# How Music Alters Decision Making: Impact of Music Stimuli on Emotional Classification

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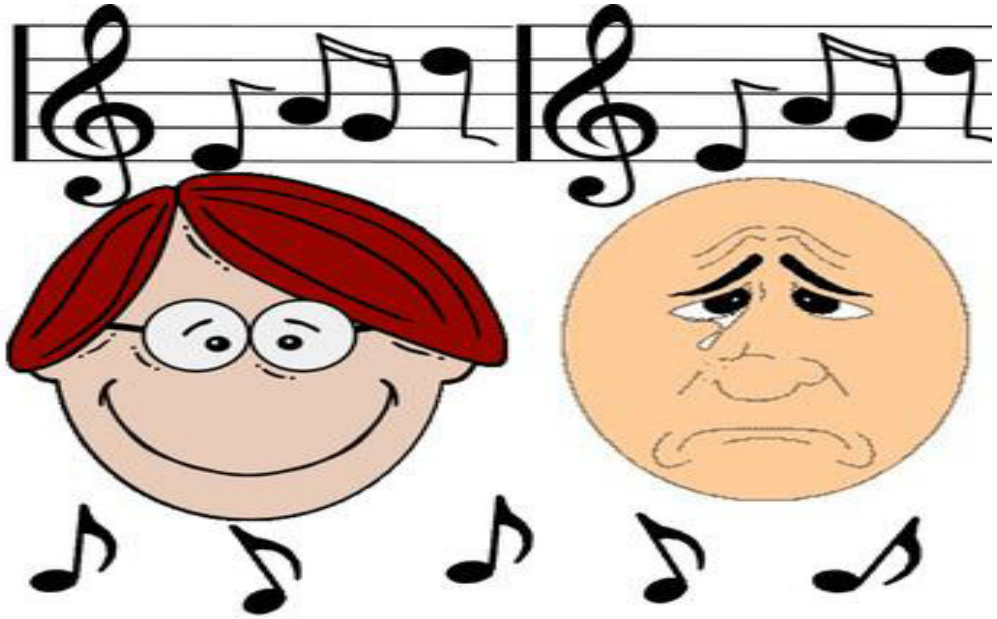
# Overview

- Mood can affect emotional processing (Behen 2011, Kuhbandner and Pekrun 2013).
- We explored how decision making is affected by music.
- Experiment - classify words as positive/negative while listening to music.
- Music chosen to induce mood.
- Results show music manipulation was effective.



# Background

- Robust evidence of mood-congruent processing, or bias (White et al. 2009, 2010).
- Music affects mood, but how does it that effect emotional decision making?

# Background

- People had to perform an emotional task.
- ...while listening to music.
- To analyze the results, we use a Drift Diffusion Model (DDM)(Ratcliff & McKoon, 2008).
- The DDM differentiates two types of bias:
  - Due to an a priori preference
  - Due to a shift in how stimuli are evaluated
- Model has been used in the past, but not in this context.

# Methods

- Participants were shown words and asked to classify them.
- Words taken from a previous paper (White et al. 2013).
- Words were categorized into three categories:
  - Positive - success, happy
  - Neutral - shelves, sipped
  - Negative - worried, sad
- The task consisted of 4 blocks of 60 trials with 20 stimuli from each word condition.

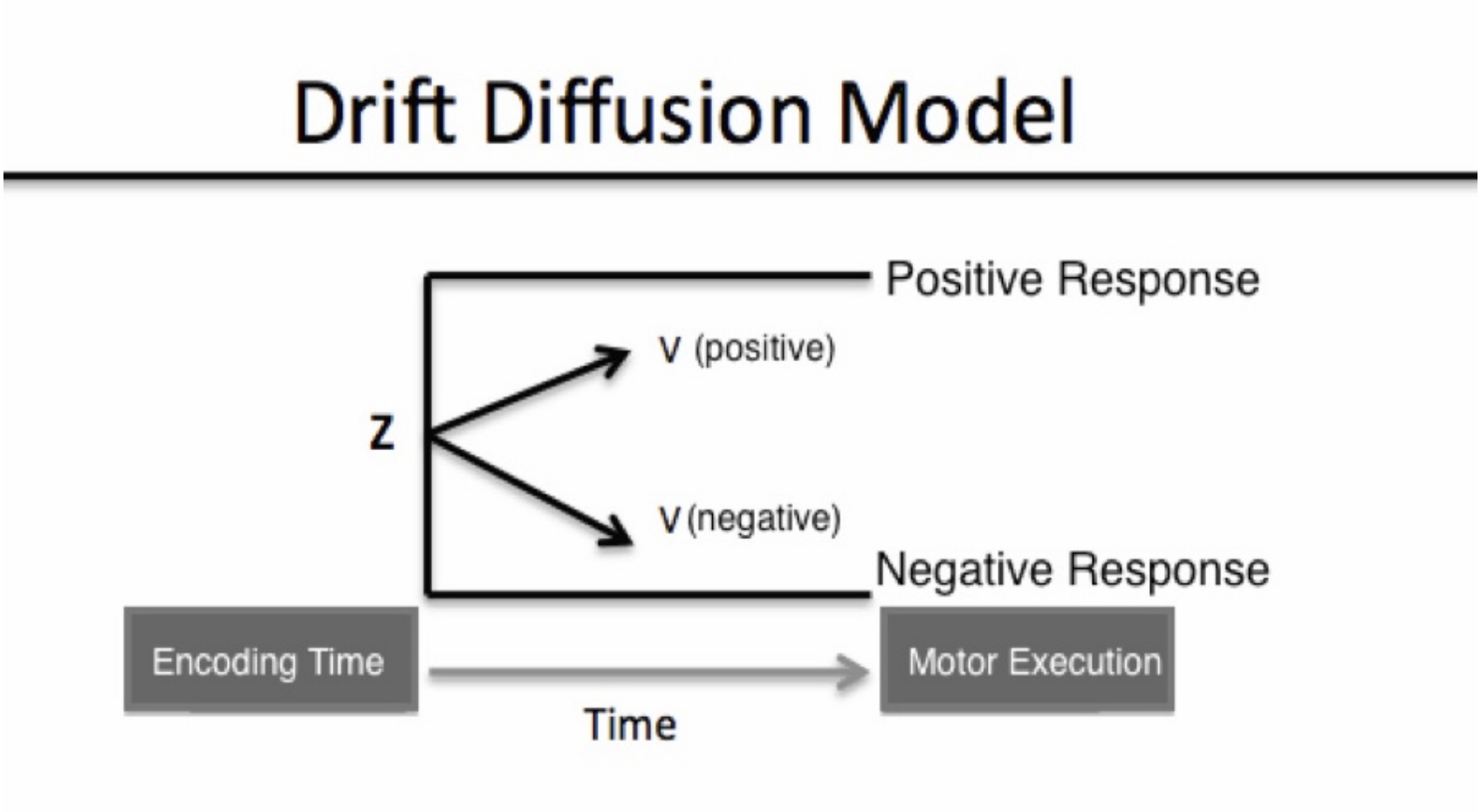
# Methods

- A different song was played during each block.
- Words were randomly assigned (20 of each type).
- The DDM was fitted to each participant's data via convex optimization (minimizing $\chi^2$).

