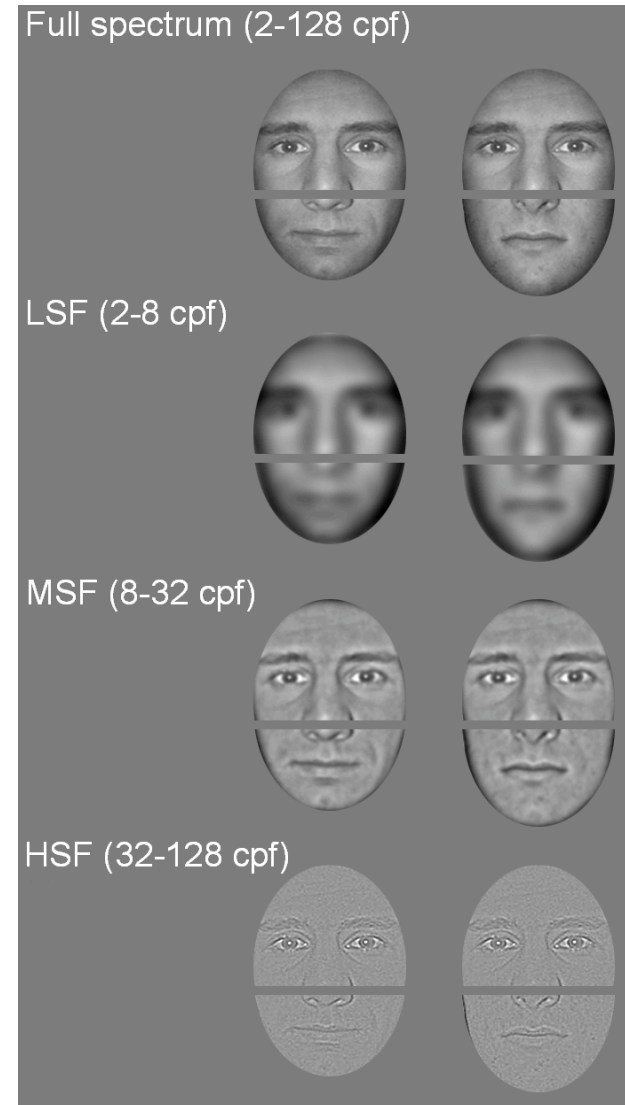


# Faces are « spatial » - Holistic face perception is supported by low spatial frequencies

Valérie Goffaux & Bruno Rossion

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## Main findings and conclusions

- \* Integration of facial features into a holistic representation is supported by low-spatial frequencies of the visual stimulus.

- \* This is supported here by showing larger whole/part advantages and face composite effects with low spatial frequencies than high spatial frequencies.

- \* In line with the coarse-to-fine hypothesis of information processing in the visual system, these observations suggest that holistic processing may precede the analysis of local features during the microgenesis of face perception.

## **Faces are processed holistically**

= Facial features are *integrated* rather than being represented and processed independently of one another

Practically, this implies that the recognition of a face feature (e.g. the eyes) is *influenced* by the processing of other the other face parts

# Two major paradigms/effects provide evidence for holistic face processing

## 1. The whole-part advantage

*Discriminating two faces differing by one feature is easier/faster than the 2 features presented in isolation*

