Face inversion disproportionately impairs the perception of vertical but not horizontal relations between features

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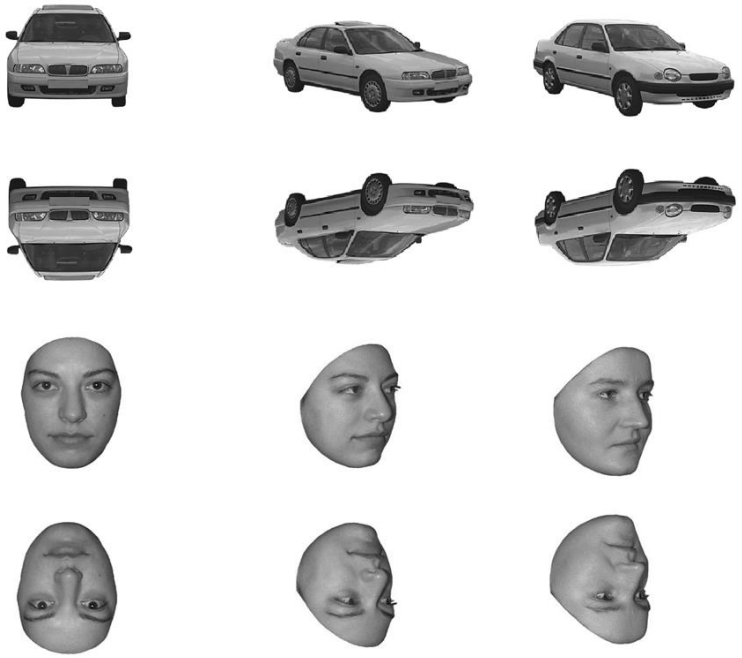
Introduction

Presenting faces upside-down:

→ Massive drop of recognition or individual discrimination performance

= Much more so than for other object categories (Yin, 1969): *the face inversion effect (FIE)*



- Found for familiar and unfamiliar faces in a variety of tasks

Inversion affects the perceptual encoding of *multiple cues*, but particularly the metric distances between features, a form of face configuration:

e.g. Freire et al., 2000; Leder & Bruce, 2000; Leder et al., 2001; Barton et al., 2001; Le Grand et al., 2001; Mondloch et al., 2002; Carbon & Leder, 2006

However, *no replication of disproportionate effects of inversion* on metric distances than local features by two recent studies:

Yovel & Kanwisher, 2004; Riesenhuber et al., 2004

→ Decrease of performance with inversion for both features and configuration

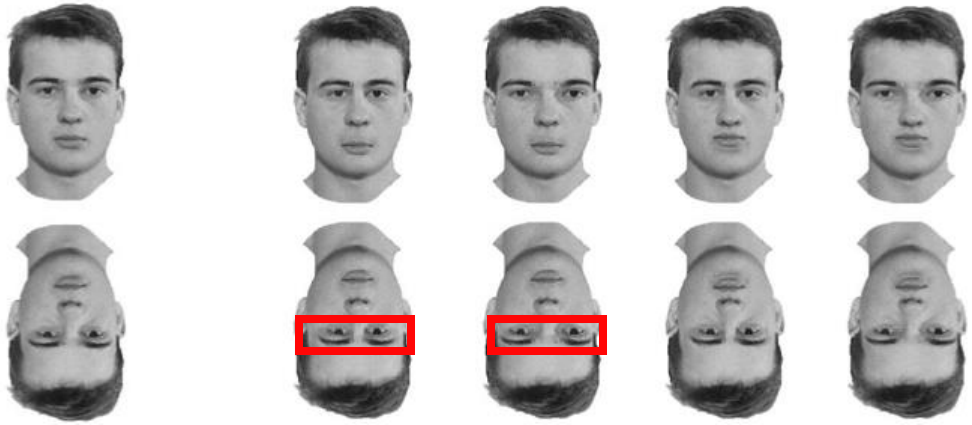
→ 'Inversion does not affect face processing qualitatively but quantitatively'

(identical conclusions by Sekuler et al., 2004)

Our reasoning:

Inversion may affect more the perception of vertical distances between features than horizontal distances between features, something that may account for discrepancies between studies

e.g. Yovel & Kanwisher (2004) only used horizontal manipulations at the level of the eyes and vertical moves of the mouth, but trials were mixed.