# Methods

Experiment console example:

# Stochastic Modeling



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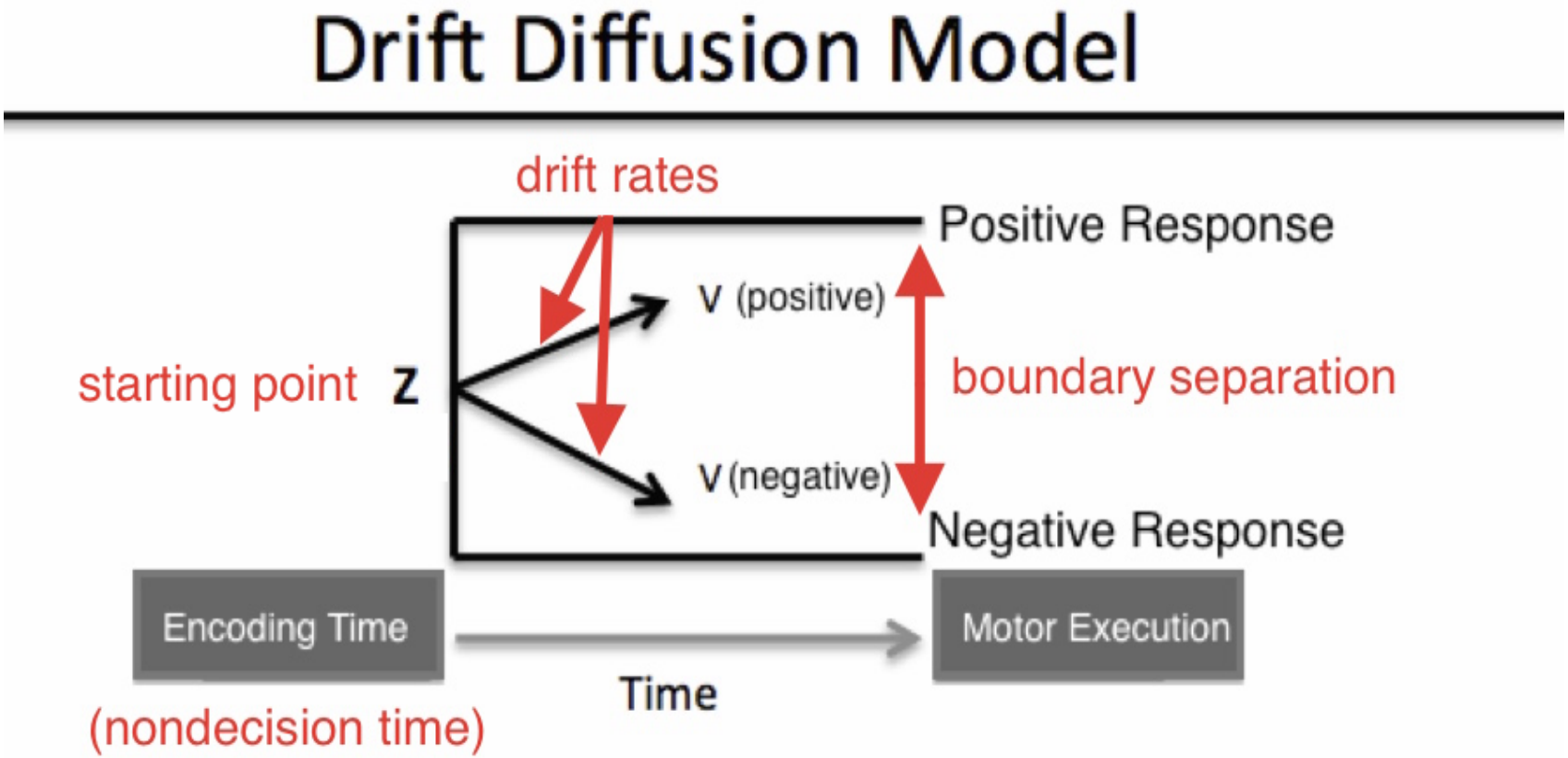