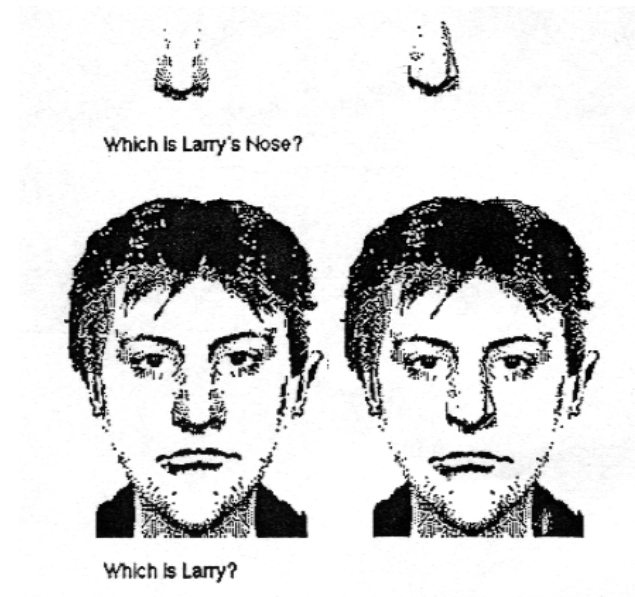
**Tanaka & Farah, 1993**

**Davidoff & Donnelly, 1990**

**Farah et al., 1998**

**Sergent, 1984**

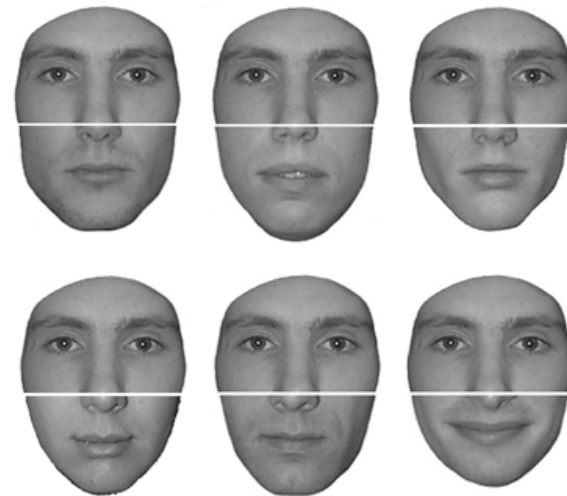
**Homa, Haver & Schwartz, 1976**



## 2. The face composite illusion

*Identical top parts of faces look different if they are aligned with different bottom parts*

**Young et al. 1987**



*Introduction*

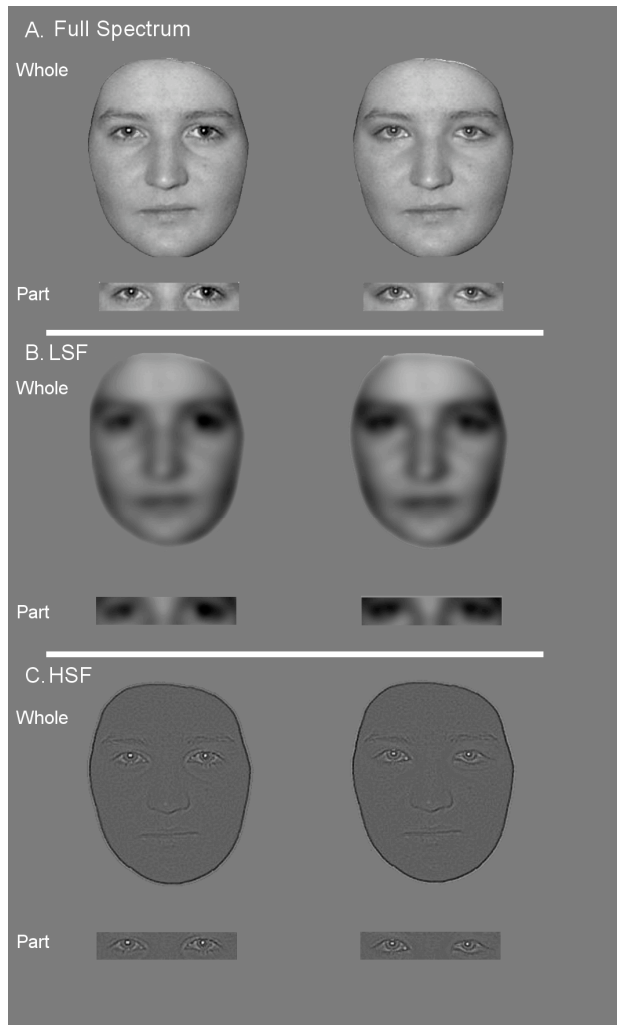
What is the visual information supporting the extraction of a holistic face representation?

