

Introduction

- Consistent with a materiality of percepts which impacts both the brain that produced them and the brain of close others, two previous block design experiments^{1,2} (1, 2) found that event related potentials (ERPs) evoked by images presented in a memorization task depend on the images *simultaneously* but *privately* and *separately* presented to a close other.
- Aim: detect JPEs using a different experimental design: **Experiment 1&2 Present experiment** "you will see different images than your partner" "you will see the same images Announcement: as your partner" • Trials: -half of the trials was **non-concordant** with the announcement: participants saw different Same as in 1&2 experiments images than their partners -half of the trials was **concordant** with the announcement: participants saw the same images as their partner • Order of trials: all trials of a **same condition in one block** trials randomized within each block International affective picture system³ (IAPS) • Stimuli: more neutral and less heterogeneous stimuli images • Visual isolation: cardboard divider and closed curtain adjacent rooms separated by a closed curtain and a double glass window ERPs mean voltages analysis same + EEG epochs mean • Analysis: voltages using a bootstrap

analysis corrected for false positive discoveries

Methods

Participants groups

- Partners who reported having felt together* during most of the experiment (N= 25, 21F, 4M) Partner who reported having felt alone* during most of the experiment (N= 26, 19F, 8M) Stimuli
- 75 images of faces from the MED bank⁴ for the concordant-condition and 75 for the concordant condition.
- Image presentation + black fixation cross

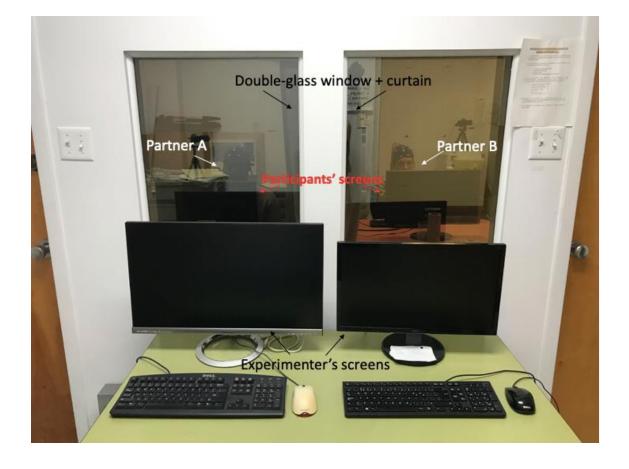
Procedure

- Setting (figure below)
- Curtains were closed before the start of the stimuli presentation. Consequently, participants were completely visually isolated from each other.
- **Task** instruction: -"try to memorize the faces"
 - -"try to feel in the presence of your partner"
- Each trial was a simultaneous presentation of two faces, one to each partner of a same pair.
- **Announcement before presentation**: -"you will see the same faces as your partner"
- Half of the trials was non-concordant with the announcement: the two faces were different from each other.
- The remaining half was **concordant with the announcement:** the two faces were identical.
- The order of presentation of concordant and non-concordant trials was randomized.
- Debriefing session question: "did you feel in the presence of your partner for more than half of the experiment ?"
 - Yes* "felt together" group
 - No* → "felt alone" group

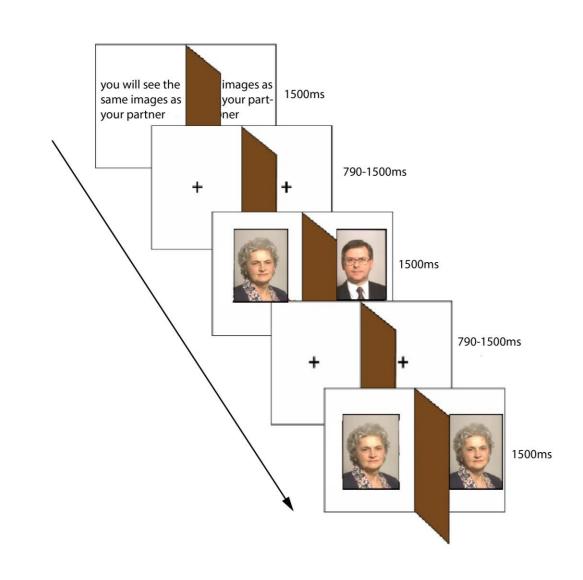
EEG recording & signal processing

- impedance < 5K Ω .
- EEG amplification: 10,000 times.
- High- and low- filter half-amplitude cut-offs: .01 & 100Hz
- 60-Hz electronic notch filter
- Channels of trials with amplifier saturations or analog-to-digital clippings removed off-line by automatic rejection criteria:
 - -if clipping >100 ms duration
 - -if amplitude out +- 100 μ V range

Experimental setup. The two entry windows were masked.