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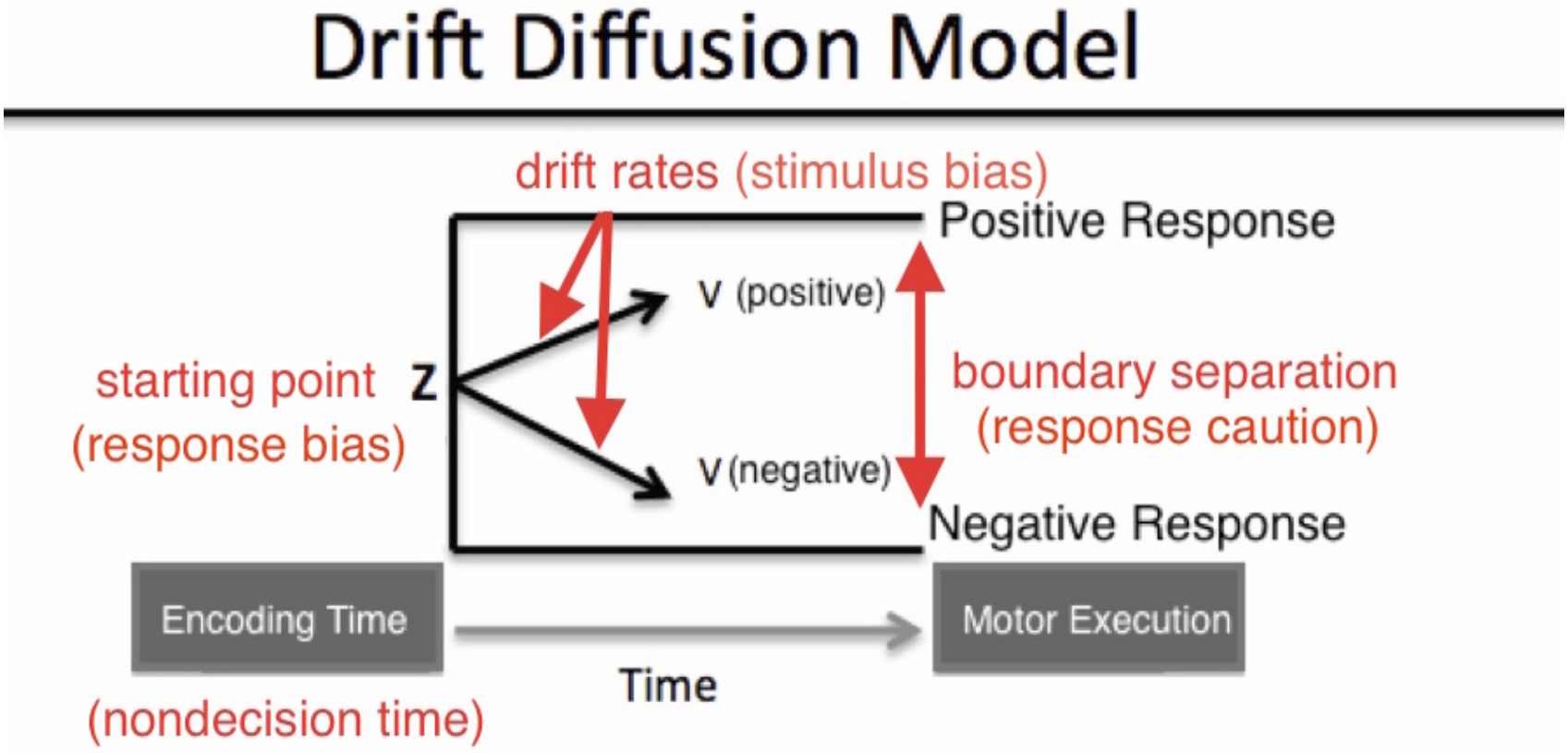
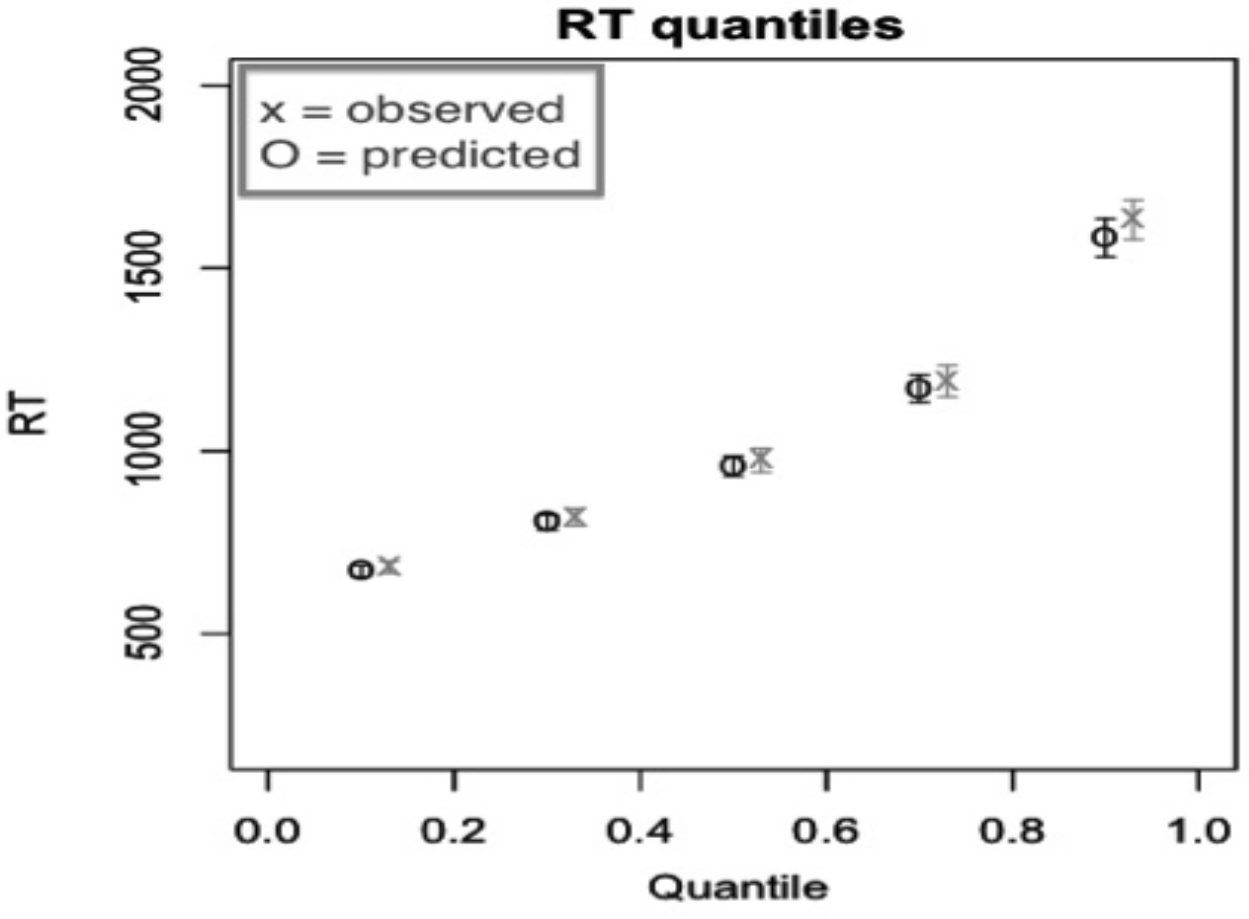