Here we test the hypothesis that holistic processing of a face is mostly dependent on **low spatial frequencies** (LSF) of the visual stimulus rather than high spatial frequencies (HSF).

This hypothesis was first put forward by Sergent (1986) and never tested empirically

# Experiment 1: whole-part advantage with LSF, HSF and full-spectrum faces

## Delayed matching task on unfamiliar faces

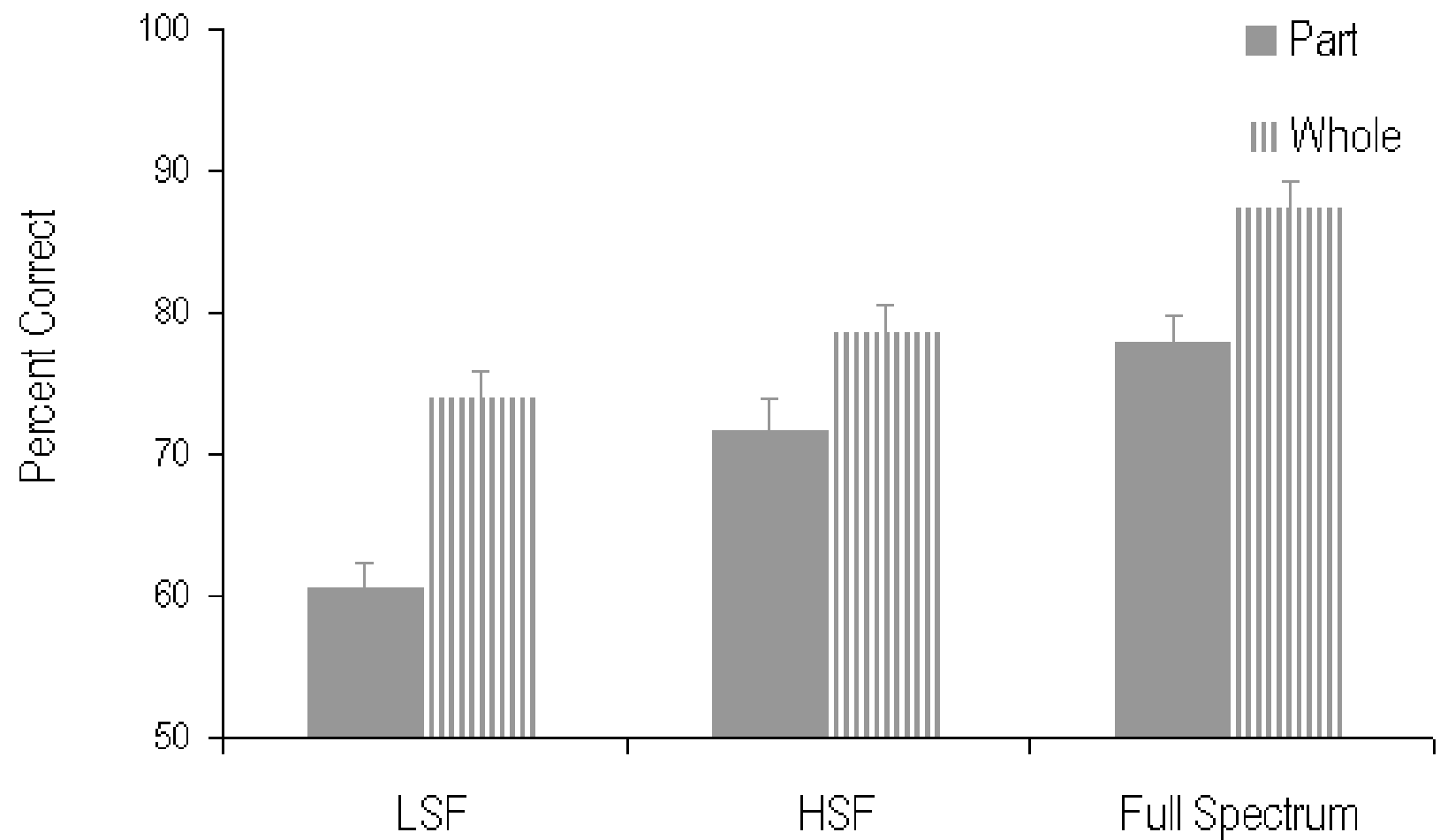


2 x 3 design

Whole-to-parts vs. Whole-to whole

LSF, HSF, full-spectrum

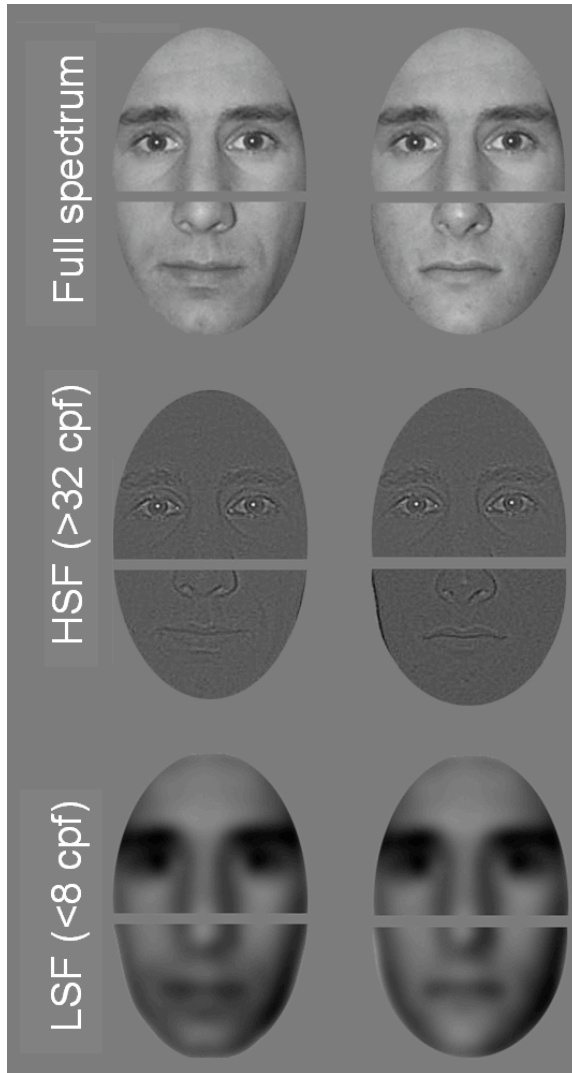
*Experiment 1*



Larger whole-part advantage for LSF face stimuli

*Experiment 1*