Trials presentation.



Experimental conditions.

Prior announcement	Reality: faces simultaneously presented in each trial	Trial Condition
"Your partner will be seeing the same images."	Identical	Concordant
	Different	Non-concordar

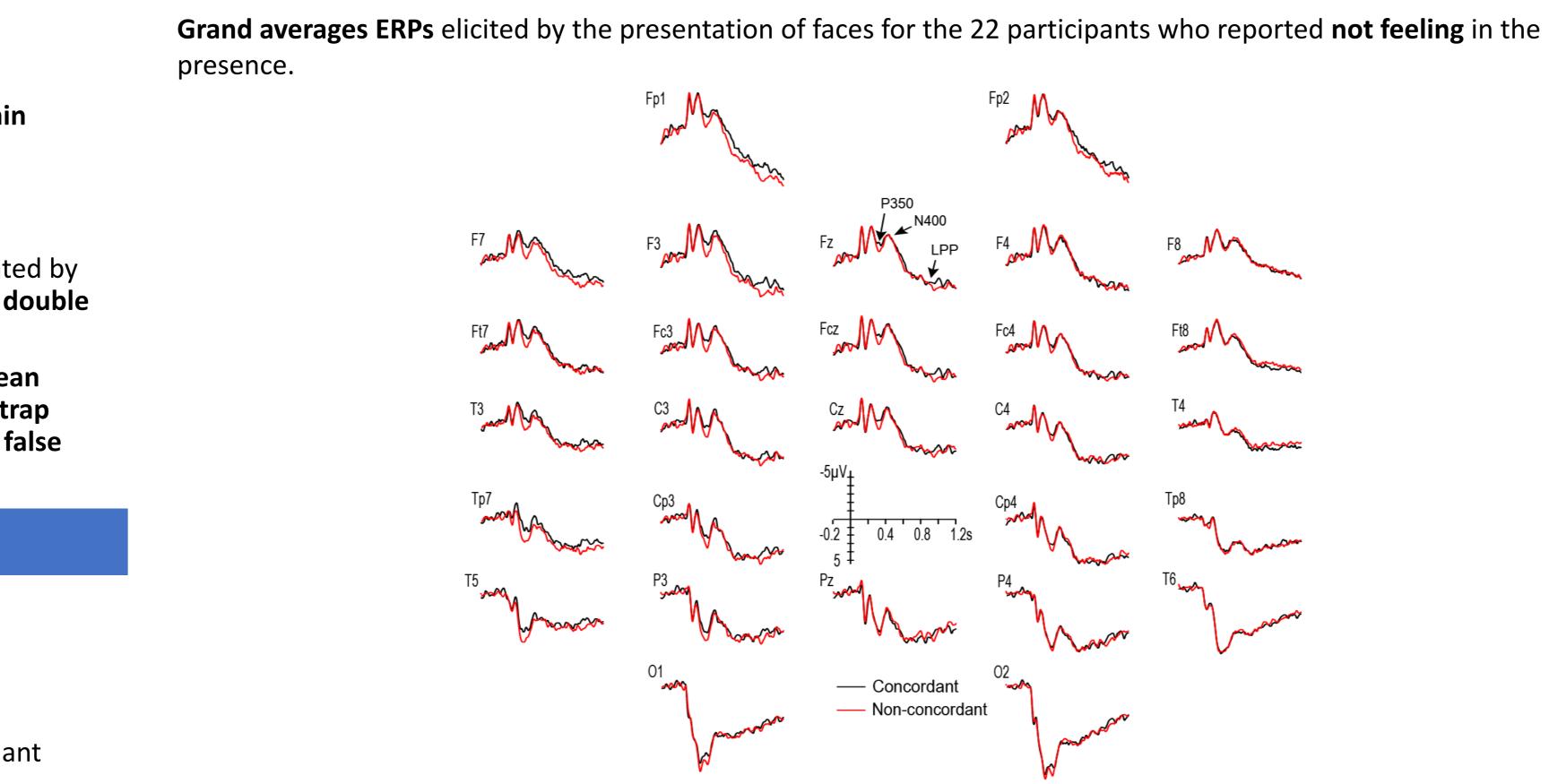
Searching for a cause of the similarity of percepts across individuals: Brains' sensitivity to the processing of stimuli by others.