# Model Fitting Quality



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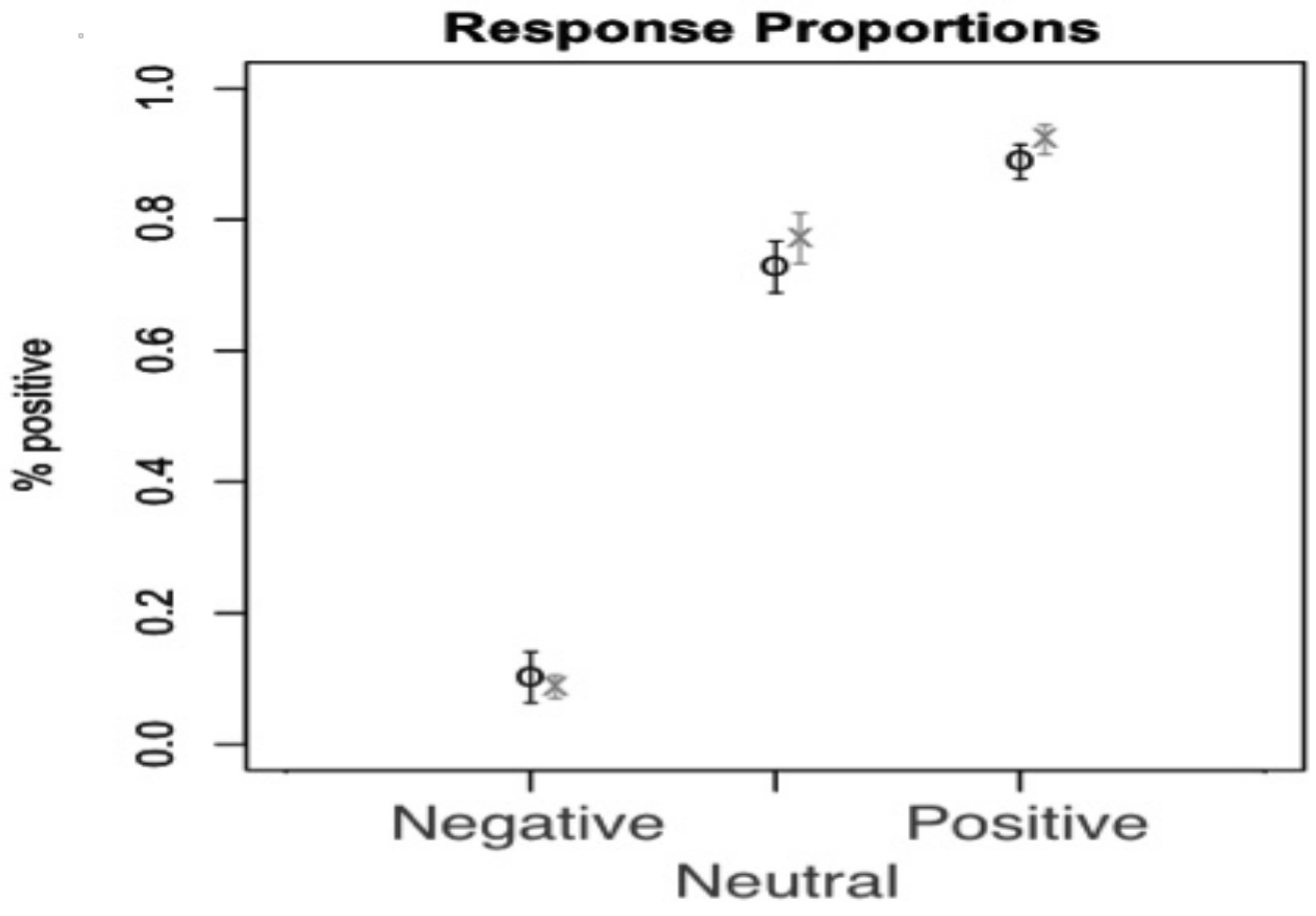
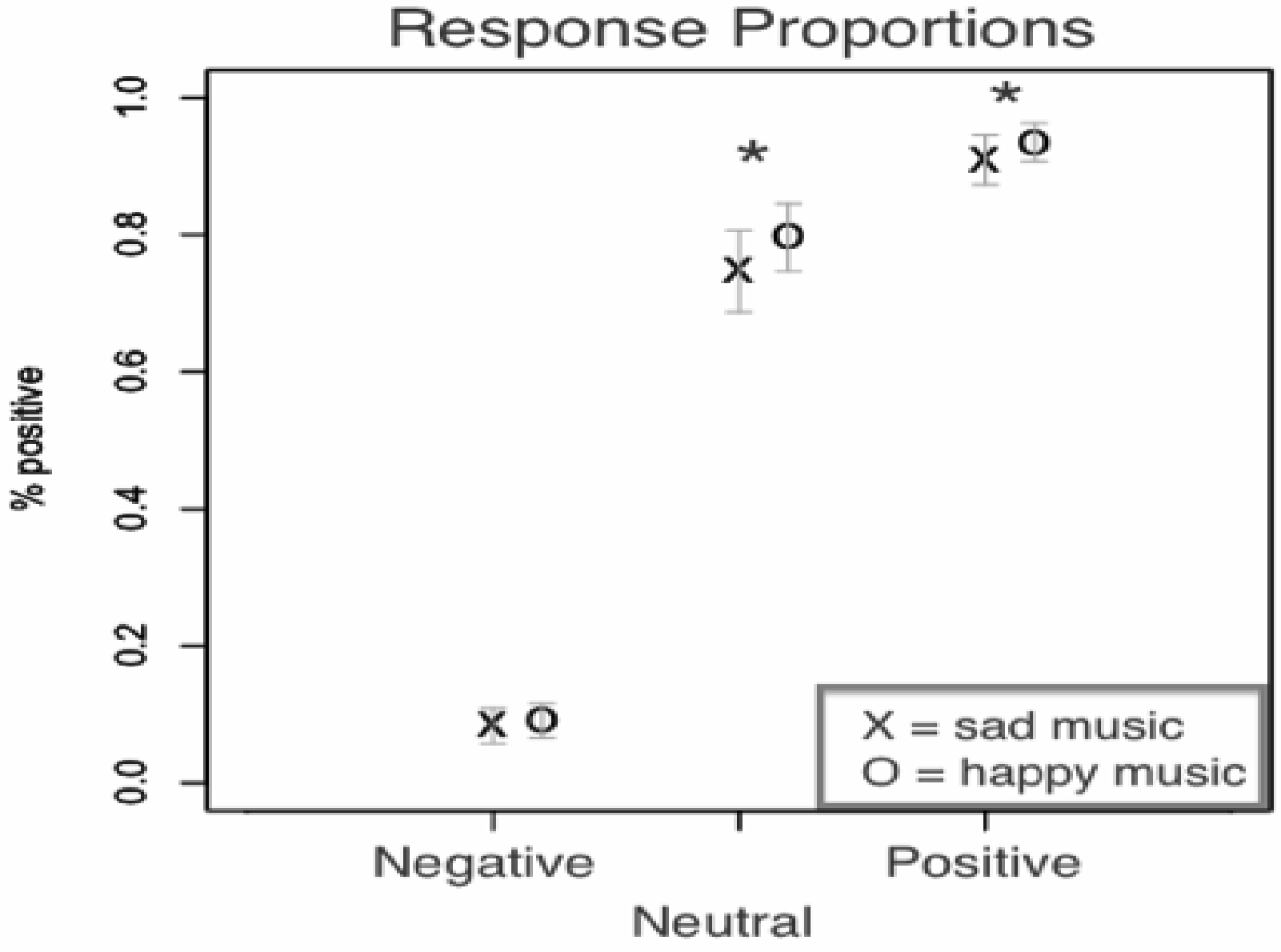