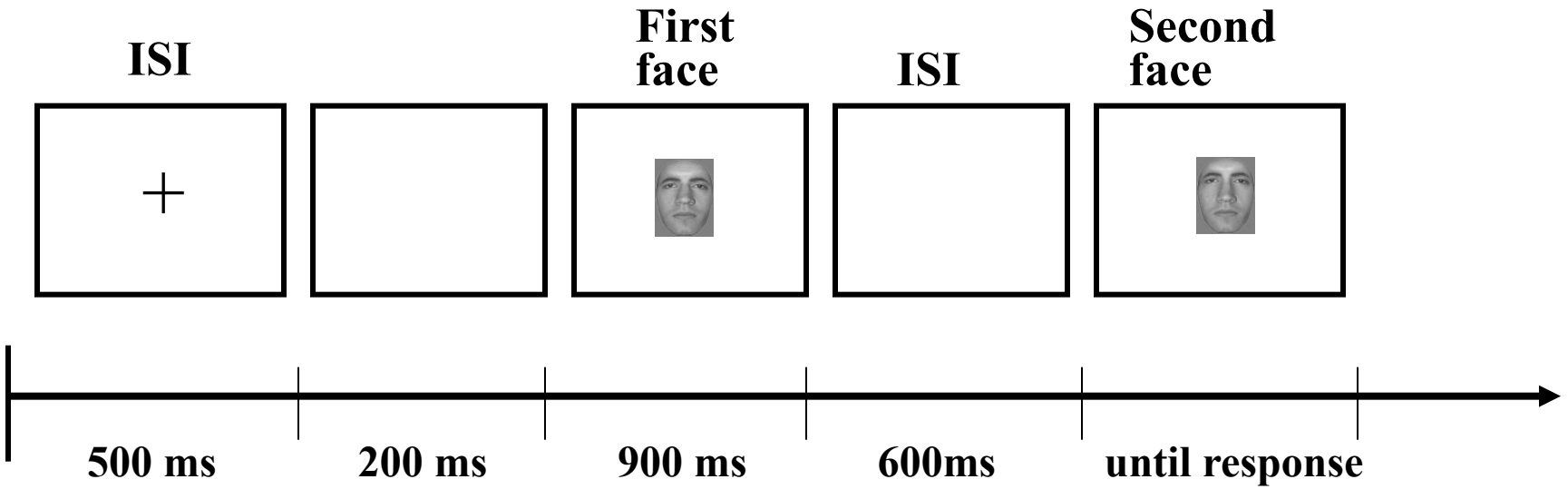
→ Horizontal moves at the level of the eyes do not seem much affected by inversion indeed!

Barton et al. (2001), dissociated both types of trials (eyes horizontal changes vs. mouth vertical changes) and found larger decrement with inversion for the latter.

Our hypothesis is that these differences may be due to the displacement direction of features rather than the region of the face under study (eyes vs. mouth).

Methods

behavioral experiments: delayed matching on faces



3 critical manipulations on the eyes x inversion

Featural

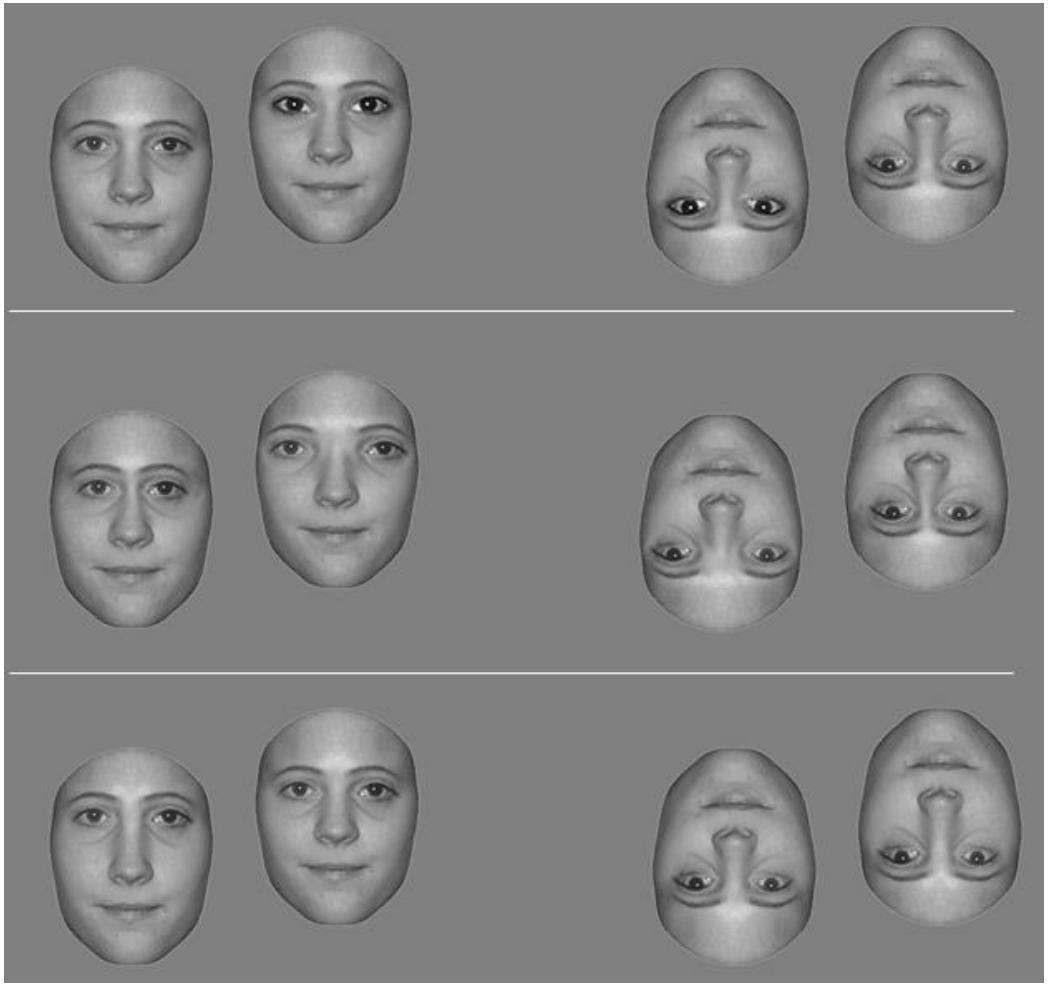
'Featural' difference between first and second stimulus: eyes contrast and shape (slightly) modified

