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

Matthieu Lenne,[1,2]Amanda Tardif,[1,2,] Ashley Chau Morris[1,2] & J. Bruno Debruille[1,2]
[1]McGill University, [2]Douglas Mental Health University Institute
*bruno.debruille@mcgill.ca

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
• Announcement:	"you will see **different** images than your partner"	"you will see the **same** images as your partner"
• Trials:	-half of the trials was **non-concordant** with the announcement: participants saw different images than their partners -half of the trials was **concordant** with the announcement: participants saw the same images as their partner	Same as in 1&2 experiments
• Order of trials:	all trials of a **same condition in one block**	trials **randomized within each block**
• Stimuli:	International affective picture system[3] (IAPS) **images**	**more neutral** and **less heterogeneous** stimuli
• Visual isolation:	cardboard divider and closed curtain	adjacent rooms separated by a closed curtain and a **double glass window**
• Analysis:	ERPs mean voltages analysis	same **+ EEG epochs mean voltages using a bootstrap analysis corrected for false positive discoveries**

Methods

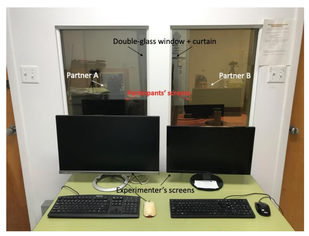
Participants groups
- Partners who reported having felt together* during most of the experiment (N= 25, 21F, 4M)
- Partner who reported having felt alone* during most of the experiment (N= 26, 19F, 8M)

Stimuli
- 75 images of faces from the MED bank[4] for the concordant-condition and 75 for the concordant condition.
- Image presentation + black fixation cross

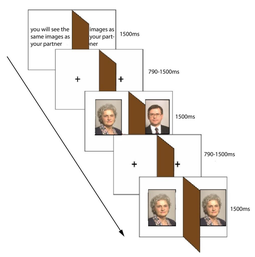
Procedure
- Setting (figure below)
- Curtains were closed before the start of the stimuli presentation. Consequently, **participants were completely visually isolated from each other.**
- **Task** instruction: -"try to memorize the faces"
  -"try to feel in the presence of your partner"
- Each trial 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 < 5KΩ.
- 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 µV 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-concordant

Measures

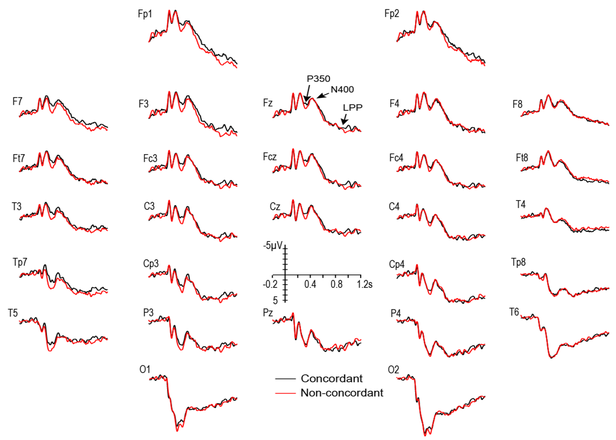
- **ERPs** elicited by faces for both concordant and non-concordant conditions for each participant were analysed in five time windows: 75-150, 200-350, 350-550, 260-380 and 650-950 900-1100ms.
- The 260-380ms and 900-1100ms time window were added after visual inspection of the grand average ERPs of 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

Analyses
- **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 D[5] effect sizes** were computed by subtracting the means of grand averages ERPs of the non-concordant by the ones of the concordant condition at each electrode for both "felt alone" and "felt together" groups in all the time windows of interest.
- A **Non-parametric bootstrap[6]** 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 rate[7]** procedure was coupled with the bootstrap analysis to correct for false positive discoveries.