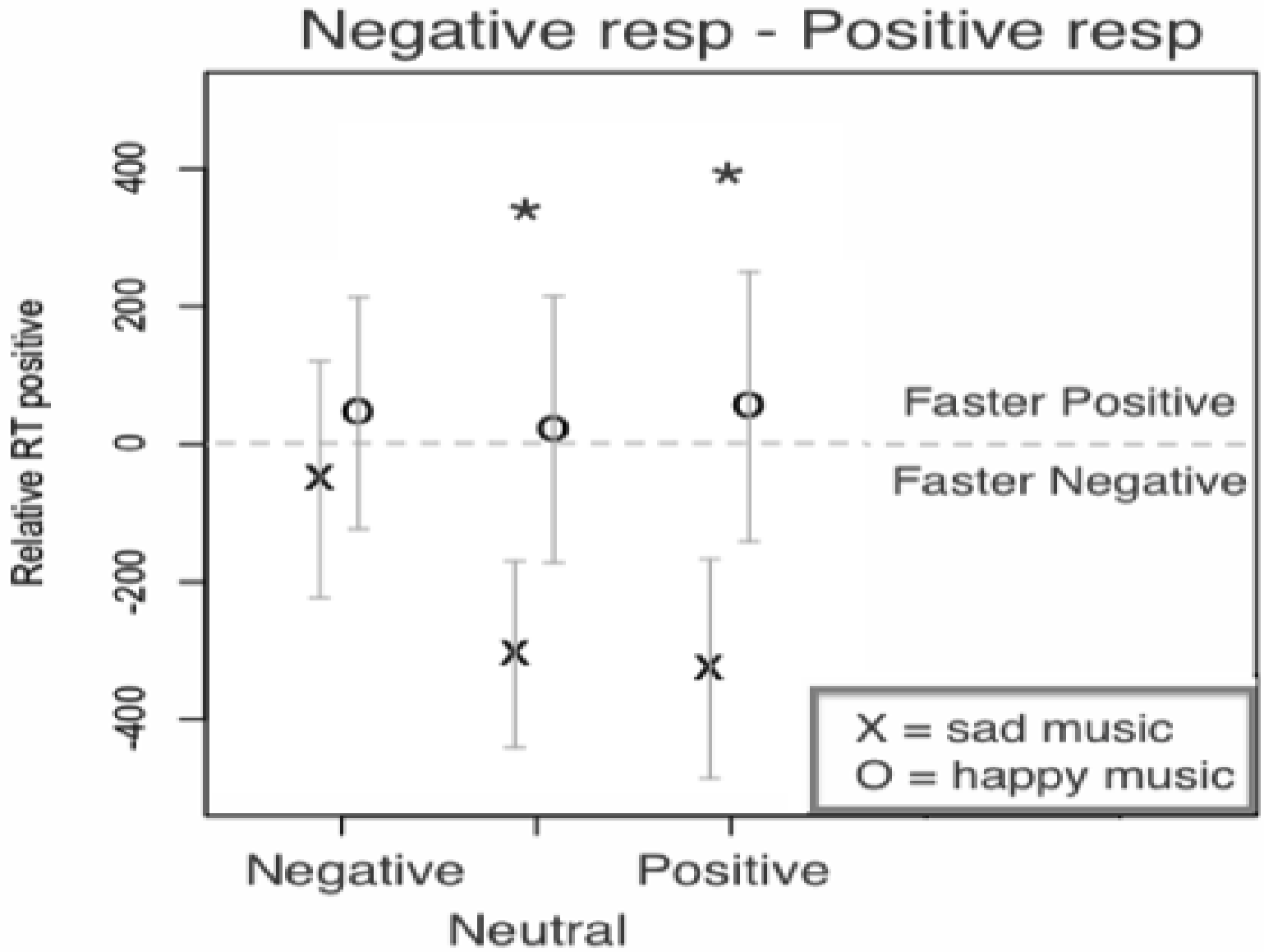
# Results

- Mood-induction successfully affected emotional bias.
- Happy music led to more “positive” responses overall.
- For the starting point, there was a significant shift.
- No reliable effect on the drift rates, response caution or nondecision time.
- Music affected the bias, but not the stimulus evaluation.