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Analyses

windows of interest.

• 4 and 5 participants but rejected from the analysis for the "felt alone" and "felt together groups, except for the bootstrap, since they were identified as outliers (2*standard deviation away from their respective group's mean)



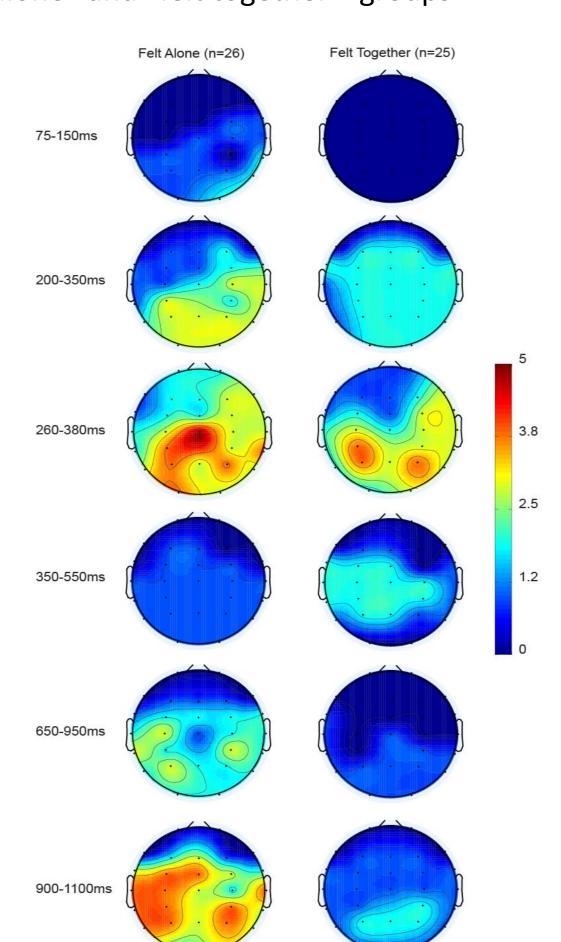
Concordance effects (JPEs) found in the subgroup of participants who **felt alone** for more than half of the experiment (n=22).

Time windows (ms)	Electrodes subset	within-subject factor	F	Р
200-350	Sagittal	Concordance	4.8	0.038
	Parasagittal	Concordance	6.4	0.019
		Concordance x hemiscalp	11.6	0.003
	lateral	Concordance	9.3	0.006
		Concordance x hemiscalp	8	0.007
260-380	Sagittal	Concordance	5.7	0.026
	Parasagittal	Concordance	6.8	0.016
		Concordance x hemiscalp	12.8	0.002
	lateral	Concordance	9.2	0.006
		Concordance x hemiscalp	9.9	0.005
350-550	Parasagittal	Concordance x hemiscalp	5.1	0.031
900-1100	Parasagittal	Concordance x hemiscalp	5	0.036

Concordance effects (JPEs) found in the subgroup of participants who **felt together** for more than half of the experiment (n=20).

Time windows (ms)	Electrodes subset	within-subject factor	F	Ρ
350-550	Parasagittal	Concordance x hemiscalp x electrodes	3.3	0.023
650-950	Parasagittal	Concordance x hemiscalp x electrodes	3.4	0.023
900-1100	Lateral	Concordance x hemiscalp	4.5	0.05
Post hoc analysis				
900-1100	Lateral	Concordance	6.9	0.017

Idiosyncratic JPEs. Spline interpolated maps depicting the number of participants having a significant difference between the EEG epochs mean voltages of the concordant and non-concordant conditions for both "felt alone" and "felt together" groups