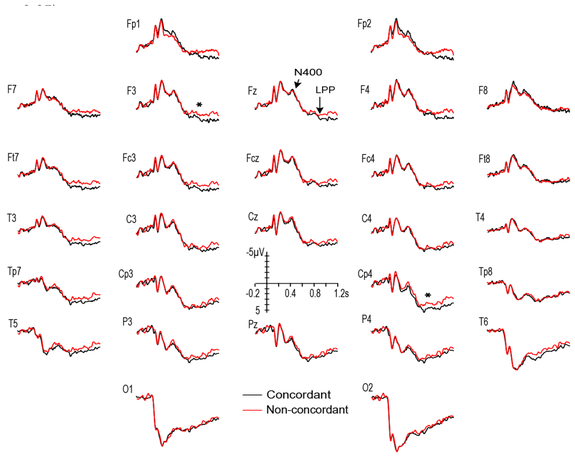
Results

- 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)

Grand averages ERPs elicited by the presentation of faces for the 22 participants who reported **not feeling** in the presence.



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

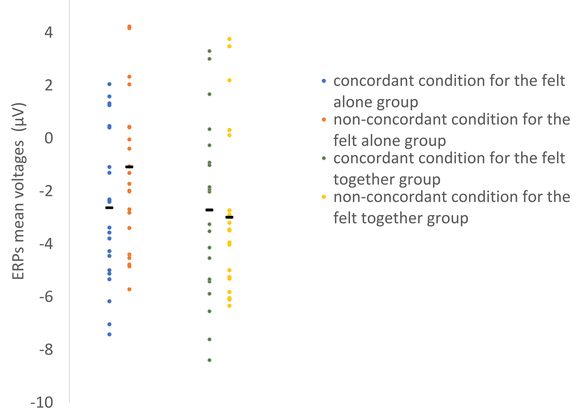


Concordance effects (JPEs) found in the subgroup of participants who **a)felt alone (n=22)** and **b) felt together (n=20)** for more than half of the experiment .

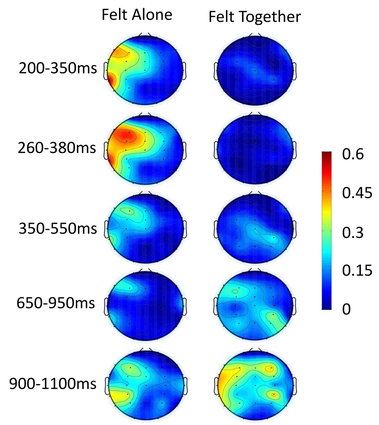
Time windows (ms)	Electrodes subset	within-subject factor	F	*P*
200-350	Sagittal	Concordance	4.8	0.038
	Parasagittal	Concordance	6.4	0.019
		Concordance x hemiscalp	11.6	0.003
	lateral	Concordance	9.3	0.006
		Concordance x hemiscalp	8	0.007
260-380	Sagittal	Concordance	5.7	0.026
	Parasagittal	Concordance	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

Time windows (ms)	Electrodes subset	within-subject factor	F	*P*
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

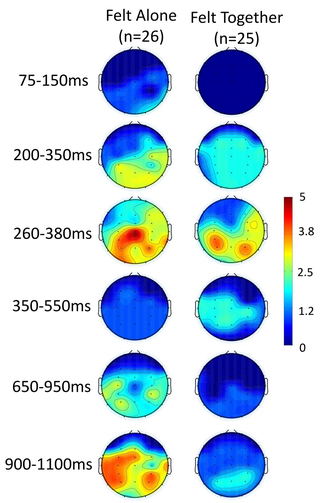
Scatterplot displaying **the ERPs mean voltages** of both concordant and non-concordant conditions for "Felt Alone" and "Felt Together" group at the **electrode F3** in the **260-380ms** time window



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 non-concordant condition(for both "felt alone" and "felt together" group.



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



discussion

- 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 isolated.
- Nevertheless, the difference was found **on different scalp sites** and temporality than in the two previous experiments.
- Additionally, the bootstrap analyses coupled with the Benjamini-Hochberg controlling for false discovery detected such a modulation by the concordance within participants. **Such idiosyncratic JPEs differed** in term of scalp sites and temporality too.
- 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** itself.
- 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 their partner for most of the experiment.

References

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