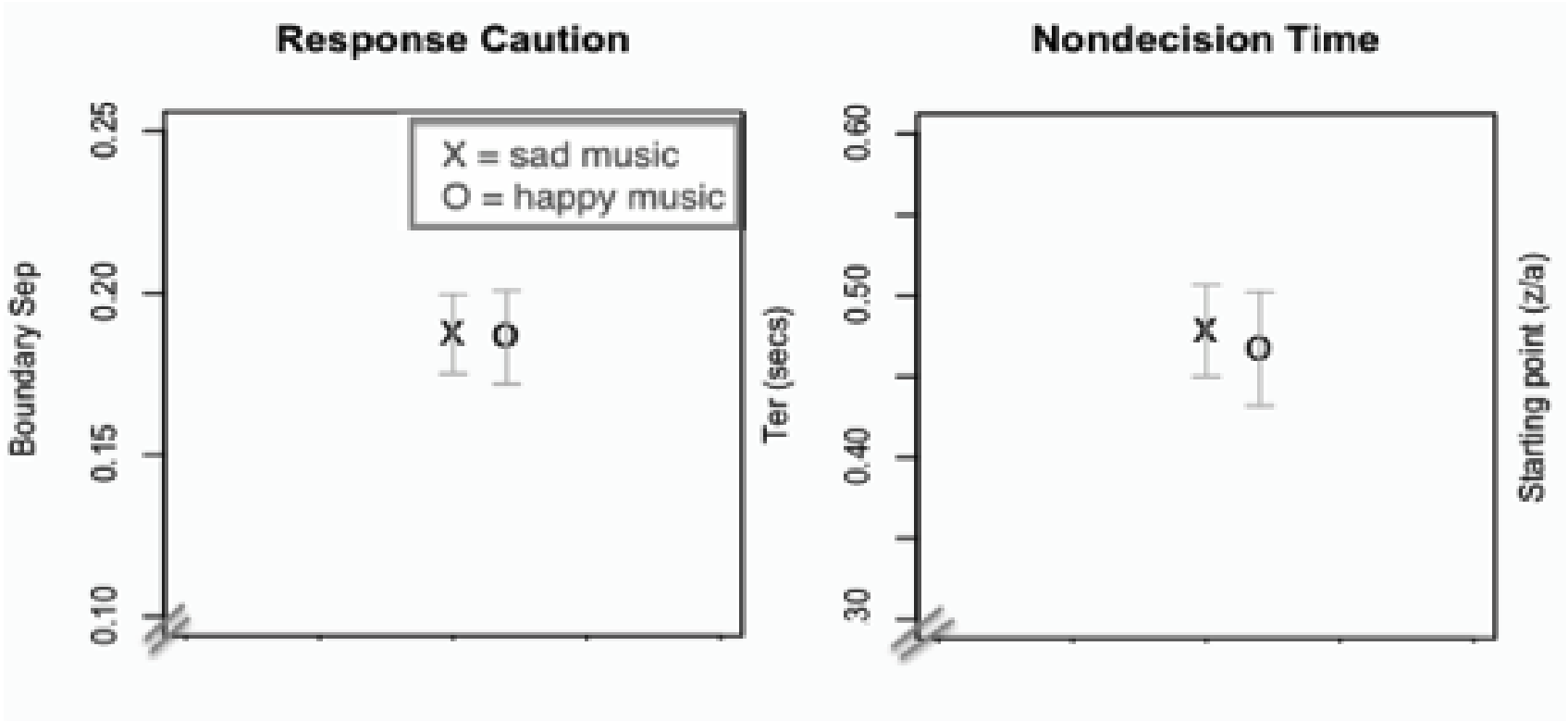
# Results


Response Proportions
% positive
0.0
0.2
0.4
0.6
0.8
1.0
*
*
X = sad music
O = happy music
Negative
Neutral
Positive

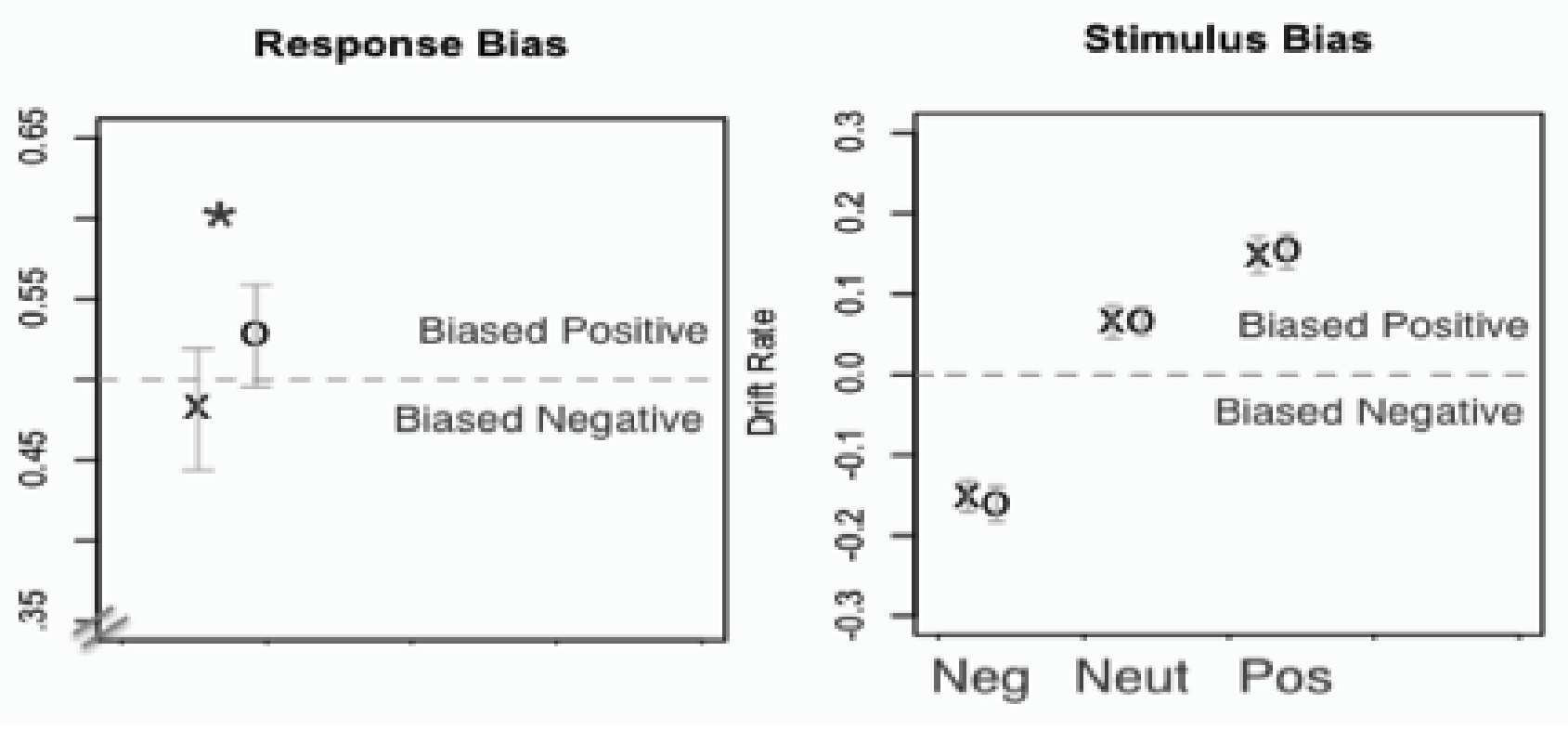
# Results


Negative resp - Positive resp
Relative RT positive
400
200
0
-200
-400
Faster Positive
Faster Negative
X = sad music
O = happy music
Negative
Neutral
Positive

# Results


Response Caution
Boundary Sep
0.10
0.15
0.20
0.25
X = sad music
O = happy music
X
O
Ter (secs)
Nondecision Time
30
0.40
0.50
0.60
X
O
Starting point (z/a)

