

# The Multiplicative Role of Attention on Choice

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## Introduction

Attention and choice are interrelated in many domains:

- Consumer goods (e.g. Towal et al., 2013)
- Risk choices (e.g. Fiedler & Glöckner, 2012)
- Strategic games (e.g. Stewart et al., 2015)
- **Attention drives the choices that we make, but what is the nature of this mechanism?**
- **Does attention to lower-valued options yield the same amount of choice bias as attention to higher-valued options?**

## Model

Attentional Drift Diffusion Model (aDDM)  
(Krajbich et al. 2010)

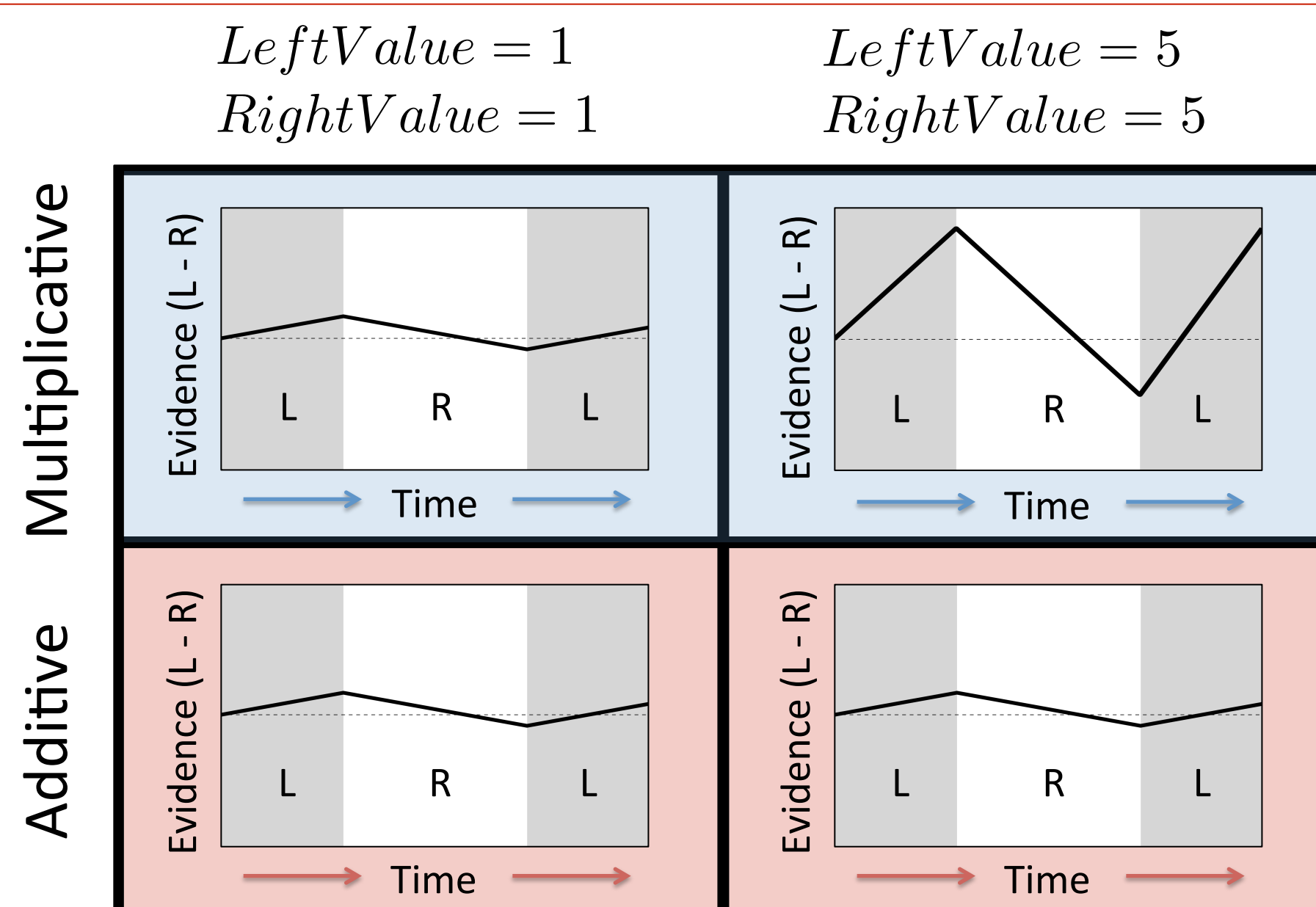
$$V_t = V_{t-1} + d(LeftValue - \theta RightValue) + \epsilon$$