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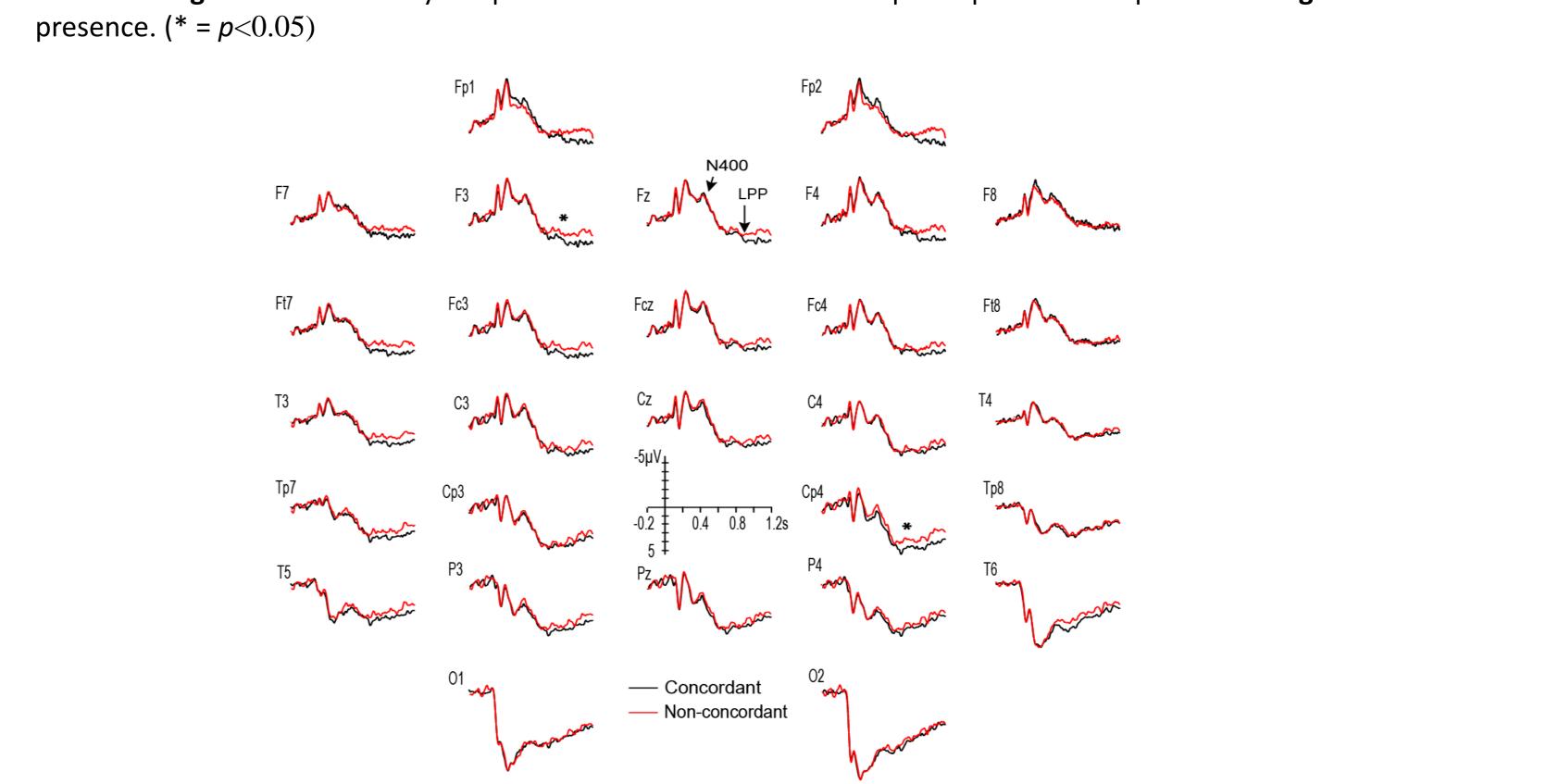
Measures

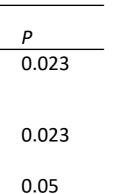
• ERPs elicited by faces for both concordant and non-concordant conditions for each participant were analysed in five time windows: 75-150, 200-350, 350-550, 260-380 and 650-950 900-1100ms. • The 260-380ms and 900-1100ms time window were added after visual inspection of the grand average ERPs of the "felt alone" group. • EEG epochs mean voltages were measured for each participant, at each electrode, each condition and for all time windows of interest. An EEG epoch consisted to -200 to 1200ms time locked to the stimulus presentation

• Repeated measures ANOVAs performed for each time window, each subset of electrode, using Joint processing effect (JPE) (concordant vs. non-concordant), electrode and hemiscalp as within subject factor • Absolute value Cohen's D⁵ effect sizes were computed by subtracting the means of grand averages ERPs of the concordant condition at each electrode for both "felt alone" and "felt together" groups in all the time

• A Non-parametric bootstrap⁶ was ran on EEG epochs mean voltages for each participant, at each electrode, each condition and for all time window. • The Benjamini-Hochberg false discovery rate⁷ procedure was coupled with the bootstrap analysis to correct for false positive discoveries.

