The effect of expectations on subjective time perception with real-world scenes

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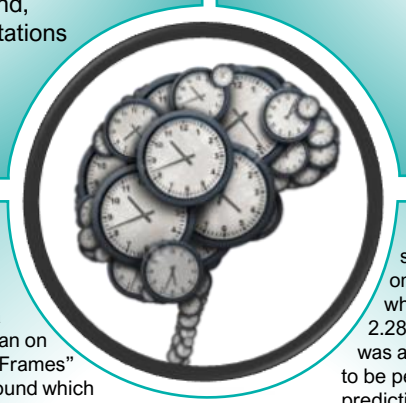
Background

Mental time travel is a phenomenon in which memory allows humans to revisit the past and predict the future (Tulving, 2002) enabling us to make decisions which allow us to function in everyday life.

Since experiments using artificial or novel stimuli may be unable to capture true perceptual and cognitive processes present in daily life (Lahti, 2015), we designed a study in which real world movie sequences were presented to investigate how well participants use these to predict what should have past and what might come in the future. This will allow us to gain an insight into how we process perceptual information in order to anticipate events.

However, extensive research has shown our expectations about how future events will unfold can strongly influence perception of time (Epstude & Peetz, 2012) and, therefore, we investigated whether the expectations we generated over time influenced accuracy in predicting past and future real-world movie scenes.

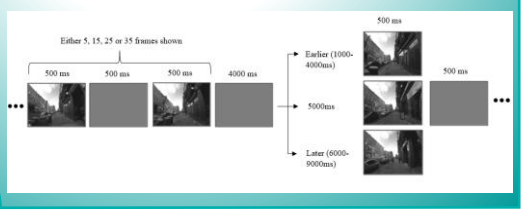


Method

Sixteen participants (Male = 4, age range = 20-30 years) viewed four 15-minute videos of walking routes along real-world streets recorded from a head-centered point of view camera.

A blank period, lasting 4 seconds, occurred after either 5, 15, 25 or 35 frames of the videos were presented in which participants were asked to 'mentally simulate' the continuation of the walking route. 5-35 frames were chosen since a previous experiment, which followed a similar paradigm to this experiment, found more than 40 frames preceding a blank period had no effect on accuracy.

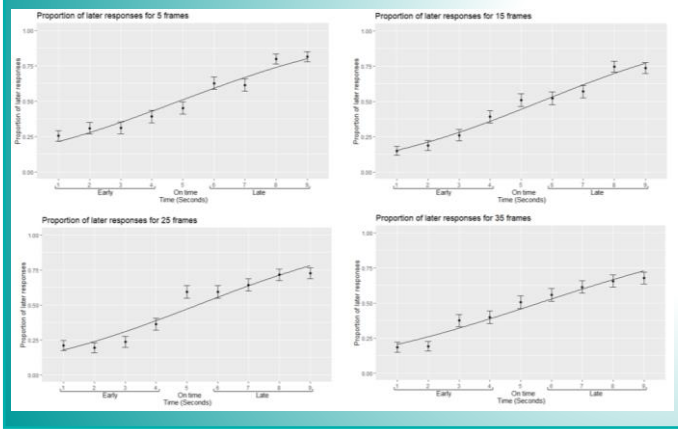
The frames resumed either earlier in time (1, 2, 3 or 4 seconds into the blank period), on-time (5 seconds) or later in time (6 , 7, 8 or 9 seconds). Participants then performed a 2-alternative forced-choice task to indicate whether the frame shown was earlier or later in time as compared to the predicted on-time frame that would have occurred if the video did not go blank.



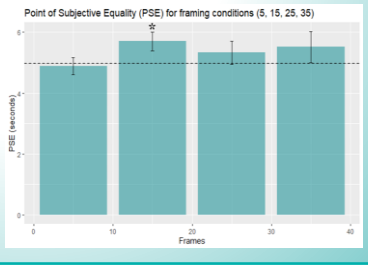
Results

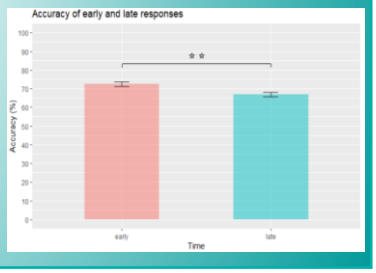
A 2-way repeated-measures ANOVA of the proportion of late responses found a main effect of "Seconds" ($F(8, 540) = 88.22$, $p<0.001$, $\eta p2 = 0.567$), indicating a difference in proportion of late responses for earlier than on time compared to later than on time. A main effect of "Frames" ($F(3, 540) = 2.968$, $p = 0.032$, $\eta p2 = 0.016$) was also found which could be due to poorer sensitivity to changes in time after 35 frames are presented.

A Bonferroni corrected paired sample t-test found a significant difference between the subjective perception of on-time after presenting 15 frames and the actual time at which the target frame was on-time, i.e. 5 seconds ($t(15) = 2.28$, $p = 0.037$). This suggests perceived timing of the frame was accelerated such that the frame had to be presented later to be perceived as on-time, indicating a small bias in temporal prediction.



A 2-way repeated-measures ANOVA of accuracy with factors "Time" and "Frames" found a significant main effect of "Time" ($F(1, 504) = 11.545$, $p < 0.001$, $\eta p2 = 0.022$) and a significant "Time*Frames" interaction ($F(3, 504) = 3.573$, $p = 0.014$, $\eta p2 = 0.021$). This was due to a higher accuracy in predicting earlier than on time compared to later than on time frames. This effect was only apparent after 15, 25 and 35 frames were presented.





Conclusion

It is evident from the results that overall most participants were able to accurately predict where they would expect to be in time based on prior information received from the real-world movie sequences shown. This aligns with the predictive coding theory which states that our brains are prediction machines that can use prior knowledge to generate an internal model of our environment, enabling us to make predictions about what we have and what we will experience (Clark, 2013). Participants were more precise predicting events that occurred earlier than on-time compared to later than on-time events, indicating our internal representations of the world are more vivid for events that are closer in time than events farther into the future.

However, the accumulation or amount of prior knowledge received did not influence the overall accuracy of subjective perception of time significantly. This indicates that in everyday life we do not completely rely on our expectations to facilitate perceptual decision making about the timing of an event. This suggests that the temporal bias found after 15 frames were presented may not be due to a lower amount of information being unable to create better expectations but instead could be a result of higher cognitive processes, such as attention influencing how we integrate temporal information about the environment (Rhodes, 2018).

References

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