$$\tilde{V}_t = V_{t-1} + d(\theta LeftValue - RightValue) + \epsilon$$

Alternative (Additive) Model  
(Cavanagh et al., 2015)

$$V_t = V_{t-1} + d(LeftValue - RightValue + \eta) + \epsilon$$

$$\tilde{V}_t = V_{t-1} + d(LeftValue - RightValue - \eta) + \epsilon$$



## Data

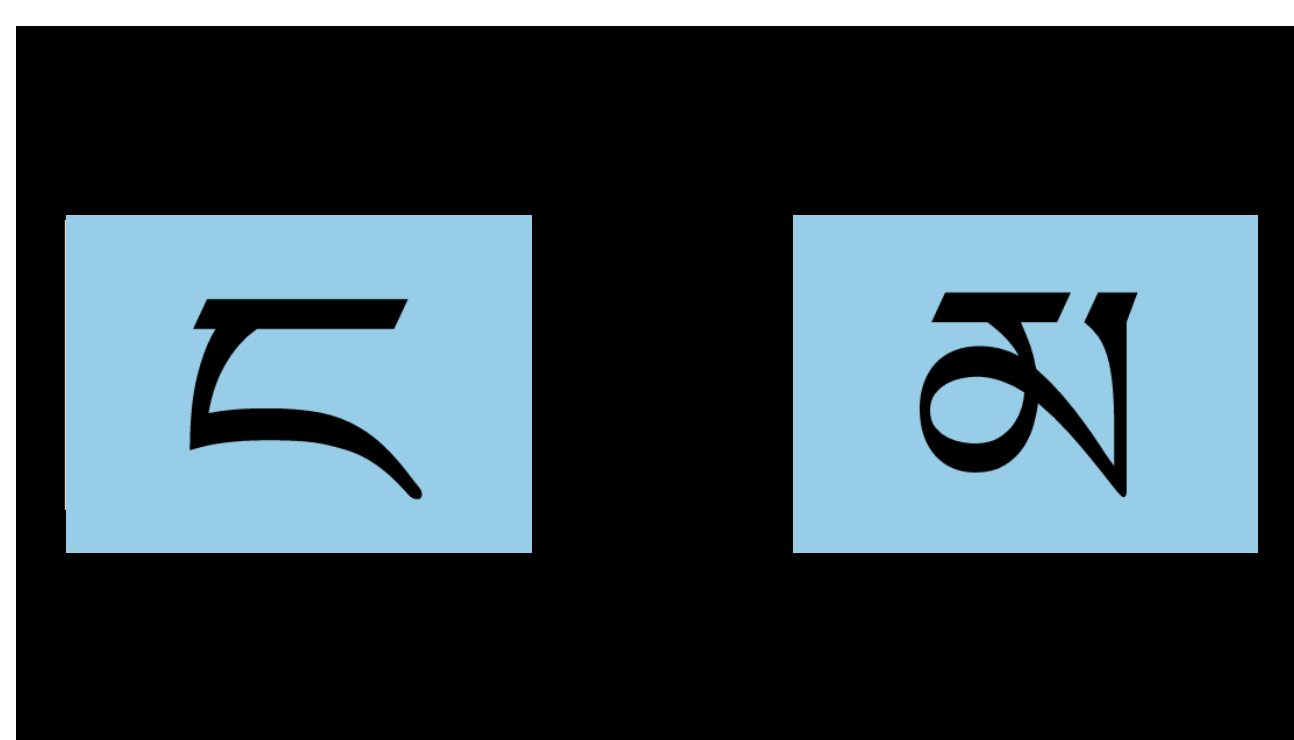
Binary Food Choice Datasets

- 1: Krajbich et al., 2010
- 2: Smith & Krajbich, under review
- 3: Chen & Krajbich, in preparation
- 4: Gwinn & Krajbich, in preparation

