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Introduction

Speed and Duration Perception:

From two stimuli which have equal veridical durations, faster one is perceived to be longer than slower one. (Kanai, et. Al., 2006)

Speed Change and Duration:

Duration perception of accelerating stimuli is compressed. (Bruno, Ayhan, Johnston, 2015)

Action and Visual Time Perception:

There is an overlap between brain areas associated with action planning and those with temporal processing. (Treisman, et. al., 1992)

The Role of Dorsal Pathway:

V5 has a direct role in speed (Liu & Newsome, 2005) and duration (Gulhan & Ayhan, Under Review) perception. V5 is also claimed to be responsible for action perception and action planning. (Rizzolatti & Matelli, 2003)

Are there action related alterations in duration perception?



Stimuli & Apparatus

- "Circular dot presentation" which consists of dots spreading from the center to the periphery in an expanding manner. Dots are hueless and produced in grayscale. Their radius is approximately 0.5 degree.
- Stimuli are presented on a CRT Monitor (Samsung Syncmaster 753 DF). For execution of experimental tasks, MATLAB, PsychToolBox is used on an iMac computer. Responses are made with an Apple Keyboard.

Study 1

How do *motor control* and *speed change* of stimuli impact duration reproduction?



Visuomotor Conditions	Pure Visual Conditions
Accelerating (1-9 deg/sec)	Accelerating (1-9 deg/sec)
Decelerating (9-1 deg/sec)	Decelerating (9-1 deg/sec)
Stable speed (5 deg/sec)	Stable speed (5 deg/sec)

Table 1. Conditions

- There were 200 trials in each condition, making a total of 1200 trials.
- 9 subjects have participated to the study.

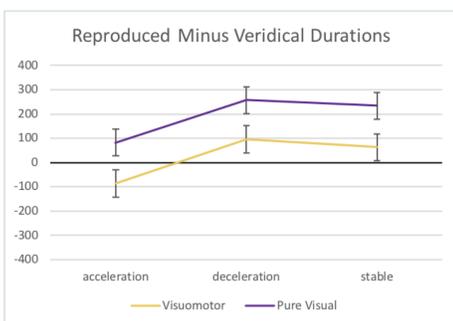


Figure 1: Mean data. Data points are deviations of reproductions from veridical durations

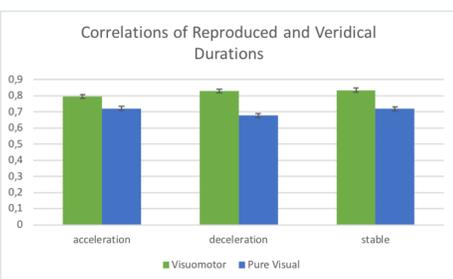


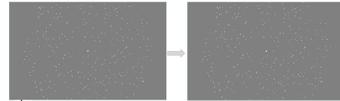
Figure 2: Mean correlations of reproduced and veridical durations in each condition

Results:

- 2 x 3 Repeated Measures ANOVA is executed.
- Main effect of *speed change* on duration reproduction was significant, $F(2,7) = 15.034, p < 0.5$.
- Main effect of *motor control* was significant, $F(1,8) = 25.539, p = .0001$.
- No interaction effect has been found, $F(2,7) = .042, p > .05$.
- Precision was higher in visuomotor conditions across all speed types.

Study 2A

Can the effect of motor control on duration perception be reproduced in a duration discrimination paradigm?



Visuomotor: (max. 1500 ms) 750 ms (stable duration)
Pure Visual: (variable duration) 750 ms (stable duration)

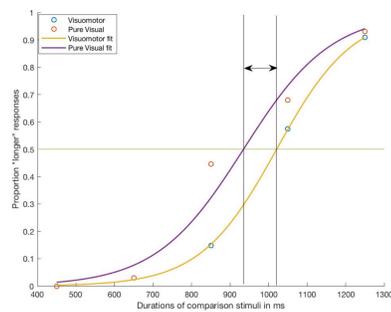


Figure 3: Psychometric Function of Participant S.A.