H-relational

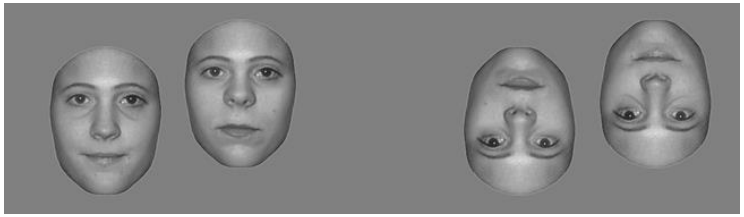
Horizontal displacement of the eyes between first and second stimulus

V-relational

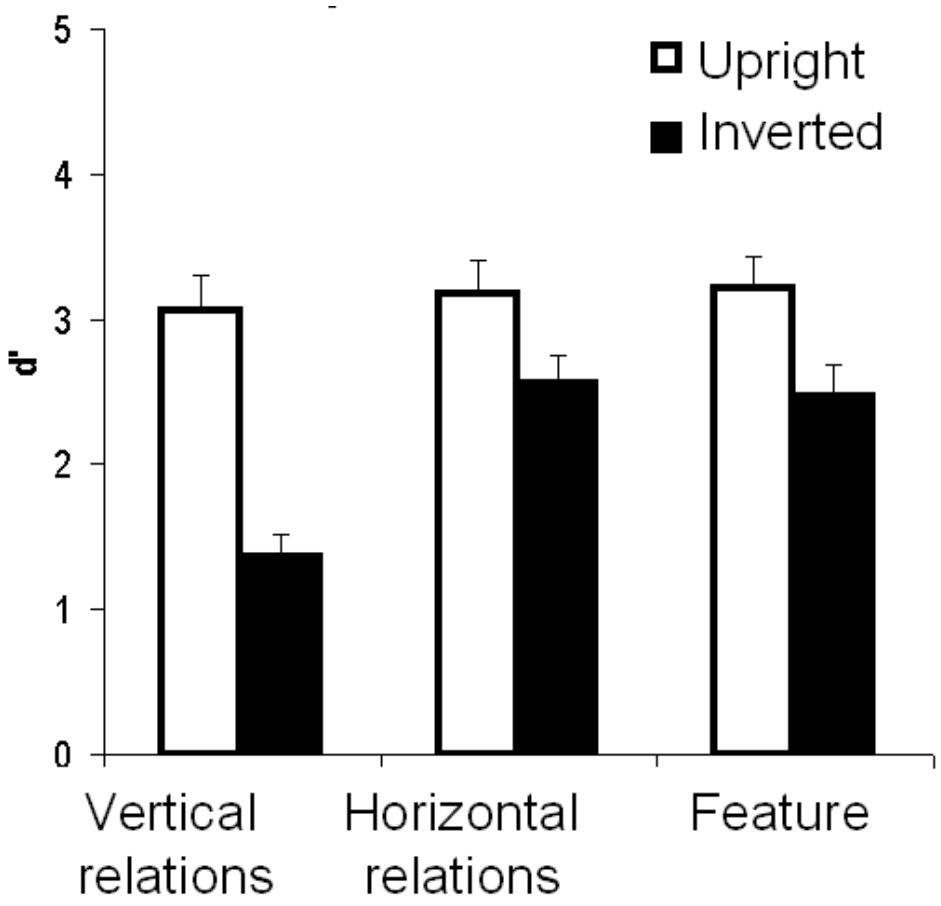
Vertical displacement of the eyes between first and second stimulus