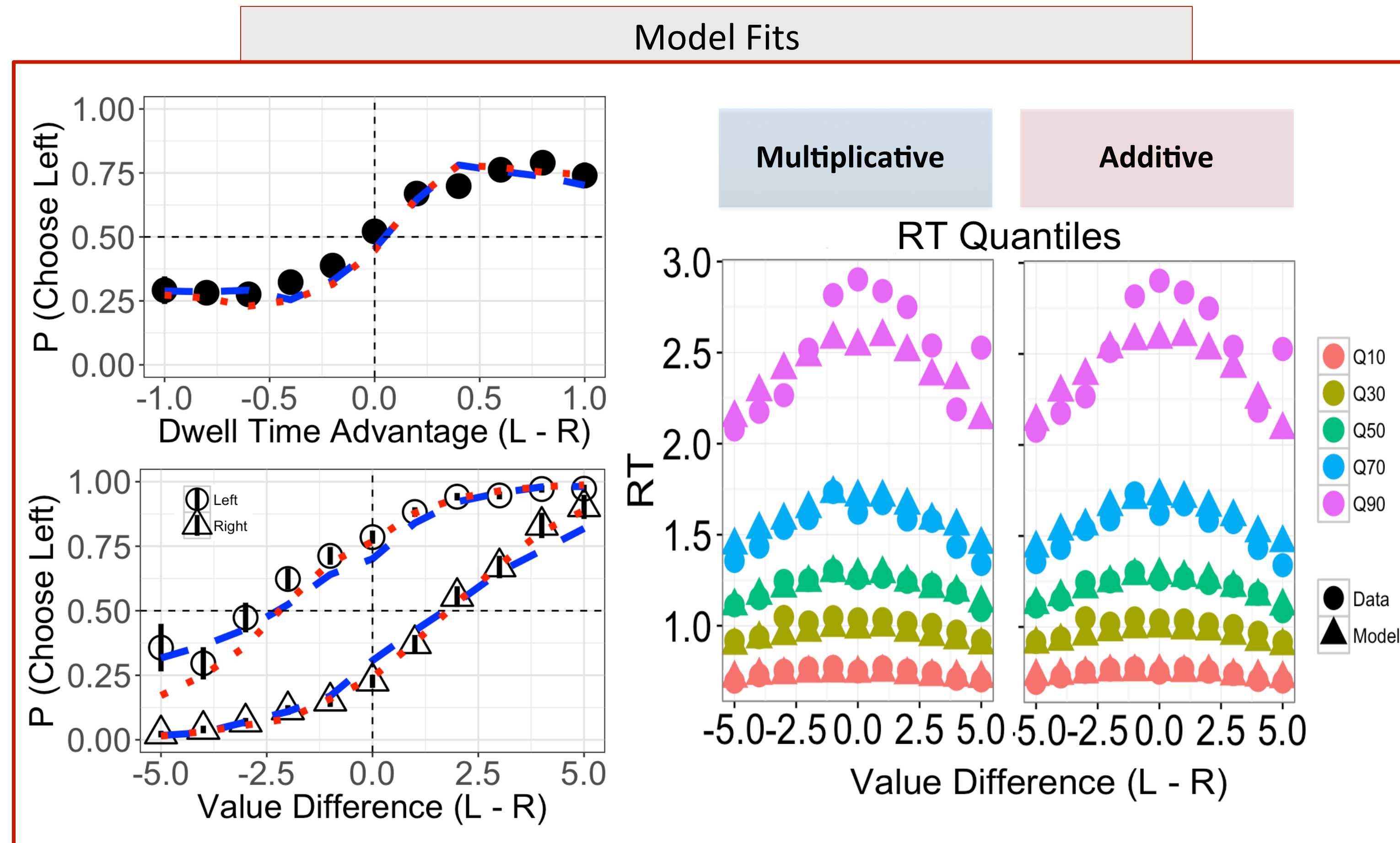


Symbolic Reward Datasets