## Experiment 2: face composite effect with LSF, HSF and full-spectrum faces

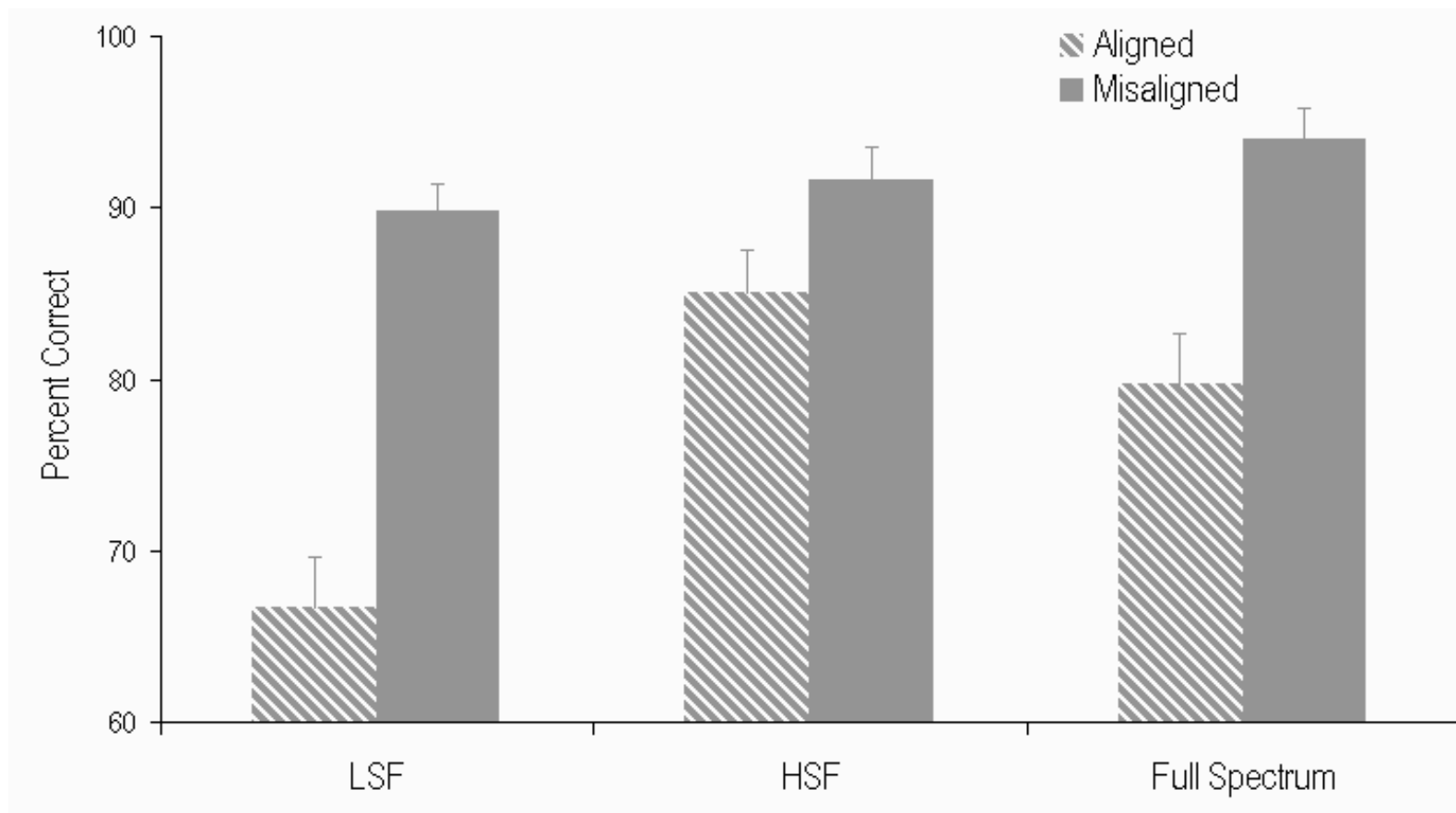


2 x 3 design

Faces aligned vs. misaligned

LSF, HSF, full-spectrum



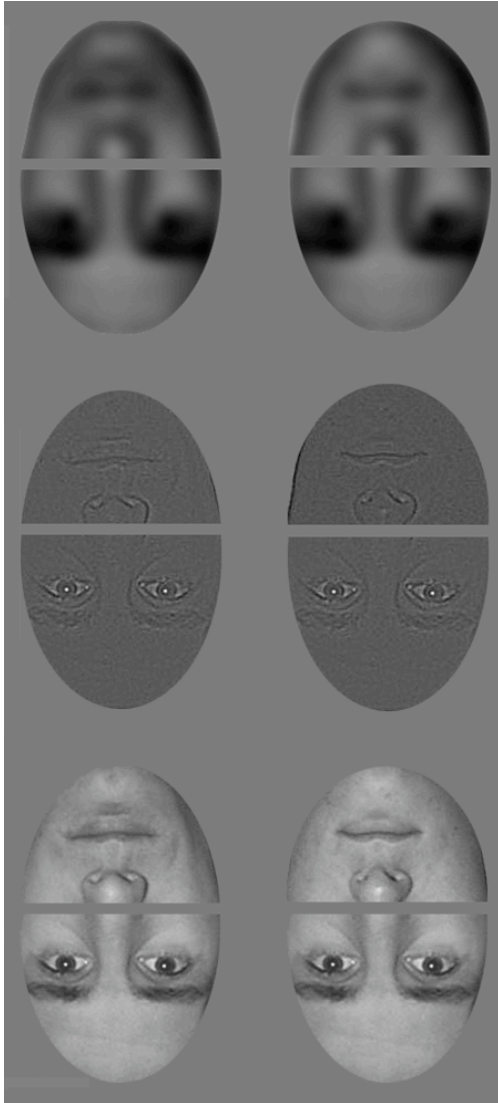


Larger face composite effect for LSF face stimuli

Note: performance is equal for all conditions when faces are misaligned

