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COGNITION AND ITS DISORDERS

The effect of a movement initiation deadline on a perceptual categorisation reaching task

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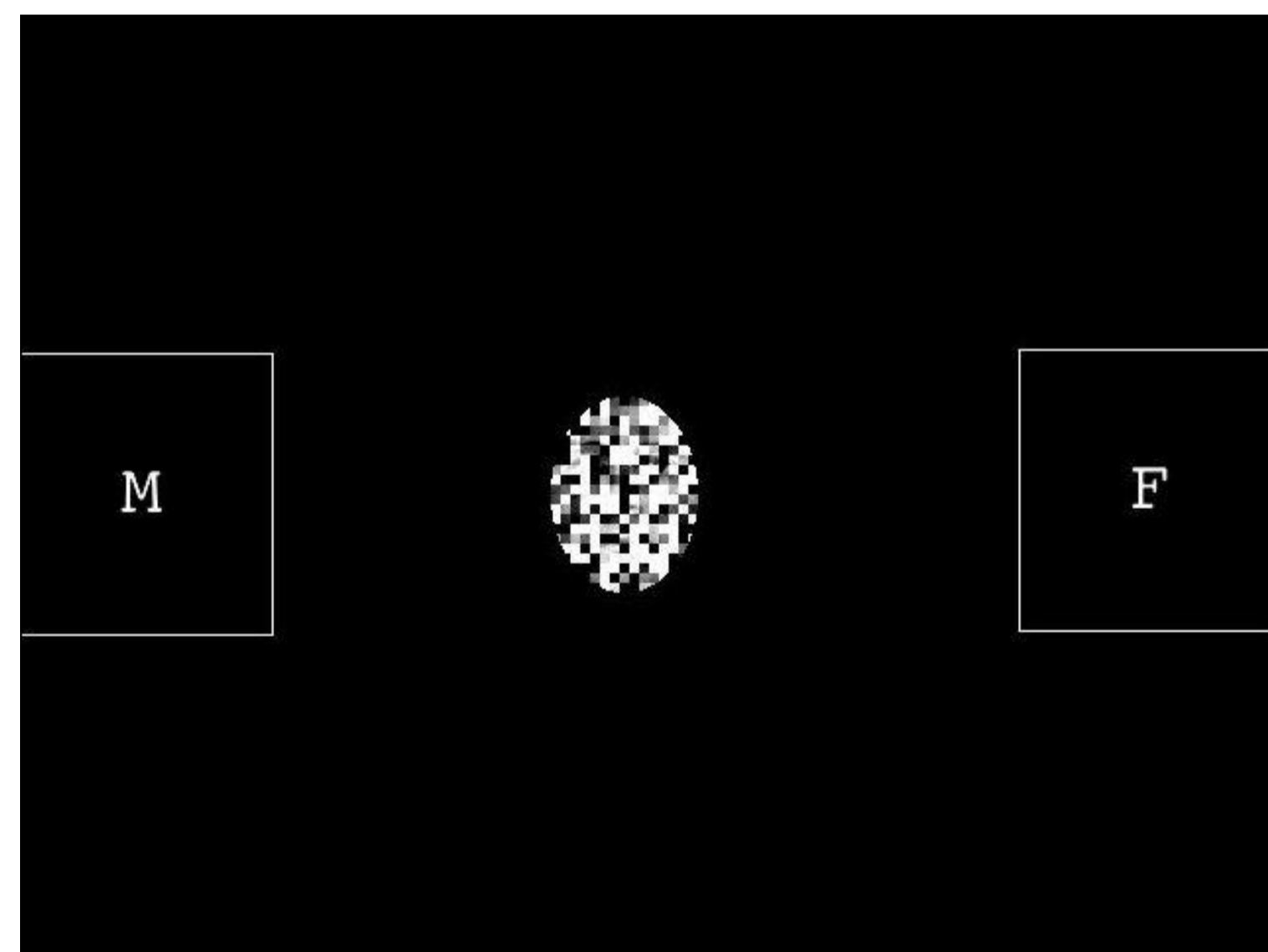
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Introduction

- Most studies of decision making use reaction times as a dependent variable
- Instead, we use arm movements made to targets on a touch screen to track the ongoing decision process
- We examine the effect of changing the task requirements (deadline for movement initiation) on the decision making process

Methods

- Subjects saw a face with noise added (in 5x5 pixel blocks, sampled from a normal distribution)
- They had to classify it as male or female by pointing to a touch screen



- The trajectories of the finger were recorded using an Optotrak motion capture system at 200 Hz.
- There were two task constraints (experimental groups):
 1. **Start Deadline:** Liftoff before 350 ms after stimulus onset [N=10]
 2. **No deadline:** Move in a fast and accurate way [N=14]
- For each group, there were three difficulty levels (amount of noise): 60%, 75% and 90% accuracy. The individual noise levels were determined using QUEST (Watson & Pelli, 1983).

Submovements

- We decomposed the arm movements into 1 or more submovements
- Submovements are the building blocks of the whole movement, and have a stereotypical velocity profile (minimum jerk)

The model

- We assume that evidence is accumulated in a noisy way until a bound is reached
- If a subject reaches a bound before they begin to move, they will make a single submovement directly to a target.
- If they have not reached a bound at movement onset, they will move towards an intermediate target and defer the final decision.

Results: Presented noise levels

The noise levels were significantly different ($p < 0.001$) between the conditions, but no significant difference between the groups.

Results: Movement onset time

There was a significant interaction between deadline and noise levels ($p = 0.009$) - the onset time only varied in the “no deadline” condition.

Results: Proportion of one submovement trials

The proportion of one submovement trials was significantly greater in the “no deadline” condition ($p = 0.002$), likely because of the later movement onset time.

Results: Last submovement onset

The onset time of the last submovement (i.e. when they started to move directly towards the target) differed significantly across groups ($p = 0.018$) and noise levels ($p > 0.001$).

Results: Maximum path offset

The maximum path offset (maximum deviation from a straight line from start to end) was significantly greater when there was a deadline ($p = 0.007$)

Conclusions

- Under time constraints, subjects use more submovements
- This is because they are less likely to have made up their mind (reached the bound) at movement onset
- Subsequently, when there is a deadline, the movements are more curved
- Features of the trajectories are modulated by task difficulty and onset deadlines - we can use these features to study perceptual decision making using arm trajectories.

Poster on the web:
<http://www.curiousjason.com/sfn2011>