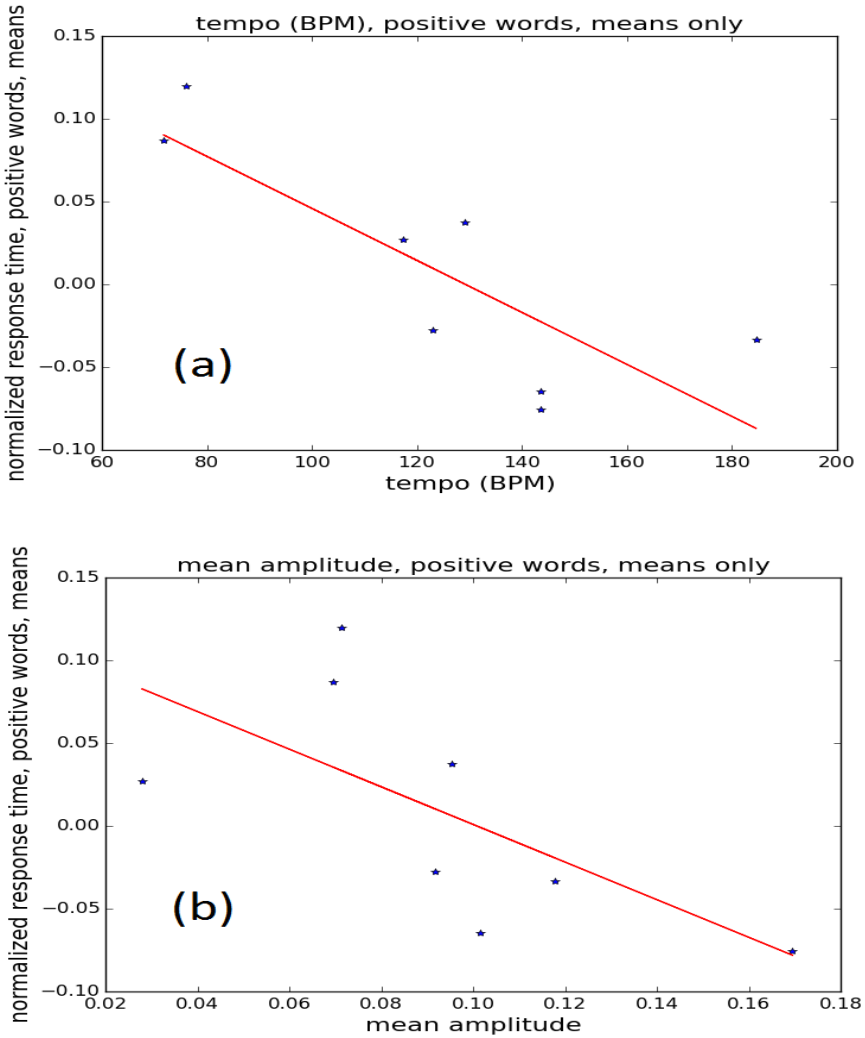
# Results


Response Bias
0.65
0.55
0.45
.35
Biased Positive
Biased Negative
Drift Rate
Stimulus Bias
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
Biased Positive
Biased Negative
Neg
Neut
Pos

# Analyzing Individual Auditory Features

- The partition to “positive” and “negative” is arbitrary.
- How do specific music aspects affect response patterns?
- We considered the 8 musical segments used.
- We focused on tempo, loudness and major/minor ratio.
- Studied how these features correlated with responses.

# Analyzing Individual Auditory Features



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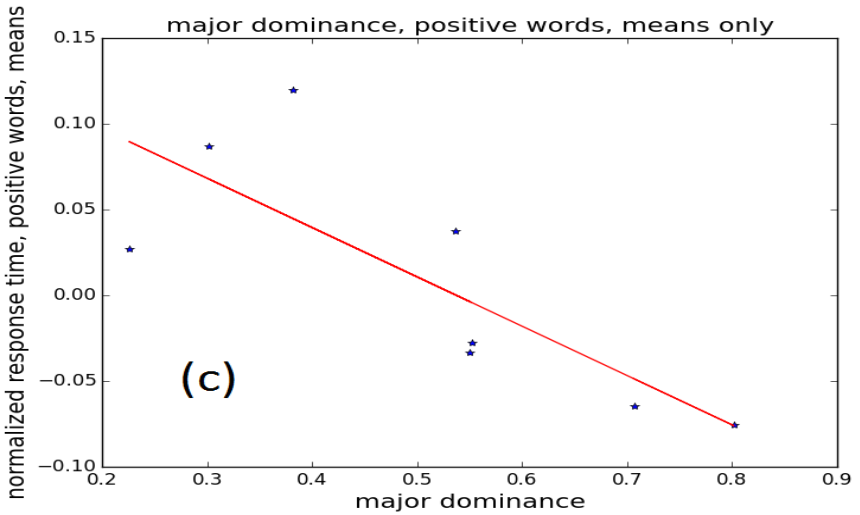