*Experiment 2*

### Experiment 3: face composite effect with LSF, HSF and full-spectrum faces presented upside-down



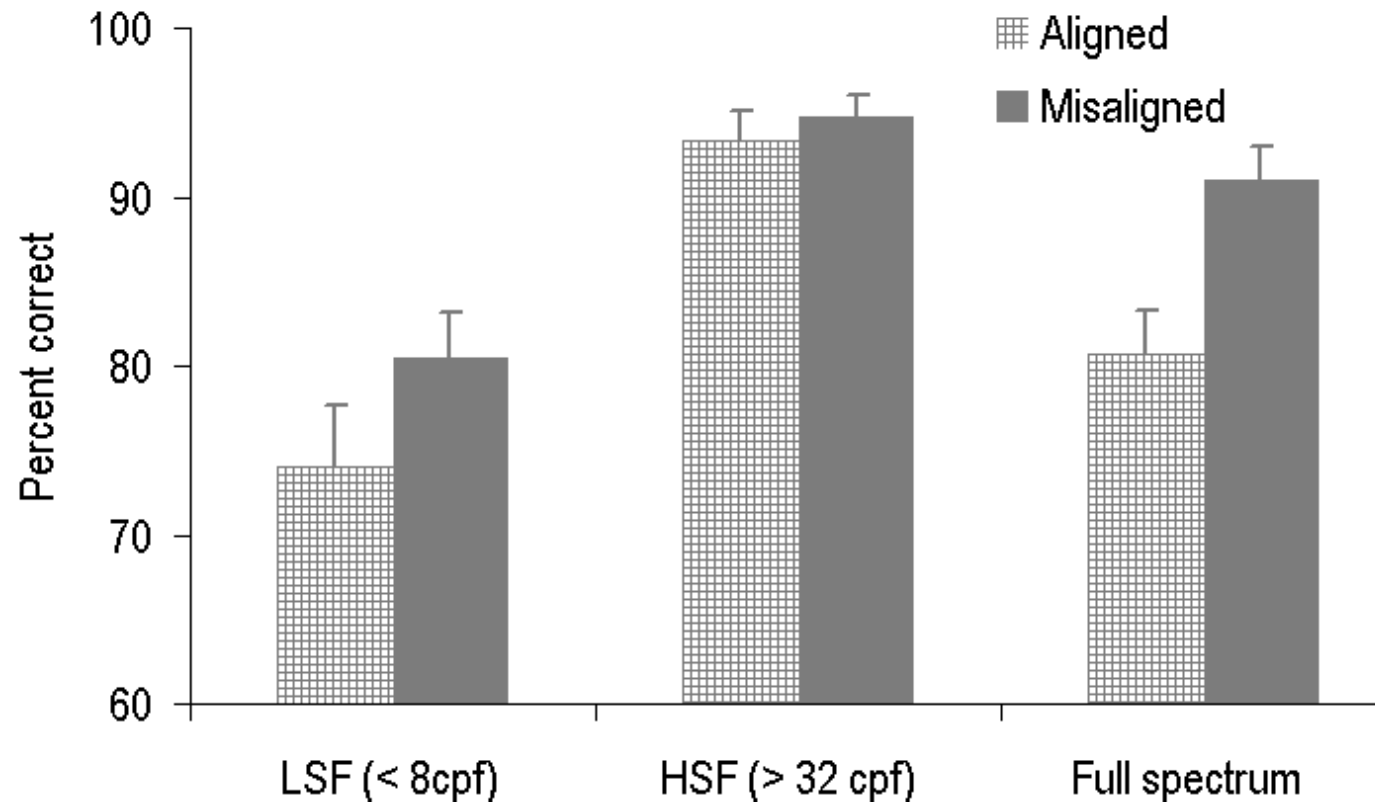
*Rationale: if the larger face composite effect for LSF truly reflects holistic face encoding, it should be reduced by inversion*

