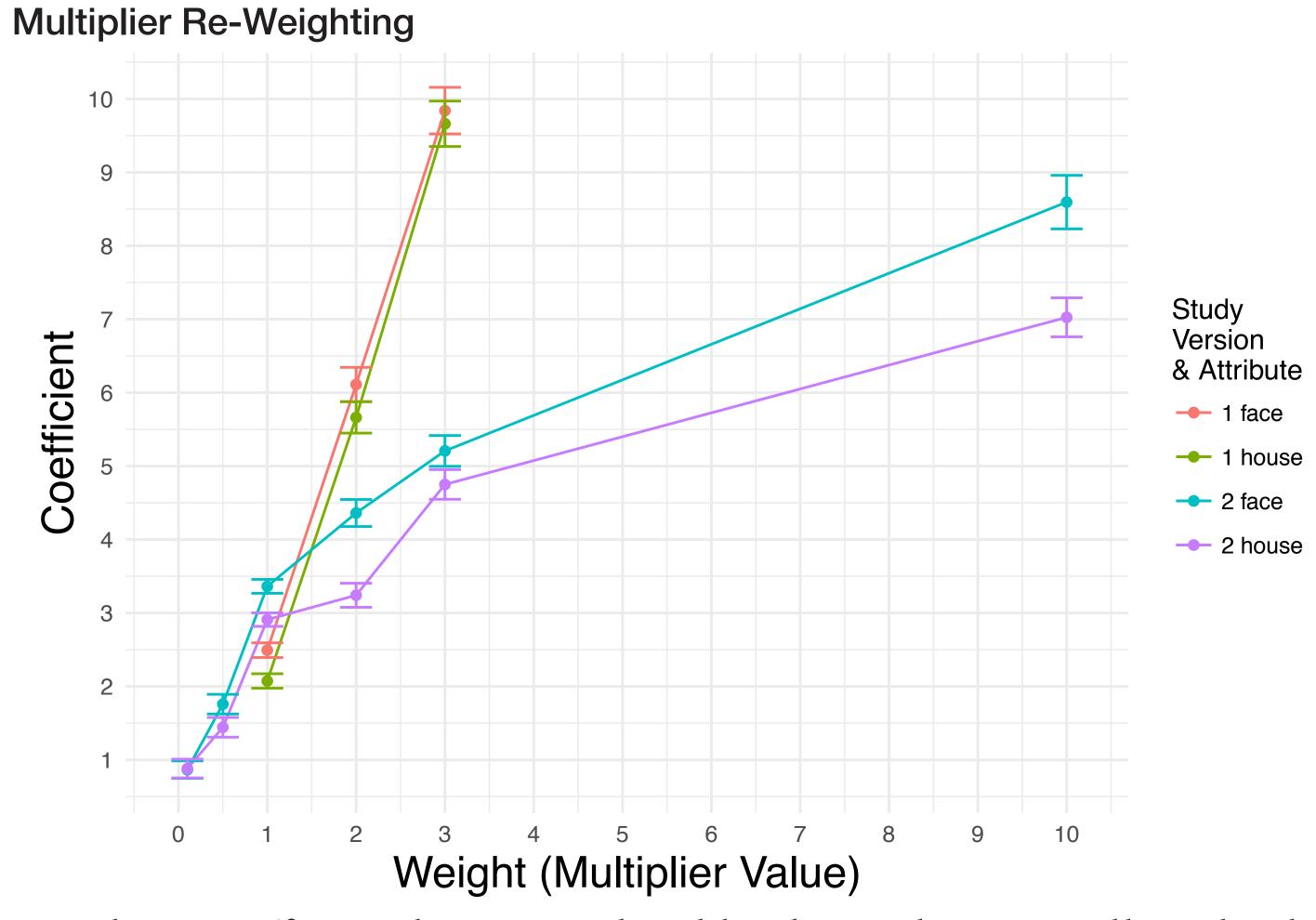




- Attention alone is not predictive of choice.
- The interaction between attention (total attribute dwell time) and value is a significant predictor of subject decisions.
- Results suggest that attention amplifies the influence of the target attribute.

* Difficult trials defined as those that have attribute values with opposite signs, and an absolute value of less than 0.25

// Attribute Re-weighting



- 1. Subjects effectively re-weighted both attributes at all multiplier levels.
- 2. Subjects weighted faces significantly more strongly than houses across multiplier level.
- **2.** Study 2 shows marked **range compression** in subject weighting of attributes.

// DISCUSSION

- 1. Attention, as measured by attribute fixation duration, is not random. It is affected by value and weighting.
- 2. Subjects are able to dynamically and flexibly re-weight attribute values, in order to make correct choices.
- 3. Attention influences choice when making difficult decisions.
- **4.** Re-weighting reveals bias and distortion. More accessible attributes show **overweighting** (e.g. face attribute), and extreme weights (e.g. 10x) show value **compression**.
- **4.** Experimentation is required to see if more accurate models of choice can be developed taking these findings into account.

// REFERENCES

- 1. Belton, Valerie. (1986). A Comparison of the Analytic Hierarchy Process and a Simple Multi-Attribute Value Function. *European Journal of Operational Research 26* (1): 7–21.
- 2. Ratcliff, R., & McKoon, G. (2008). The diffusion decision model: theory and data for two-choice decision tasks. *Neural Computation*, 20(4), 873–922.
- 3. Krajbich, I., Armel, C., & Rangel, A. (2010). Visual fixations and the computation and comparison of value in simple choice. *Nature Neuroscience*, 13(10), 1292–1298.

// ACKNOWLEDGEMENTS

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// FURTHER INFORMATION

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