- 5: Cavanagh et al., 2013
- 6: Konovalov & Krajbich, 2016

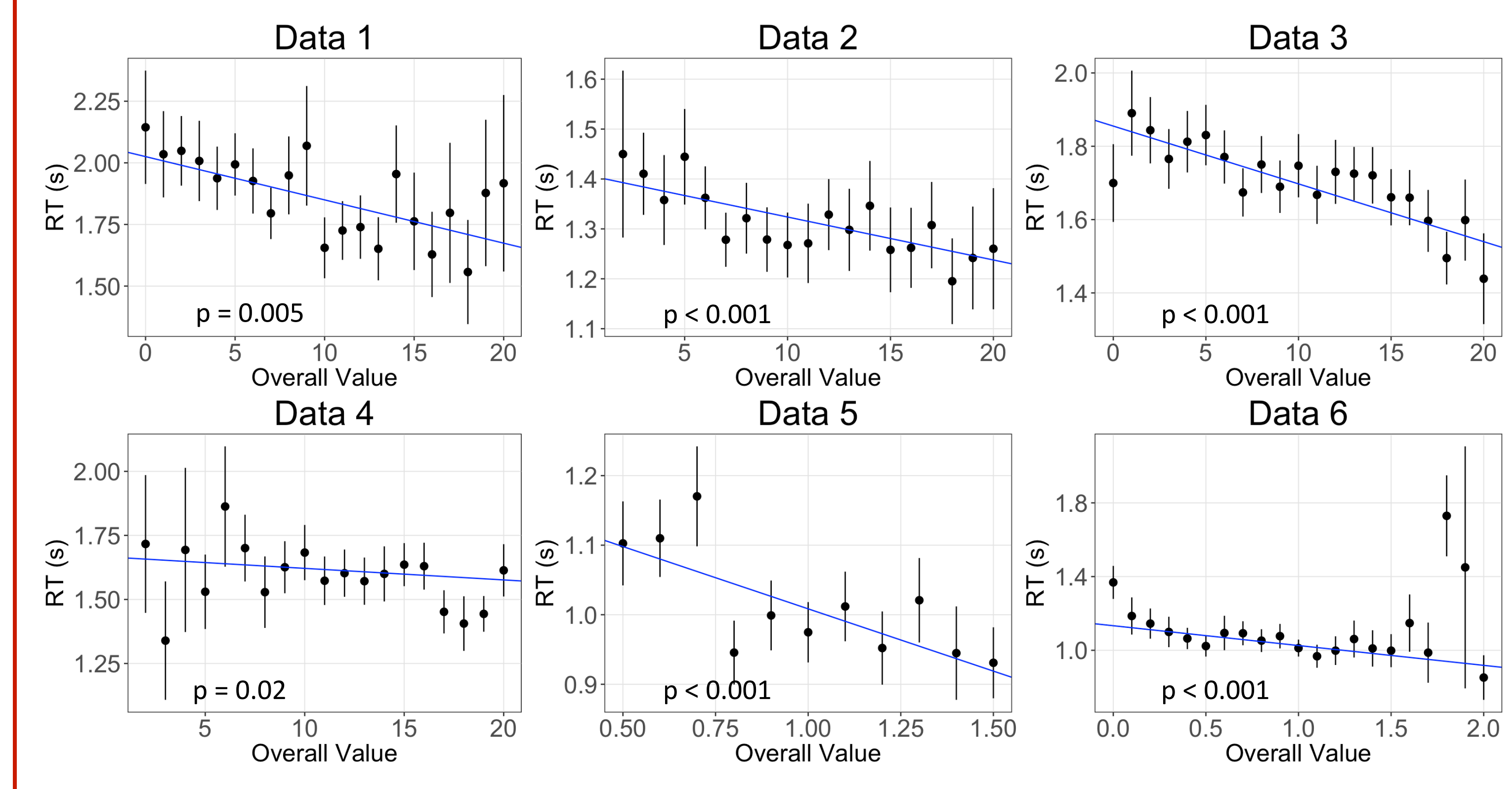
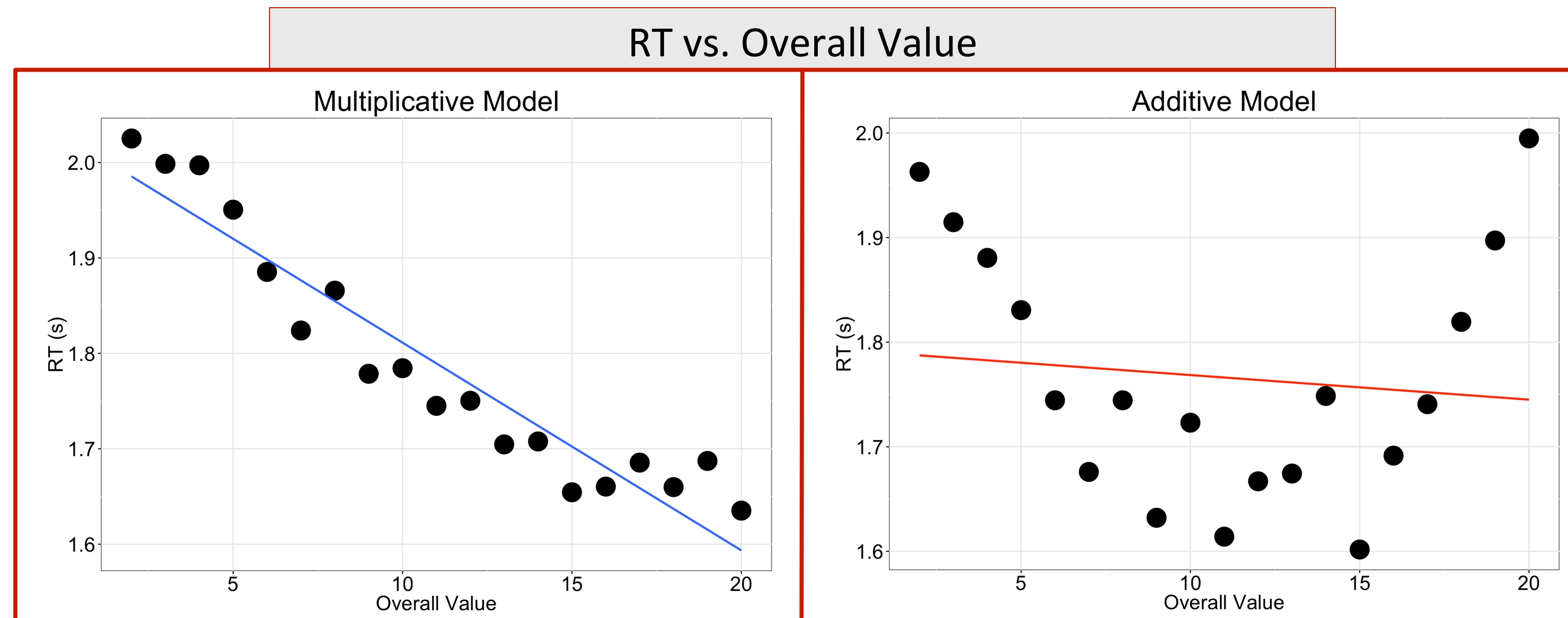