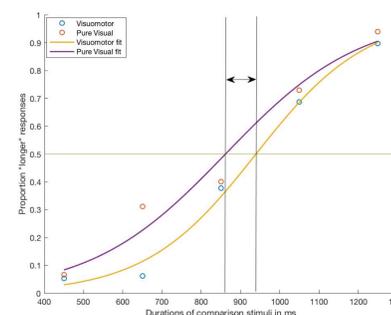
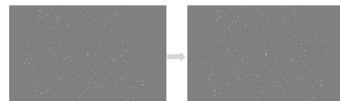


Figure 4: Psychometric Function of Participant U.O.

Perceived duration in visuomotor sequences are compressed in comparison to pure visual sequences. This means that visuomotor sequences are perceived shorter than- and further from veridical duration.

Study 2B

Does motor control have an impact on speed discrimination of visual stimuli?



Visuomotor: (variable speed) 5 deg/sec for the same duration (stable speed)
Pure Visual: (variable speed) 5 deg/sec for the same duration (stable speed)

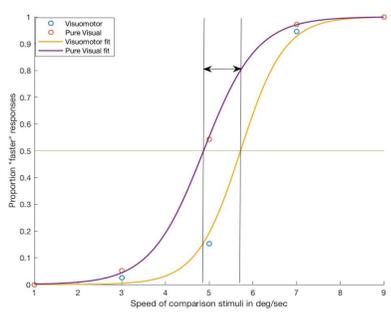


Figure 5: Psychometric Function of Participant S.A.

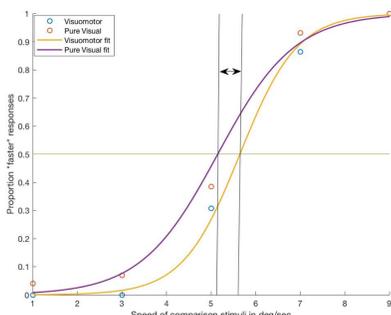


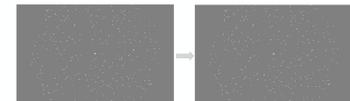
Figure 6: Psychometric Function of Participant U.O.

Visuomotor sequences are perceived to be slower than pure visual sequences. This means that change in the perception of visuomotor sequences may be compressed due to altered speed perception. To understand this, bias in speed for each subject should be taken into consideration.

Study 2C

Are visuomotor sequences perceived shorter when perceived speed of the standard stimuli is matched with the perceived speed of the comparison stimuli?

Procedures are same with Study 2A. The only difference is the speed of the 2nd stimuli (stable duration). This study is preliminary. Further data will be collected soon. For Subjects S.A. and U.O.:



Visuomotor: 5 deg/sec 4.28 or 4.35 deg/sec
Pure Visual: 5 deg/sec 5.13 or 4.85 deg/sec

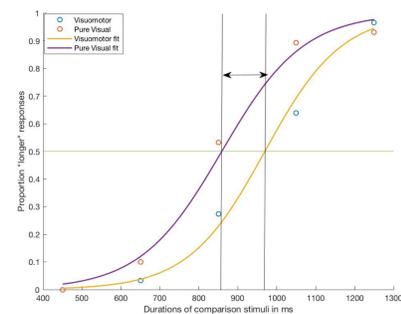


Figure 7: Psychometric Function of Participant S.A.

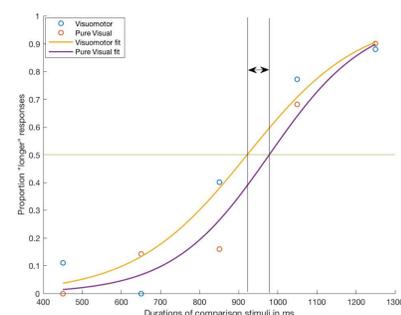
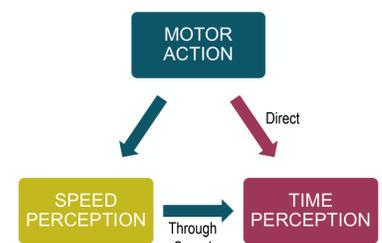


Figure 8: Psychometric Function of Participant U.O.

There are converging results in terms of Pure Visual condition. However, it is evident in the data that compression in Visuomotor stimuli is decreased when speed is matched.

Conclusion



Motor action has an influence on duration perception. We supported this in both duration reproduction and duration discrimination tasks.

Synchronous motor action and visual stimuli are perceived shorter and slower than pure visual stimuli.

However, it is not clear yet how much of the effect is through speed perception and how much of the effect is direct.

Acknowledgements

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