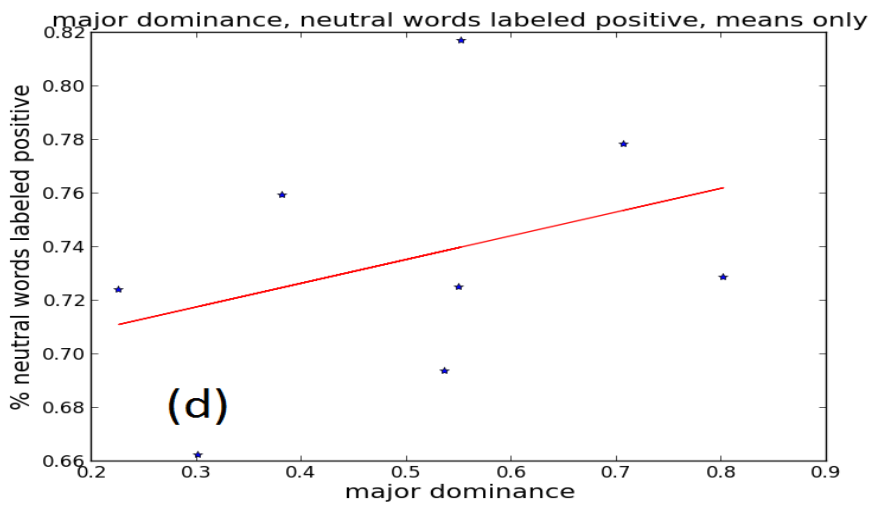

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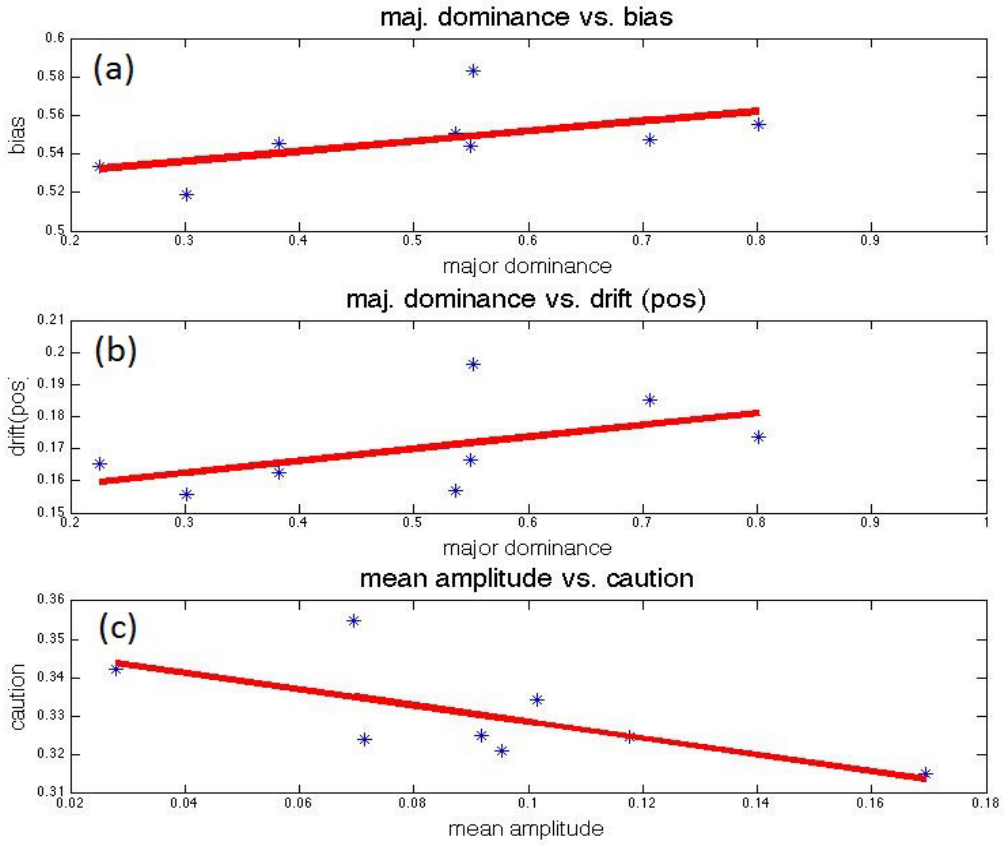


# Discussion

- Music does not significantly affect content evaluation.
- Rather, music initializes a prior preference.
- In other words, negative words stay as negative.
- But music biases the selection process.
- This type of analysis is only possible thanks to the DDM.

# Discussion

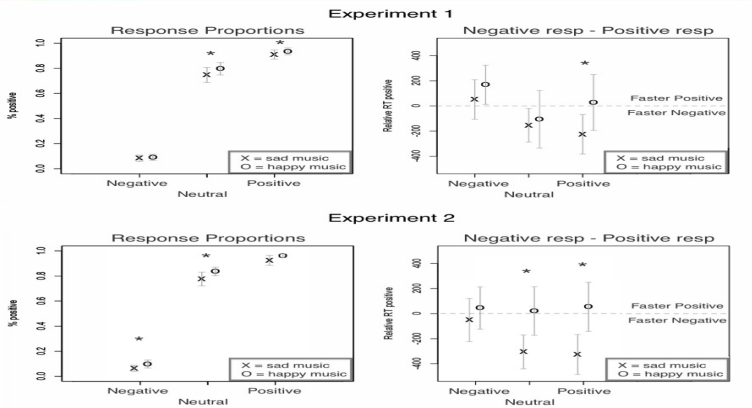
- Does this bias originate in the frequent pairing of sad/happy content with sad/happy music, or is it an innate property? Hard to tell.

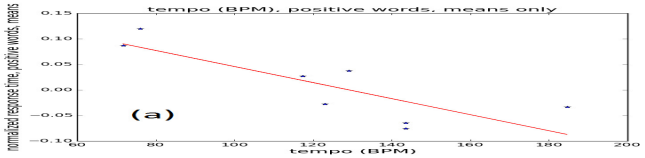
- (...but we can show music correlates with responses on a basic feature level)

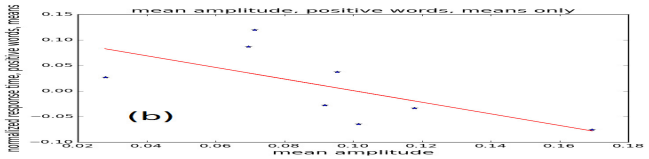
# Summary

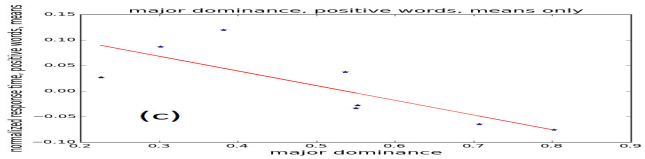
- Want to understand how music affects processing.
- The Drift-Diffusion model decomposed behavior into meaningful constructs.
- Participants classified words as positive or negative.
- They did so while listening to mood-inducing music.
- Music-induced mood affected expectancy.
- ...but not stimulus evaluation, caution or encoding time.
- Tempo, loudness and harmony are correlated with participant behaviors.

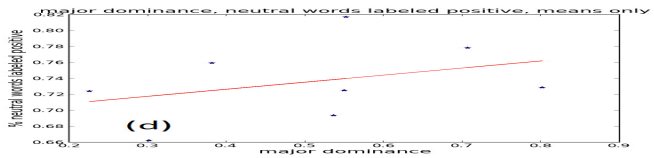
# Questions?

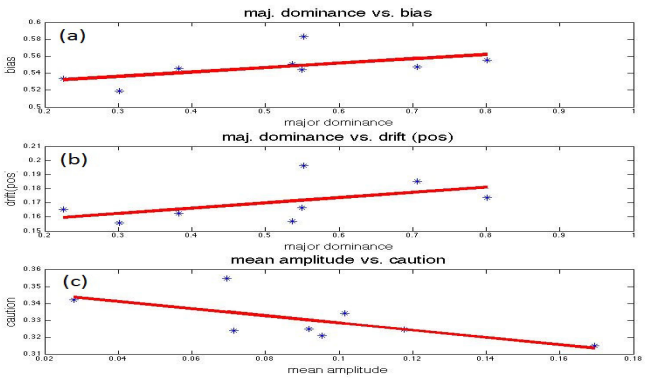



Thank you!