2 x 3 design

Faces aligned vs. misaligned

LSF, HSF, full-spectrum

*Experiment 3*

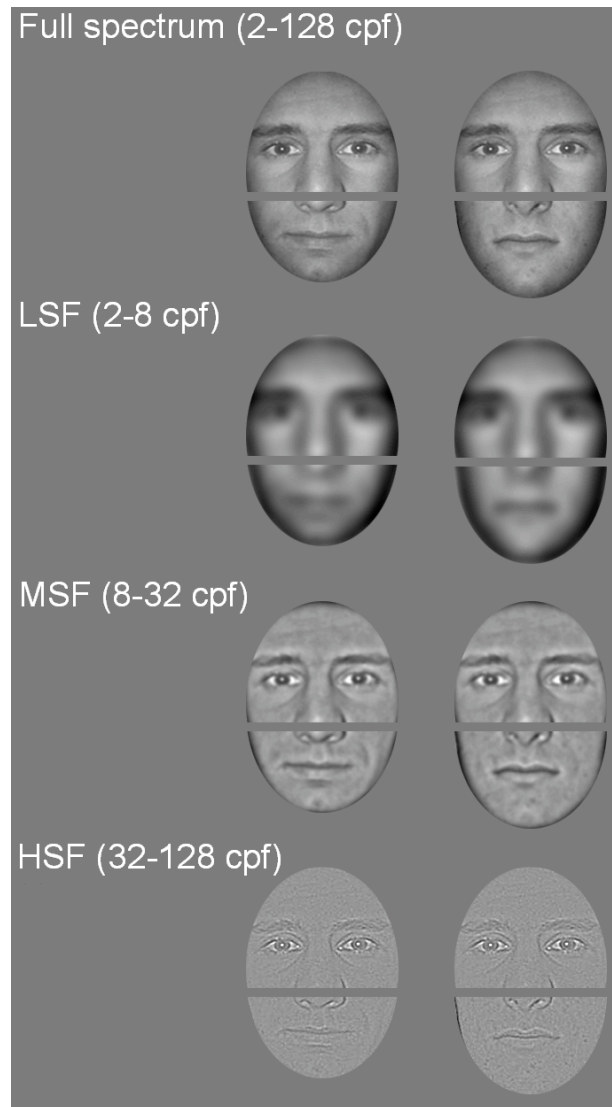


Compared to experiment 2, larger drop of face composite effect for LSF stimuli with inversion

Note: blurring faces (LSF) + inversion dramatically affects recognition (// Collishaw & Hole, 2000).

*Experiment 3*

Experiment 4: face composite effect with LSF, HSF and full-spectrum faces + middle spatial frequency range (MSF), thought to be particularly important for face recognition

