**Nonconscious Emotional Processing of Pictures and Videos Involve Distinct Neural Pathways**

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### Introduction

Facial expressions are known to impact observers’ behavior, even when they are not consciously identifiable. We measured how participants exposed to happy vs. neutral crowded faces rated the pleasantness of a subsequent neutral target.

Using fMRI along with PPI analysis, we investigated the neural determinants of this nonconscious preference bias, either induced by static (i.e., pictures) or dynamic (i.e., videos) facial expressions.

### Methods

#### Stimuli

Videos were extracted from 5 females expressing dynamically happiness (HA), anger (AN) or neutral (NE), matched for luminance, contrast, size (3°x3°). They started with a neutral expression (100ms), followed by emotional progression until paroxysm followed by emotional progression until paroxysm. Snapshots were extracted from each movie at t =0ms for the neutral expression condition, and 1 to 1400ms for the emotional paroxysm condition. Flankers were created by blending 2 non emotional faces and 4 objects, resulting in 2x2x4 non informative patterns (luminance 40% higher than that of the faces). Targets were 3°x3° Chinese pictographs, without repetition for a single subject.

#### Design

180 preference trials intermixed randomly with 60 visibility trials and 34 baseline trials, equally divided in 2 blocks of 137 trials. Each block contained exclusively either dynamic (dyn) or static (stat) stimuli.

#### fMRI acquisition

3T Trio Siemens scanner (Tim 32 channels). T2* weighted interleaved images using EPI pulse sequence (43 slices oriented on AC-PC, 3x2x3mm, TR =2100ms, TE =2.5ms, flip angle 90°).

#### fMRI analysis

After standard preprocessing, we analysed the signal using a GLM with regressors on expression valence (HA-NE), type (dyn/stat), preference judgement (please/unplease), baseline & visibility trials. The convolution used a HRF function with time and dispersion derivatives. Motion parameters were included as covariates of no interest.

PPI Time series of activity were extracted from a 5mm sphere centred on the individual peak of activity in the FFA (localized during a separate session). The psychological regressors ([HA-NE]), the time series, and their interaction were introduced in two different GLM depending on the static vs dynamic nature of the stimuli.

### Results

#### Gaze Contingent Crowding (GCC)

As soon as participants stared outside the fixation area, the peripheral prime was substituted by a neutral pattern (neutral face).

**Procedure.** The stat/dyn crowded face was displayed for 1200 ms (2.6° spacing with flankers). In 3/4 trials, participants had to indicate whether the target displayed for 150 ms was pleasant or unpleasant. In 1/4 trials, they had to answer to a question concerning the facial expression. In the baseline trials, only the fixation cross and 6 flankers were presented.

#### Behavioral results

A. Preference bias by upright faces (stat: 6.7%, p < 0.05; dyn: 7%, p < 0.05; p = 0.18). Face inversion canceled the effect (stat: -1%, ns; dyn: -4%, ns).

B. Replication with baseline showed a difference between HA & NE (3.7%, p < 0.05), but not AN & NE (1.1%, p > 0.6).

C. Conscious preference bias between HA-NE (10%, p < 0.05) & AN-NE (-7.7%, p < 0.05).

#### Functional results

A. Whole brain for HA-NE in the stat & dyn condition (p < 0.05, unc & p < 0.05, SVC in Am).

B. FFA ROI for HA-NE: (p < 0.05; left .82%; right .85%)

C. Linear regression between activity in FFA and amplitude of preference bias (stat: R² = .24, p < 0.05; dyn: R² = .07, p = .9).

D. PPI analysis between the FFA and the amygdala: stat (left 17vox, Z = 3.25, p < 0.05 SVC; right 18 vox, Z = 3.25, p < 0.05 SVC; dyn: left Z = 0.9; right Z = 1.25 ns).

E. Tentative model for the nonconscious processing of static and dynamic stimuli (PPC Posterior Parietal Cortex, FFA Fusiform Face Area, STS Superior Temporal Sulcus, Hipp Hippocampus, S1 Substantia Innominata, Am Amygdala, OFC Orbitofrontal Cortex, ACC Anterior Cingulate Cortex).

### Conclusion

**First,** we showed that stat & dyn facial expressions were processed along different pathways. We proposed that stat stimuli were processed through the ventral pathway, including the FFA in connection with the Am. Dyn stimuli were processed through the dorsal pathway, including the PPC and dorsal subcortical structures such as the SI. This dissociation questions the existence of form-motion integration during the nonconscious processing of biological motion.

**Second,** we found that crowded stimuli were encoded such as to bias preference judgment. We proposed that the bias arose from both evaluation of the emotional context and aesthetic preferences computation, respectively supported by the Hipp and the OFC. This shows that crowded information can modulate a broad set of brain regions supporting high-level cognitive functions, despite being reflected subjectively as a jumbled, uninformative experience.