# Neurophysiological correlates of purchase decision-making

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#### Introduction

Purchase decision-making process entails the process to choose between options without the existence of a clear feedback.

Purchase decision is a multifactorial cognitive process that involves, principally, the prefrontal cortex and its substructures (OFC, mPFC, ACC). 134

Evidence report the existence of left frontal asymmetry as predictor purchase decisions when the price showed was below the normal one, even when the normal was an implicit and subjective reference<sup>3</sup>, expressed in power increases in alpha band<sup>1</sup> and a weaker theta band activation in the prefrontal zone<sup>4</sup>.

Most of existent evidence have been focused on post-decision elements commonly related to marketing elements.

The goal is to determine the neurophysiological correlates of purchase decision making in uncertain

#### scenarios

Both decisions will lead differences in ERPs components, in addition to differences in response-induced power in bands reported by literature.

**Hypotheses:** 

#### Methods

## Participants

25 healthy young adult Barcelona City (8 men, mean age 22 ± 4.4 (S.D)) for monetary compensation.

**Compensation = 25€ + (saved\*2)/10** 

## Design

## The Purchase Decision Making task (PDMt)

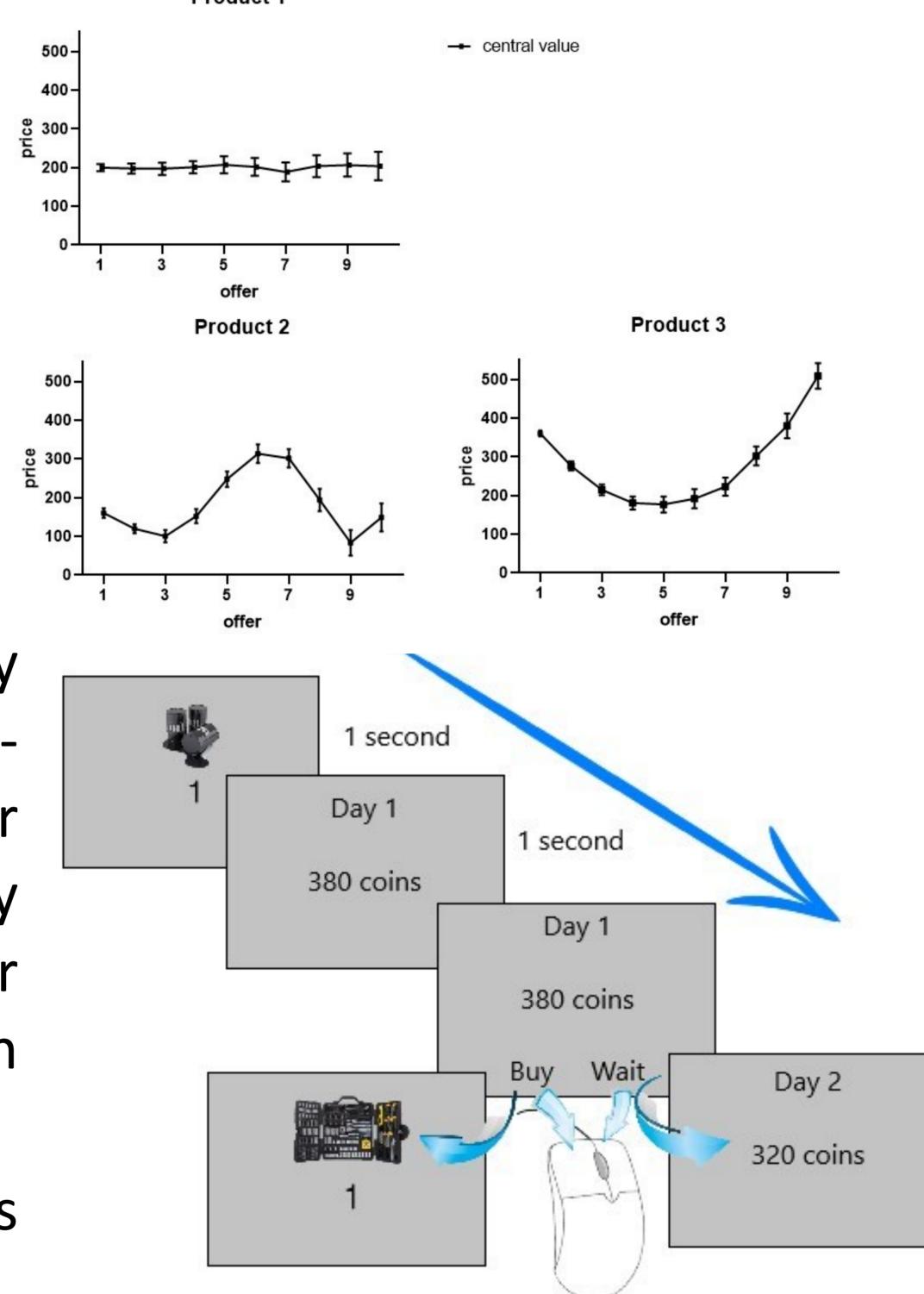
Objective: purchase three unknown products (navigation spare parts, oil barrel, tool set), in 20 purchase sequences of one of each products, having as budget 1000 coins for each sequence.