+ catch trials: lower part of the face differ so that subjects do not look only at the eyes in the experiment

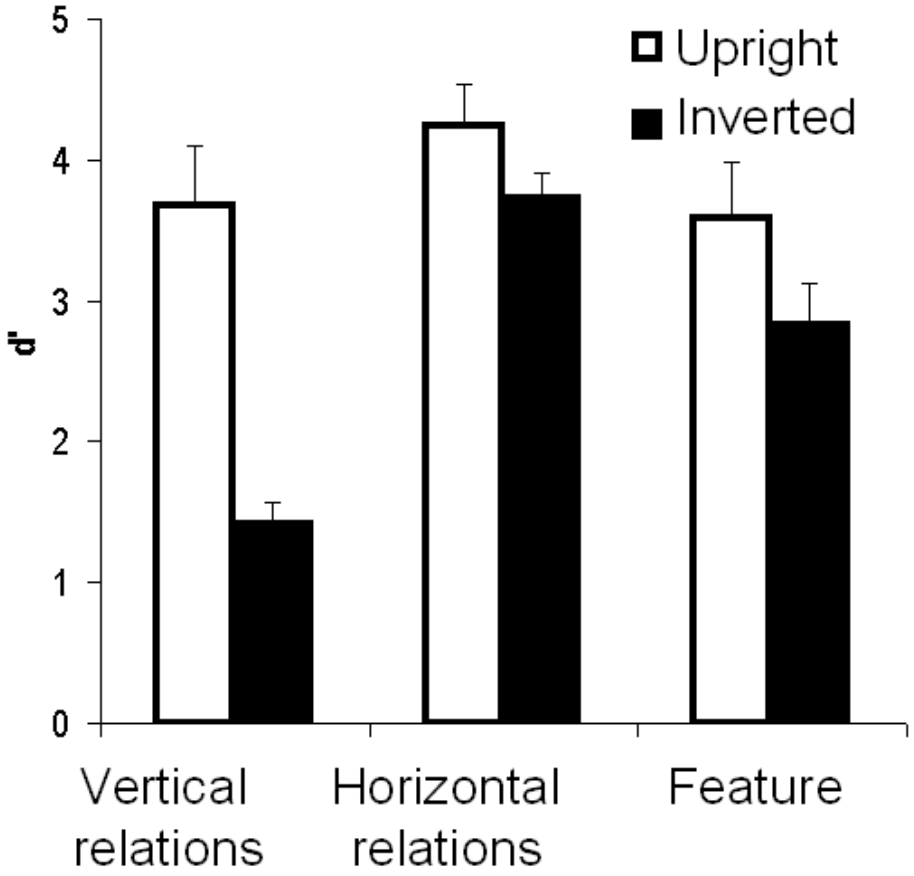


Experiment 1: stimulus orientation blocked



Results

Experiment 2: stimulus orientation randomized



Results

Conclusions of experiments 1 & 2

Whether presentation orientation is blocked or randomized …

- Small effects of inversion, of the same magnitude, for featural and horizontal-relations

- Much larger effects of inversion for vertical relations

→ Performance for upright faces is equal between conditions, but inversion affects more the perception of horizontal metric distances between features

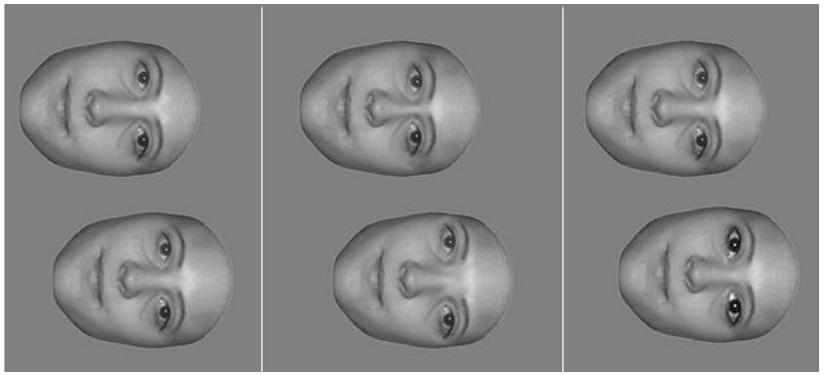
= **Qualitative** effects of face inversion

Experiment 3 (blocked trials)

Is the effect of inversion on vertical relations due to the structure of faces (vertically oriented, more diagnostic information along the vertical axis) or to the fact that inversion corresponds to a vertical flip of the stimulus?