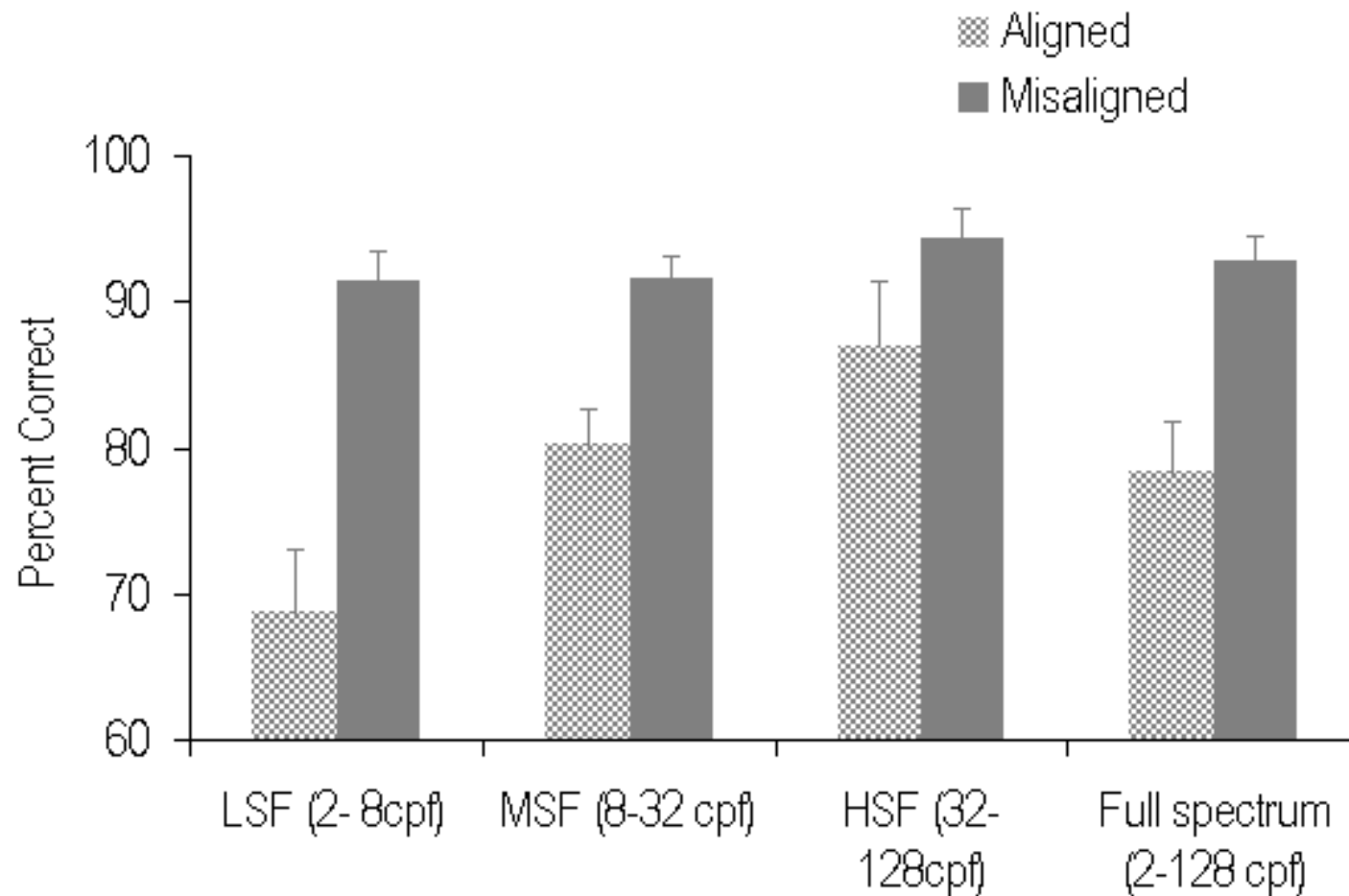


2 x 4 design

Faces aligned vs. misaligned

LSF, HSF, MSF, full-spectrum

*Experiment 4*



Larger face composite effect for LSF face stimuli

Note: performance is equal for all conditions when faces are misaligned

*Experiment 4*

## Conclusions

Holistic face perception is rooted in coarse visual cues transmitted by early spatial frequency filters, as first hypothesized by Sengco (1986)

- Holistic face representations can be built from low resolution face pictures suggesting that holistic processing may help detecting and segmenting the face stimulus by linking internal and external facial features together against the background scene.
- Neuropsychological and developmental studies also support a critical role of LSF to build holistic 3D individual representations of faces

- SF filtering technique provides a means to reduce, or enhance, holistic processing of faces
- The well-documented **temporal precedence of LSF processing** over HSF processing (e.g. Bredfeldt & Ringach, 2002; Mihaylova, Stomonyakov & Vassilev, 1999; Loftus & Harley, 2004) and the present observations that holistic perception of faces is predominantly supported by LSF, suggest that the extraction of a holistic face representation may be **an early stage** in face processing. Such initial LSF-derived holistic representation may be based on the earliest visual inputs to high-level visual areas showing a preference for face stimuli (i.e. middle fusiform gyrus).