## Results



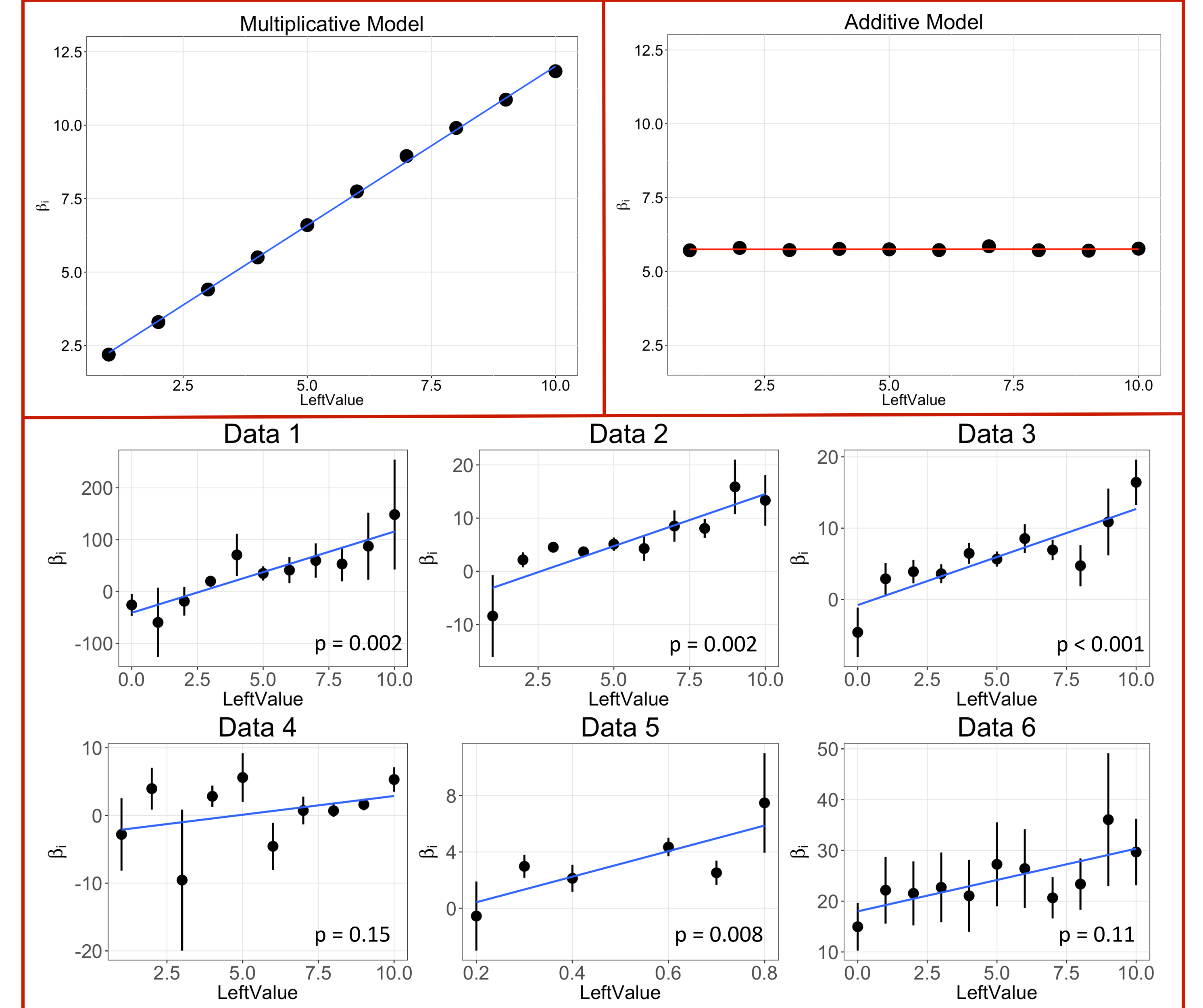
Maximum Likelihood Goodness-of-Fit from Model Fits