#### Goal: "try to save as much coins as you can"

Prices of each product followed a pre-defined pridistribution, with a maximum of 10 offers <sup>500</sup> each.

Participants saw an offer by day, having to decide between buying or waiting for the price presented. If they chose to wait, a new offer was shown, with no option to return to a previous offer.

maximum of 10 days (offers) to decide.



## Analyses

#### ERPs cluster-based analysis

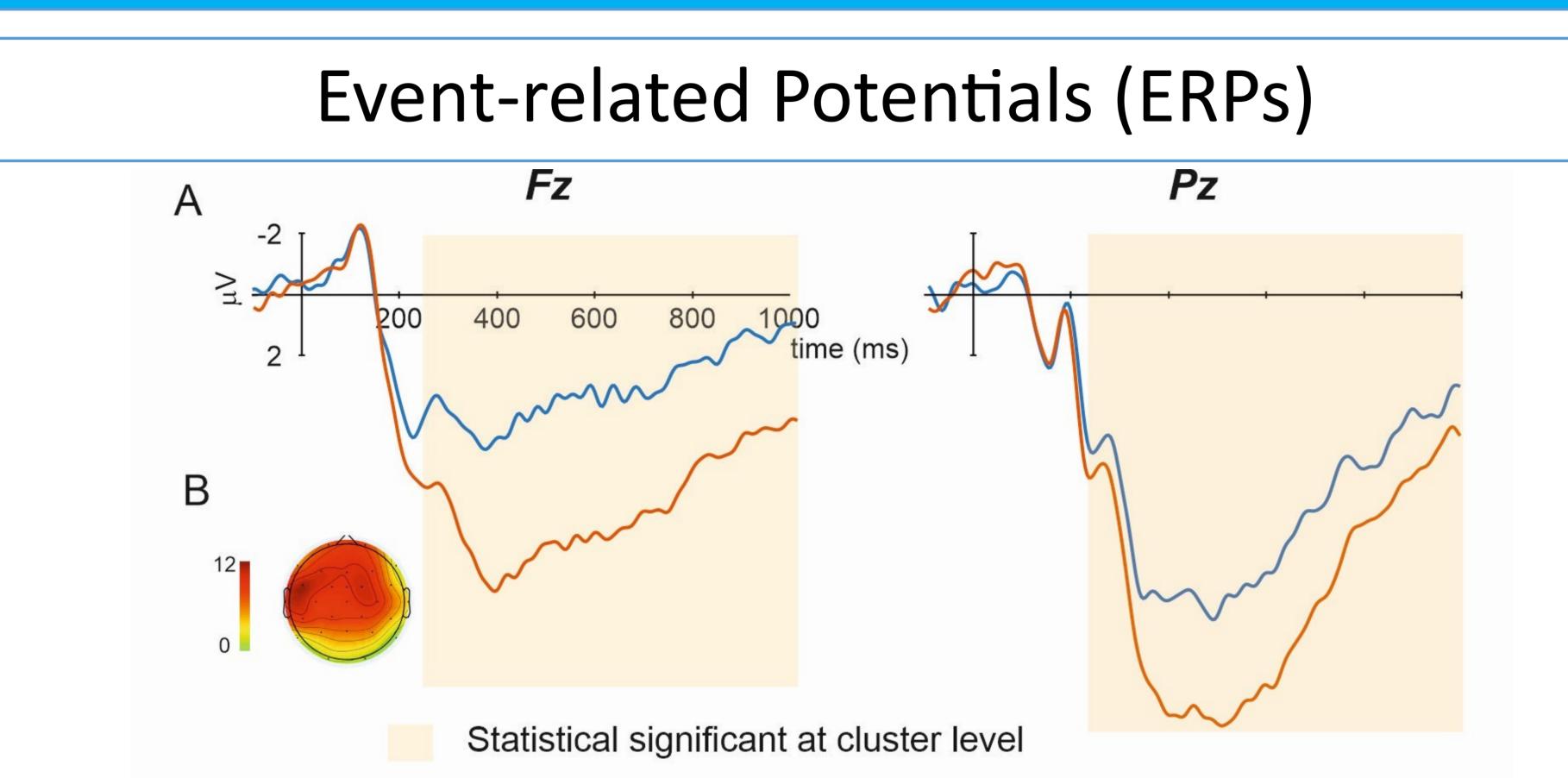
Cluster based spatiotemporal permutation (n=1000) F-test on full sensor data was performed, in order to detect the specific time in which differences in ERPs components occur and its consistence across the time.

