Predicting A-V timing perception and confidence from brain dynamics (#4361)

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1) What's the main question being asked or hypothesis being tested in this study?
Subjective timing decisions can be predicted from the dynamics of brain activity, even when the influence of physical stimulation is held constant.

2) Describe the key dependent variable(s) specifying how they will be measured.
We will use electroencephalography (EEG) to measure the dynamics of brain activity evoked by audio-visual stimulations, and machine learning to decode both the type of physical stimulation and peoples' subjective experiences of timing.

3) How many and which conditions will participants be assigned to?
Six types of stimulation will be applied. Audio stimulations will either lead or lag visual stimulations by 300, 150 or by 50ms. Responses will be coded as a high-confidence sound first, low-confidence sound first, low-confidence light first, or as a high-confidence light first response.

EEG signals will be acquired using a Biosemi ActiveTwo electrode system (Amsterdam, The Netherlands) from 64 scalp electrodes, digitized at a sample rate of 1024 Hz with 24-bit analog–digital conversion.

4) Specify exactly which analyses you will conduct to examine the main question/hypothesis.
Data will be epoched offline, with a peristimulus window of -100 (before stimulations) until +350ms (after stimulations). Data will be band-pass filtered (1 to 40Hz), and notch filtered (49 to 51 Hz). Blink correction achieved using an independent component analysis (ICA) on epochs. Trial data will be baseline corrected relative to average amplitudes from -100ms until physical stimulation (0ms).

Type of physical stimulation will be decoded via a nearest neighbour classifier with jack-knifed cross validation. Decoding will be successful when decoded and actual input timings match. Statistical significance will be assessed via a permutation test, consisting of 2000 simulations wherein trial labels are randomly reassigned. Decoding will be regarded as successful if the correct stimulation is decoded on a proportion of trials that falls within, or is positioned above the top 5% of all null distribution success rates. A single planned t-test will be conducted on data aggregated across participants – to test if decoding success rates exceed the numerical chance level (~17%).

Subjective timing will be analysed in a similar fashion. Differences will include that trials will be decoded on a decision basis – as a high-confidence sound first, a low-confidence sound first, a low-confidence vision first, or as a high-confidence vision first trial. Decoding will be successful when decoded and actual decisions match.

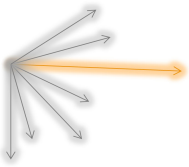
Two permutation tests will be conducted for each participant. The first will be as described above for analyses of physical AV timing. The second will hold the influence of stimulation constant. For this analysis decoded and actual decisions will be randomly re-assigned between trials involving the same type of physical stimulation. Each permutation will therefore provide an estimate of the proportion of trials on which decoded decisions might match actual decisions, presuming matches are guided only by knowledge of what types of judgement were made following each type of physical stimulation. For each individual, statistical significance will be inferred if decisions are successfully decoded on a proportion of trials that falls within, or is positioned above the top 5% of all relevant null distribution success rates.

5) Any secondary analyses?
In addition to permutation tests, rank partial correlation coefficients will be calculated for data aggregated across participants. These will encompass physical stimulation times, decoded timing decisions and actual timing decisions on a trial-by-trial basis. These analyses will reveal if decoded timing decisions are additionally predictive of actual timing decisions, independent of physical stimulation timings.

6) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.
In total, we will collect data from 15 individuals. The strength of the relationship between brain activity variance and subjective timing suggested by pilot data suggests a large effect (Cohen's d of >=0.8), implying power above 80% given a sample size of 15.

7) Anything else you would like to pre-register? (e.g., data exclusions, variables collected for exploratory purposes, unusual analyses planned?)

8) Have any data been collected for this study already?
No, no data have been collected for this study yet



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