Data	1	2	3	4	5	6
<b>Multiplicative 1</b>	-9467	<b>-19437</b>	<b>-22772</b>	-16825	<b>-12863</b>	-14466
<b>Additive 1</b>	<b>-9424</b>	-19485	-22799	<b>-16794</b>	-13096	<b>-14053</b>
<b>Multiplicative 2</b>	<b>-8248</b>	<b>-16839</b>	<b>-20380</b>	-13849	<b>-10763</b>	<b>-14143</b>
<b>Additive 2</b>	-8264	-16950	-20541	<b>-13847</b>	-10766	-14157

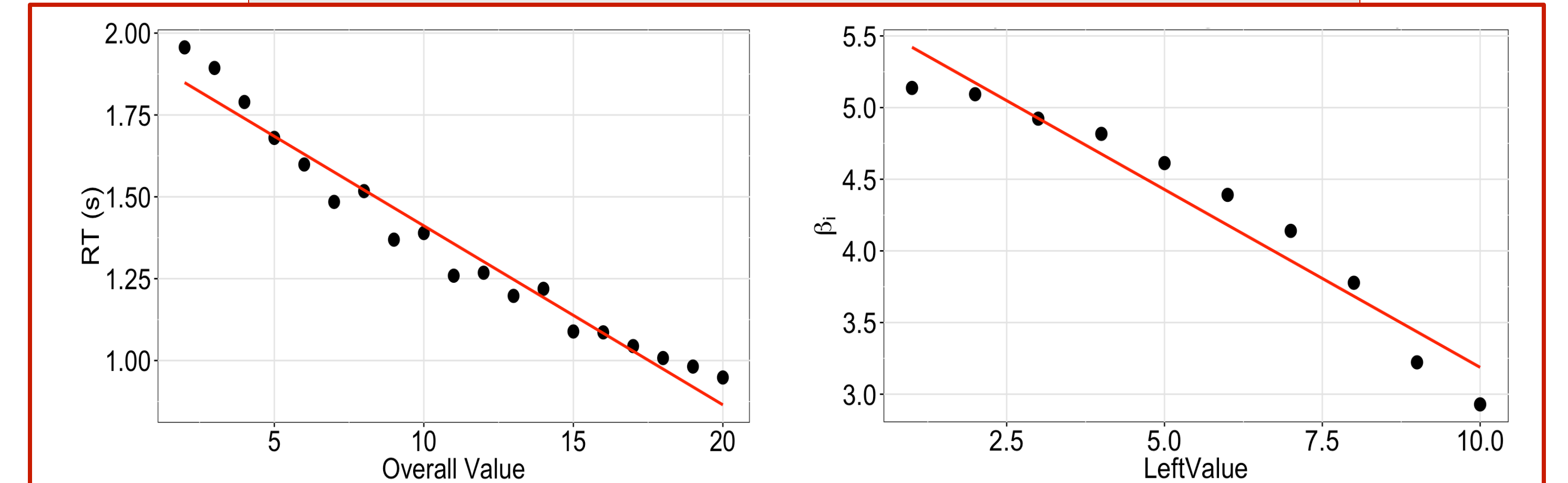


## Effect of Value on Attentional Influence

$$ChooseLeft \sim \beta_0 + \beta_1 LeftValue + \beta_2 RightValue + \sum_{i=\min(LeftValue)}^{\max(LeftValue)} \beta_i (LeftDwellProportion)^i (LeftValue = i)$$



## Additive Model with Decreasing Bounds (as proposed by Cavanagh et al., 2013)



## Conclusions

- Using traditional model fitting, both models can offer reasonable fits to the data
- Looking at qualitative aspects of the data, attention seems to exert a multiplicative influence on the choice process, as evidenced by:
  - A decrease in RT as Overall Value increases
  - An increase in the effect of attention as the value of the gazed-at option increases
- The course of evidence accumulation depends not only on the difference between the two alternatives, but also on the values of the options

## References

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