Results







isolated

-10

(hV)

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- Nevertheless, the difference was found on different scalp sites and temporality than in the two previous experiments.
- participants. Such idiosyncratic JPEs differed in term of scalp sites and temporality too.
- itself
- their partner for most of the experiment.

References

¹ Bouten, S., Pantecouteau, H., & Debruille, J. B. (2014). Finding indexes of spontaneous brain-to-brain communications when looking for a cause of the similarity of qualia assumed across individuals. F1000Research, 3.

² Haffar, M., Pantecouteau, H., Bouten, S., & Debruille, J. B. (2018). Effects of stimulus processing on event-related brain potentials of close others. ³ Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). International affective picture system (IAPS): Technical manual and affective ratings. NIMH Center for the Study of Emotion and Attention, 39-58.

⁴ the MED bank; Debruille, Brodeur, & Stelcner 1999

⁵ Cohen, J. (1977). The Concepts of Power Analysis. *Statistical Power Analysis for the Behavioral Sciences*, 1–17. ⁶ Nocera, F. D., & Ferlazzo, F. (2000). Resampling approach to statistical inference: Bootstrapping from event-related potentials data. Behavior Research Methods, *Instruments, & Computers,* 32(1), 111–119.

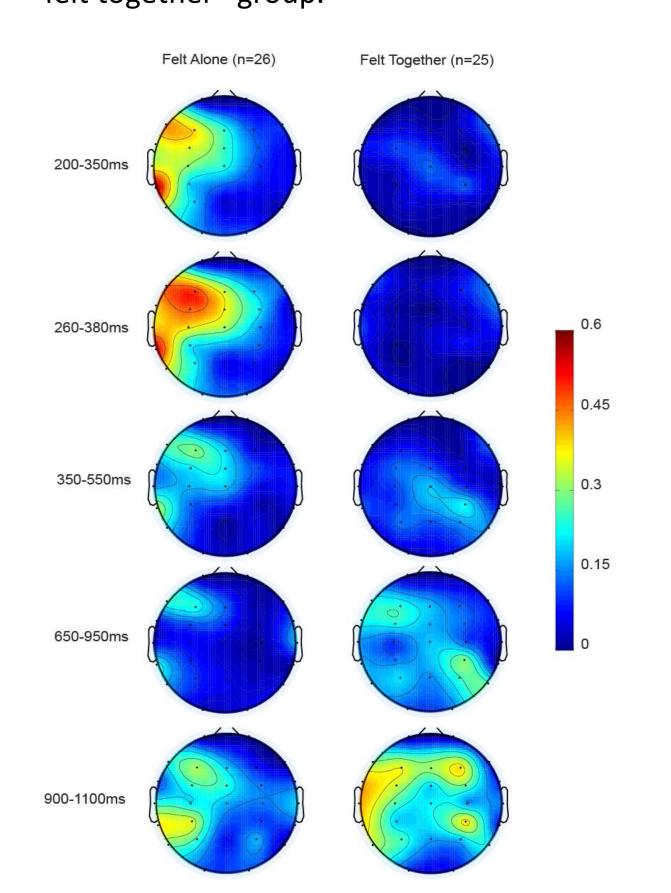
⁷ Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. Journal of the Royal statistical society: series B (Methodological), 57(1), 289-300.



Grand averages ERPs elicited by the presentation of faces for the 20 participants who reported feeling in the

Scatterplot displaying the ERPs mean voltages of both concordant and non-concordant conditions for "Felt Alone" and "Felt Together" group at the electrode F3 in the 260-380ms time window

Spline interpolated maps depicting the **absolute** value Cohen's D effect size calculated from the subtraction of the grand averages ERPs mean voltages of non-concordant minus nonconcordant condition(for both "felt alone" and "felt together" group.



 concordant condition for the felt alone group

• non-concordant condition for the felt alone group concordant condition for the felt

together group

 non-concordant condition for the felt together group

• Results support the hypothesis of one's stimuli processing impacting that of another. Indeed, ERPs were found to be modulated by the concordance between the announcement and the real sameness of the two simultaneously presented images. Importantly, this JPE was found while participants were visually and acoustically

• Additionally, the bootstrap analyses coupled with the Benjamini-Hochberg controlling for false discovery detected such a modulation by the concordance within

• These findings suggest the possibility of different JPEs being modulated by the order of trials, the distance between partners and/or the nature of the stimulus

• However, further studies should be conducted to understand why the joint processing effects seem to be delayed for participants who did feel in the presence of