## Time-frequency analysis

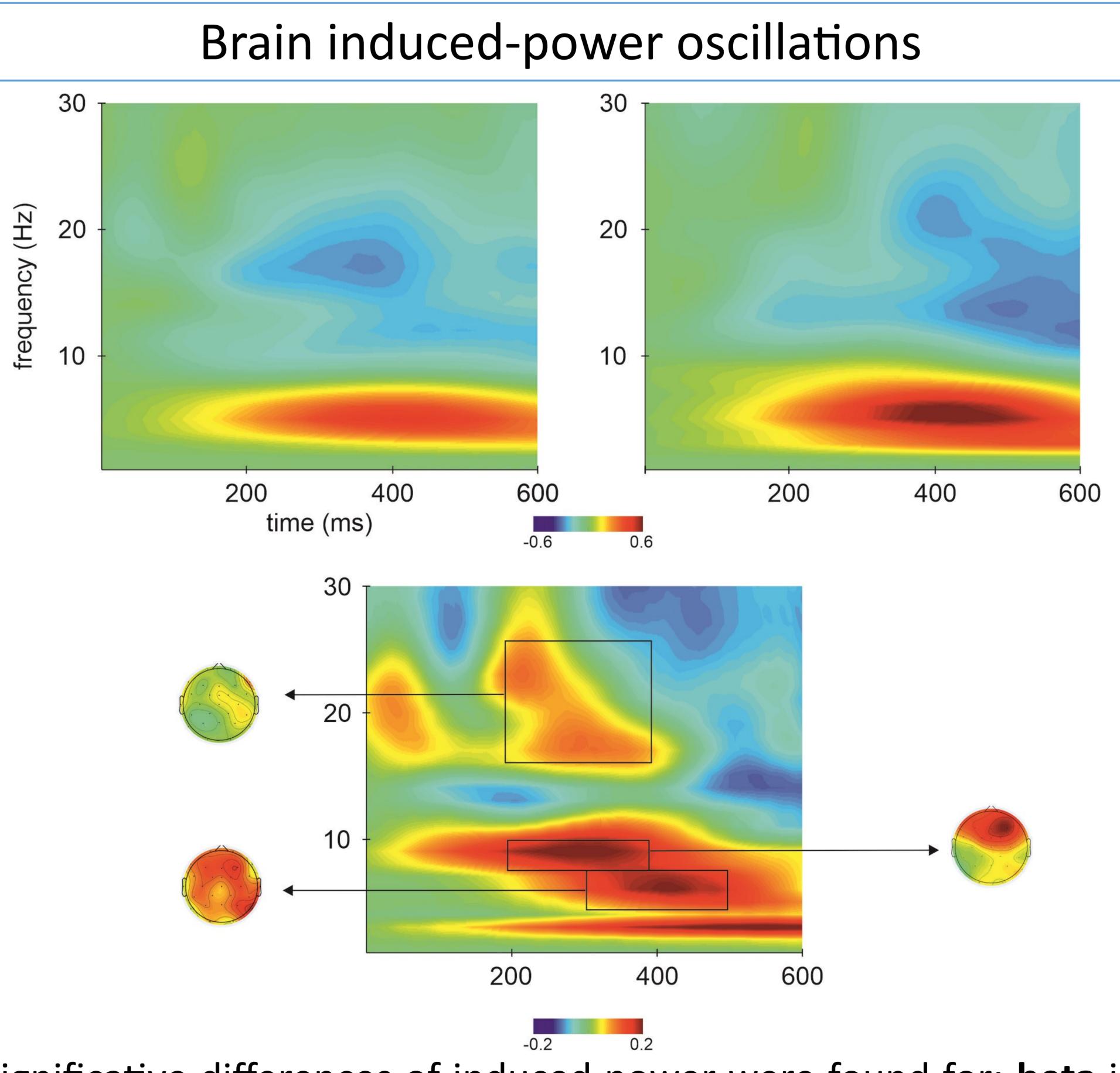
Single trial data were convoluted using a complex Morlet wavelet. Induced responses were computed, which are changes in time varying energy in the frequencies, compared to baseline, that cannot be explained by the average power<sup>2</sup>. Differences were tested using a Factorial Anova for repeated measures, including three factors: Area (3), Laterality (3), and condition (2). And the covariance analyzes were performed using linear regressions.

Difference between the purchase price and the immediate previous one (first derivative) and the differences between the variations (second derivatives) were extracted for the covariance analyzes.

## Results



Results reveals a significant difference in potentials evoked at 256 ms (P3), until 1000 ms (end of the trial). Differences are consistent in 28 electrodes, represented in topography.



Significative differences of induced power were found for: beta in Frontal (F(2,46) = 4.805; p=.013); in alpha for condition <math>(F(1,23))=6.202; p=.020), and interaction of Frontal and condition (F(4,92) =5.423; p=.008); and in **theta** band for Frontal (F(2,46) =4.966; p=.011), condition (F(1,23) =4.472; p=.046), and interaction of Frontal and midline (F(4,92) = 3.008; p=.022).

Differences in power related to contextual information reveal significant effects in theta and beta bands. In Theta, a positive correlation of the induced power is observed with the absolute value of the price variation (first derivative)(t=3.486; p<.001). On the contrary, in Beta a positive correlation is identified between the induced power and the absolute value of the second derivative (t=2.262; p=.024) or, in other words, the speed of variations.

No correlations were found for Alpha band.

#### Conclusions

Results are consistent with the existing evidence, in addition to opening new possibilities for studying the role of beta and theta band in these types of decisions.

Can theta and beta band power increase reflect the implicit feedback process involved in the purchase?

Our results reveal a significant change in ERPs and brain oscillations at 256 milliseconds, it turns out to be a key time in making these kinds of decisions.

Can we assume that decision of purchase is made in the first 300 milliseconds after seeing a price?

#### References

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