The psychophysiological mechanisms of real-world time experience

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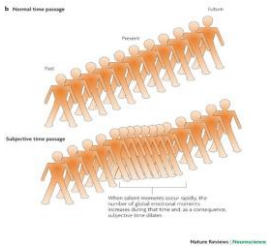
Background

Our subjective experience of time is flexible and vulnerable to distortion (1).

Craig's (2009) (2) model suggests that changes in physiological may be related to distortions to time.

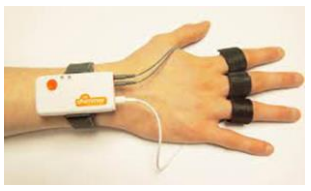


Lab studies show that increases in SNS are associated with time passing more quickly (3). Increases in PNS are associated with time passing more slowly (4).

Aim: to establish the role of SNS & PNS activation during real-world temporal experience.

Method

67 participants completed a normal days activities for 6 hours whilst wearing wearable ambulatory ECG, SCL & movement sensors.



Each hour participants used 9-point scales to rate;

1) In comparison with a typical hour, how quickly did you feel that the last hour passed?

2) Their mood over the last hour

3) Their level of engagement over the hour.

Analysis: SCL & ECG were split into 10 & 30/s epochs. ECG epochs with any missing peaks were removed. Heart Rate, RMSSD, tonic & phasic SCL were calculated for each participant. Standardised residuals, corrected for movement, were analysed using MLM in Stata.

Results

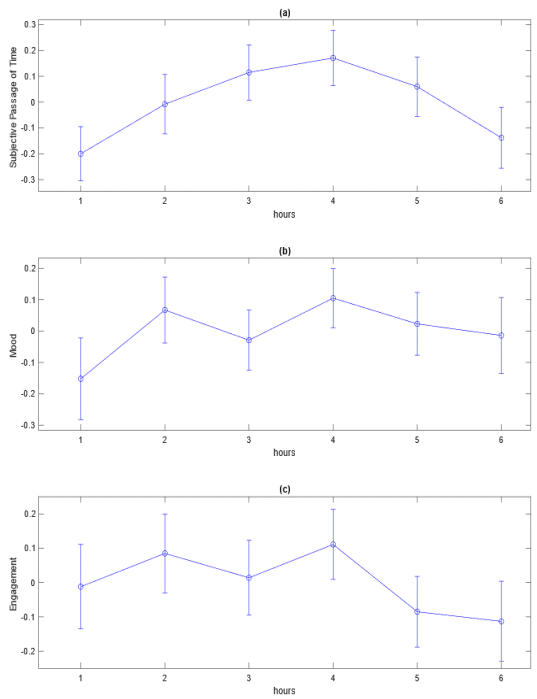
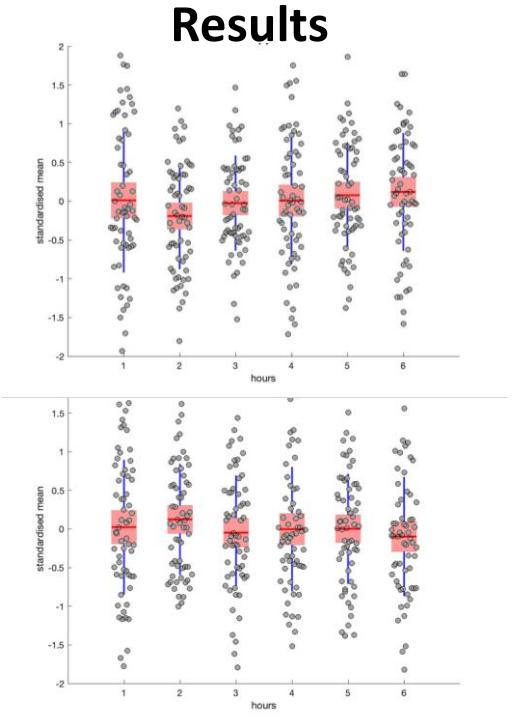
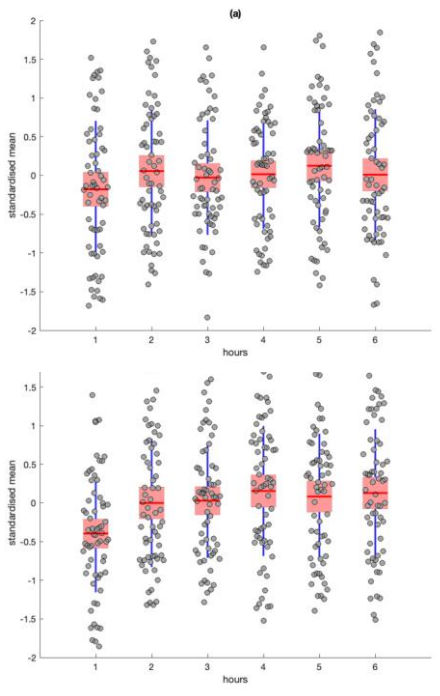


Figure 1. Line plots with error bars for standardised subjective data, (a) passage of time judgements (b) mood, and (c) engagement.



Heart rate (a) & RMSSD (b). Red line = mean, pink box= SD, blue lines = 95% CI, grey circles = raw data.



Mean SCL (a) & SCL frquency (b). Red line = mean, pink box= SD, blue lines = 95% CI, grey circles = raw data.

	B	*SE*	*p*	*95% CI*
SCR	.14	.07	.047	.01 - .27
HR	.15	.07	.04	.01 - .29
RMSSD	.08	.07	.24	-.05 - .22
SCL	-.10	.07	.17	-.23 - .04
Mood	-.10	.06	.08	-.22 - .01
Engagement	.007	.06	.90	-.11 - .12

Passage of time, mood, engagement, HR, RMSSD & mean SCL did not vary across the 6 hours ($p > .05$).

SCR frequency was lower in hour 1 than 4-6 [$F(5,58) = 3.37$, $p = 0.01$, $h^2 = 0.23$].

The MLM was significant Wald $\chi^2(6) = 12.74$, $p < .05$. SCR and HR were significant positive predictors of the passage of time.

Conclusions

Greater SNS activity (increased heart rate, frequency of phasic skin conductance response) was associated with time passing more quickly.

PNS activity was not related to time experience.

These findings confirm the importance of physiological arousal in real-world temporal experience and provide empirical support for current theoretical models (Craig, 2009).

1 Wearden, J. H. (2015). Passage of time judgements. *Consciousness and Cognition*, *38*, 165-171 **2** Craig, A. D. (2009). Emotional moments across time: a possible neural basis for time perception in the anterior insula. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1525), 1933-1942. 3 Ogden, R. S., Henderson, J., Slade, K., McGlone, F., & Richter, M. (2019). The effect of increased parasympathetic activity on perceived duration. *Consciousness and cognition*, *76*, 102829 4.Piovesan, A., Mirams, L., Poole, H., Moore, D., & Ogden, R. (2019). The relationship between pain-induced autonomic arousal and perceived duration. *Emotion*, *19*(7), 1148.