Impact of Music on Decision Making in Quantitative Tasks

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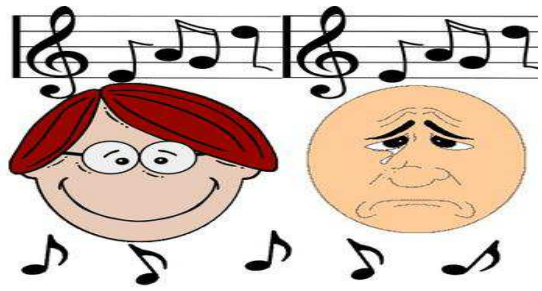
Overview

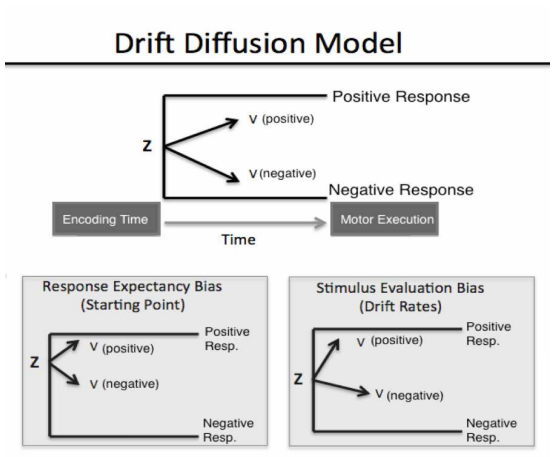
- Numerous studies have demonstrated that **mood** can affect **information processing**.
- In this paper, we explore how decision making is affected by **music**.
- This study focuses on the impact of music on risk assessment and quantitative reasoning.
- Participant asked to either accept or reject various types of gambles.
- Music was chosen to induce either positive or negative mood.
- Results show **music manipulation was effective**.
- **Participants manifested different levels of discernment** in the positive and negative music conditions.
- There was no evidence that music biased the likelihood of accepting or rejecting bets.
- We proceeded to study how **specific aspects** of music affect response patterns.
- Our results have implications for future studies of the connection between music, mood, and decision making.



Background

- Robust evidence that mood affects **cognitive processing**.
- Music affects mood, and has been shown to affect emotional decision making, but what about risk and quantitative reasoning?
- To study this question, we employ a stochastic sequential decision model called **Drift Diffusion** (DDM).
- The **DDM** decomposes the decision process into **latent factors**, providing more insight on **decision mechanics**.
- This model has been successfully used in the past, but not in this context.

The Drift-Diffusion Model



- Relates observed decision behavior to **underlying decision components**.
- Posits decisions involve the **gradual sequential accumulation** of noisy evidence.
- Once a boundary is reached, it signals a commitment to that response.
- Four parameters - **nondecision time, boundary separation, starting point, drift rate**.

Acknowledgements

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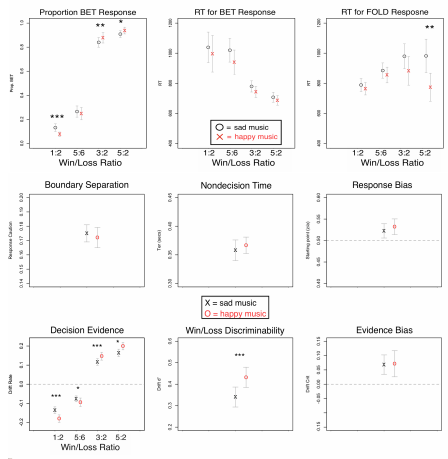
Methods

- Participants were offered **simple binary gambles** and asked to either **accept** or **reject** them while listening to music.
- Each gamble had a **50%-50% chance** of success, with **varying win to loss ratio**, reflecting how much was to be gained vs. lost.
- For example, a 15:5 win-loss ratio reflects a 50% chance to win 15 points and a 50% chance of losing 5 points.
- The gambles were partitioned to **very negative** (win-loss ratio $[0.33, 0.66)$), **negative** (win-loss ratio $[0.66, 1)$), **positive** (win-loss ratio $[1, 2)$), and **very positive** (win-loss ratio $[2, 3]$).
- Each **experiment** comprised **20 batches of 20 gambles**, such that in each batch each stimuli condition was repeated 5 times (gamble order was randomized).
- **A different song** was played during each **block of 5 batches**, alternating from positive to negative (order was counterbalanced).
- **The DDM was fitted** to each participant's data (minimizing χ^2).

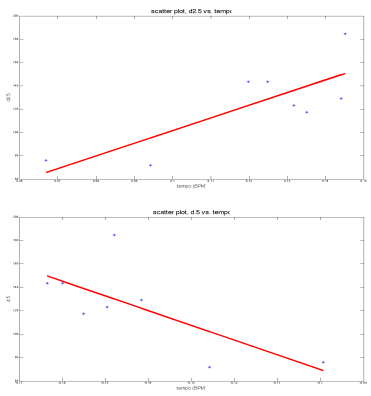
Results



- **Mood-induction successfully affected decision behavior**.
- **Fitted parameters** for the drift rates indicate **an overall change in evidence processing** in the two conditions.
- **Happy music** led to **better and faster discernment** between good and bad bets.
- Unlike emotional processing, music conditions did not differentially affect bias.
- In other words, music neither affected a-priori betting inclination, nor has it led to a relative difference in processing different bet types.
- **Rather, happy music made people make better decisions compared to sad music**.

Analyzing Individual Auditory Features

We studied the correlation of decision behavior to tempo, loudness and major/minor ratio. Features were extracted computationally.



Decision	Gamble	RT Avg	RT Var.	Avg. p-val	Var. p-val
bet	v. negative	**-0.73**	**-0.61**	**0.03**	**0.1**
bet	negative	**-0.65**	0.48	**0.07**	0.22
bet	positive	**-0.77**	**-0.64**	**0.02**	**0.07**
bet	v. positive	**-0.78**	-0.59	**0.02**	0.11
fold	v. negative	**-0.81**	**-0.65**	**0.01**	**0.07**
fold	negative	**-0.78**	-0.56	**0.02**	0.14
fold	positive	-0.45	-0.45	0.25	0.25
fold	v. positive	**-0.77**	**0.76**	**0.02**	**0.02**

Table 1. Correlation values between tempo and response times (average and variance). Results with p-value ≤ 0.1 are marked in bold.

Summary & Discussion

- Our results show that while there is no evidence for music-induced bias in the decision making process, **music does have a differential effect on decision making behavior**.
- Participants who listened to music categorized as **happy** were **faster to make decisions**.
- The decisions participants made listening to **happy music** were **consistently better**.
- Analysis indicates a **correlation between tempo and the speed and quality of decision making** in this setting.
- Additional properties are also connected to better decision making.
- Unlike the case for emotional processing (Liebman, Stone and White, ISMIR 2015), music did not differentially affect bias.
- This gap implies the **psychological mechanisms** involved in emotional classification and risky analytical decision making **are inherently different**.