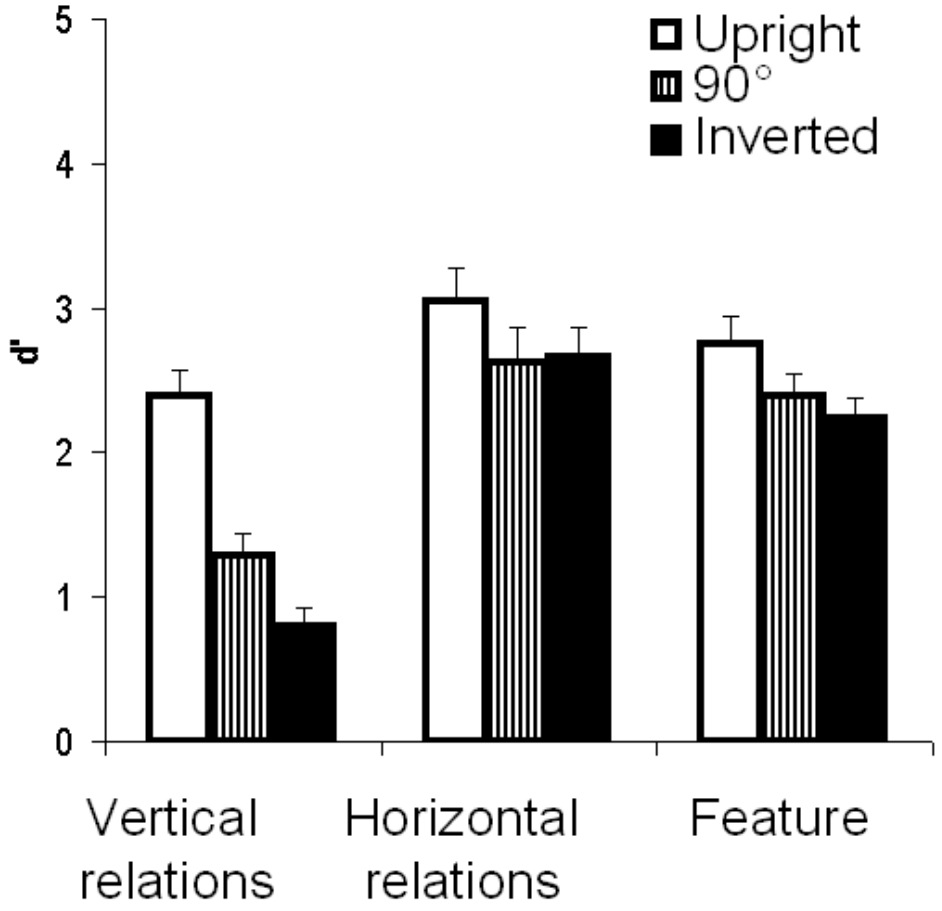
= Is the effect *object-based* or *view-based*?

→ Addition of a condition with faces flipped at 90°



Methods

Experiment 3



Even at 90 degrees of orientation, the perception of vertical relations between features is more impaired than horizontal relations.

Results

Conclusions (1)

Inversion affects more the perception of metric distances between features than the features, but only if the metric distances are in the (main) vertical axis of the face stimulus

→ Inversion does affect configuration more than features

= Qualitative rather than simpy quantitative effects of face inversion

This effect is not due to

- Subject's expectations (blocks or random trials; Riesenhuber et al., 2004)
- Upright performance unequal between conditions (Yovel & Kanwisher, 2004)

Conclusions (2)

This larger effect of inversion for the perception of metric distances between features along the vertical axis is NOT due to

- Subject's expectations (blocks or random trials; Riesenhuber et al., 2004)

- Upright performance unequal between conditions (Yovel & Kanwisher, 2004)

- The fact that inversion corresponds to a vertical flip of the stimulus

It is due to the structure of the face stimulus, whose main axis is vertical, and which contains a number of features whose relations are organized along the vertical axis