

**Holistic face processing is mature at 4 years of age:
Evidence from the composite face effect**

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JECP, in press, 2006

Main findings

Presence of a **composite effect since 4-years of age**, suggesting that holistic face processing is mature as early as 4 years of experience with faces

Aim of the study

Clarifying the question of the **emergence** and **development** of holistic face processing by testing adults and 4-, 5- and 6-year-old children with the exact same paradigm

Hypothesis

A. “Quantitative” view

Children and adults should present a composite face effect but children’s accuracy should be poorer than that of adults

B. “Qualitative” view (~ Switch hypothesis)

The composite face effect should emerge at a certain age, testifying the emergence of holistic face processing abilities

EXPERIMENT 1

Participants

Adults (N = 15; mean age: 19.07 years; 3 males)

6-year-old children (N = 15; mean age: 80 months; 11 males)

5-year-old children (N = 15; mean age: 65 months; 8 males)

4-year-old children (N = 15; mean age: 53 months; 4 males)

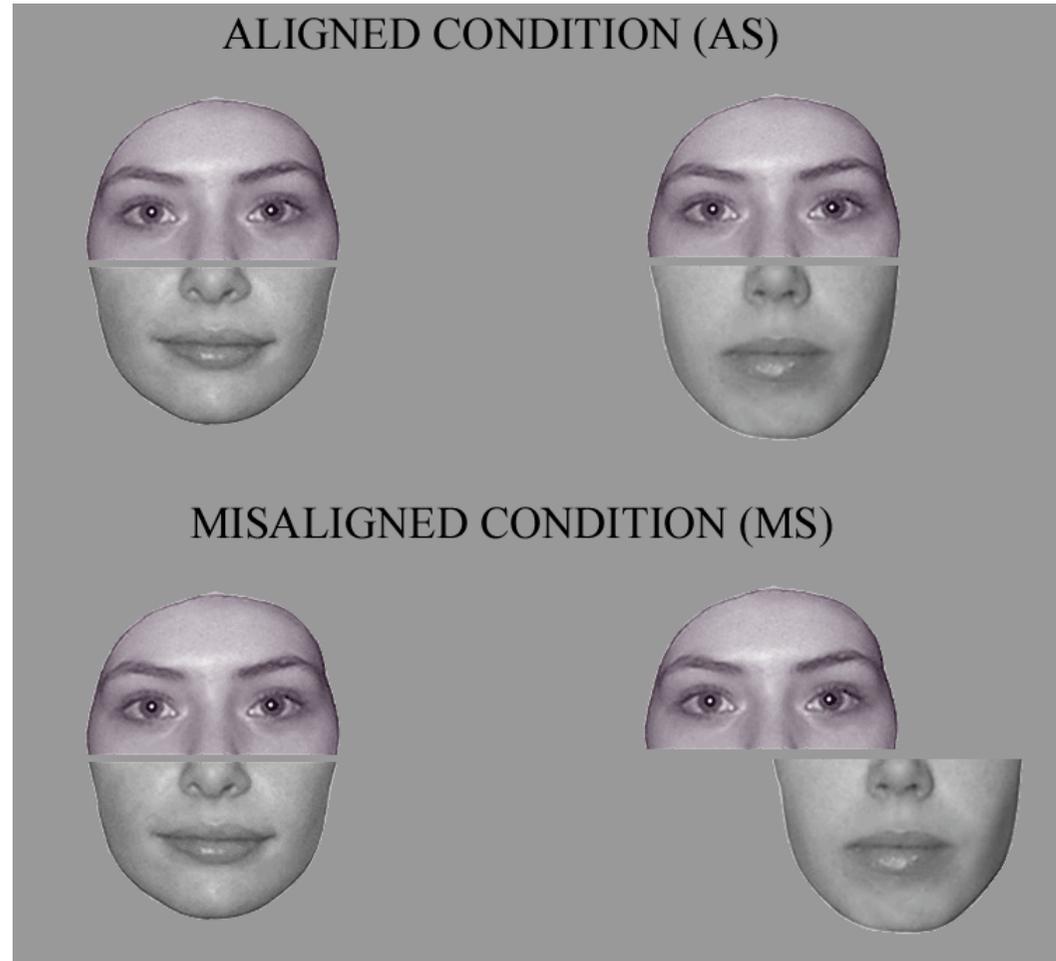
Procedure

30 'AS' trials

+ 20 'AD' trials

30 'MS' trials

+ 20 'MD' trials



Focus on the colored upper parts of the faces (presented simultaneously) and press as accurately and as fast as possible a green patch if they are identical or a red patch if they are different

Figure 1

Experiment 1

Results

Significant interaction between test condition & age, confirmed by a composite effect (MS-AS) on Accuracy, in adults and 6-years-old children

No significant difference between these 2 groups

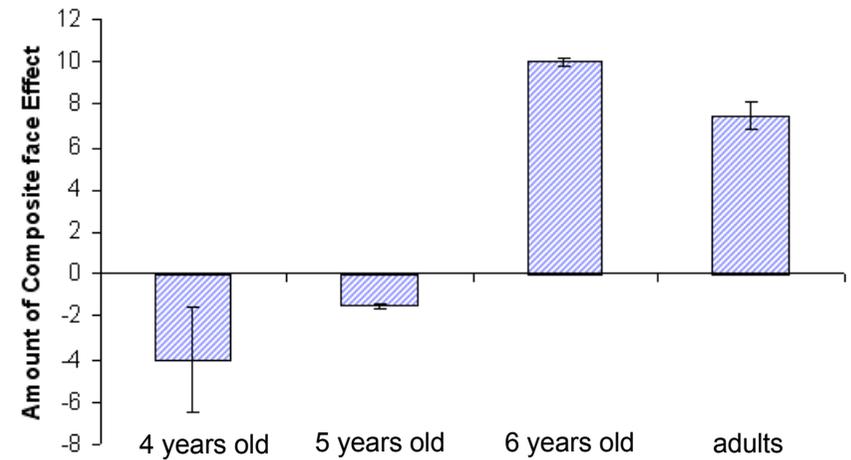


Figure 2

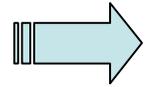
	4-years old		5-years old		6-years old		Adults	
	A	M	A	M	A	M	A	M
Same	83 ₍₁₁₎	79 ₍₂₁₎	71 ₍₁₉₎	71 ₍₁₈₎	71 ₍₁₄₎	81 ₍₁₅₎	83 ₍₁₂₎	90 ₍₉₎
Different	74 ₍₁₄₎	72 ₍₁₃₎	80 ₍₁₈₎	72 ₍₂₀₎	84 ₍₁₉₎	80 ₍₁₅₎	87 ₍₁₂₎	81 ₍₁₄₎

Table 1

Global performance improving with age

Experiment 1

Discussion



6-years-old children formed holistic representations of faces

... However...

2 misaligned faces could also have been used (Legrand et al., 2004; Goffaux & Rossion, in press).

Younger children's performance was quite low in the misaligned condition with 'same' and 'different' trials (see Table 1)



They might have erroneously answered 'different', perhaps making their decision on the format of the stimuli rather than on their identity



EXPERIMENT 2

Experiment 1

EXPERIMENT 2

Participants

Adults (N = 15; mean age: 19.7 years; 5 males)

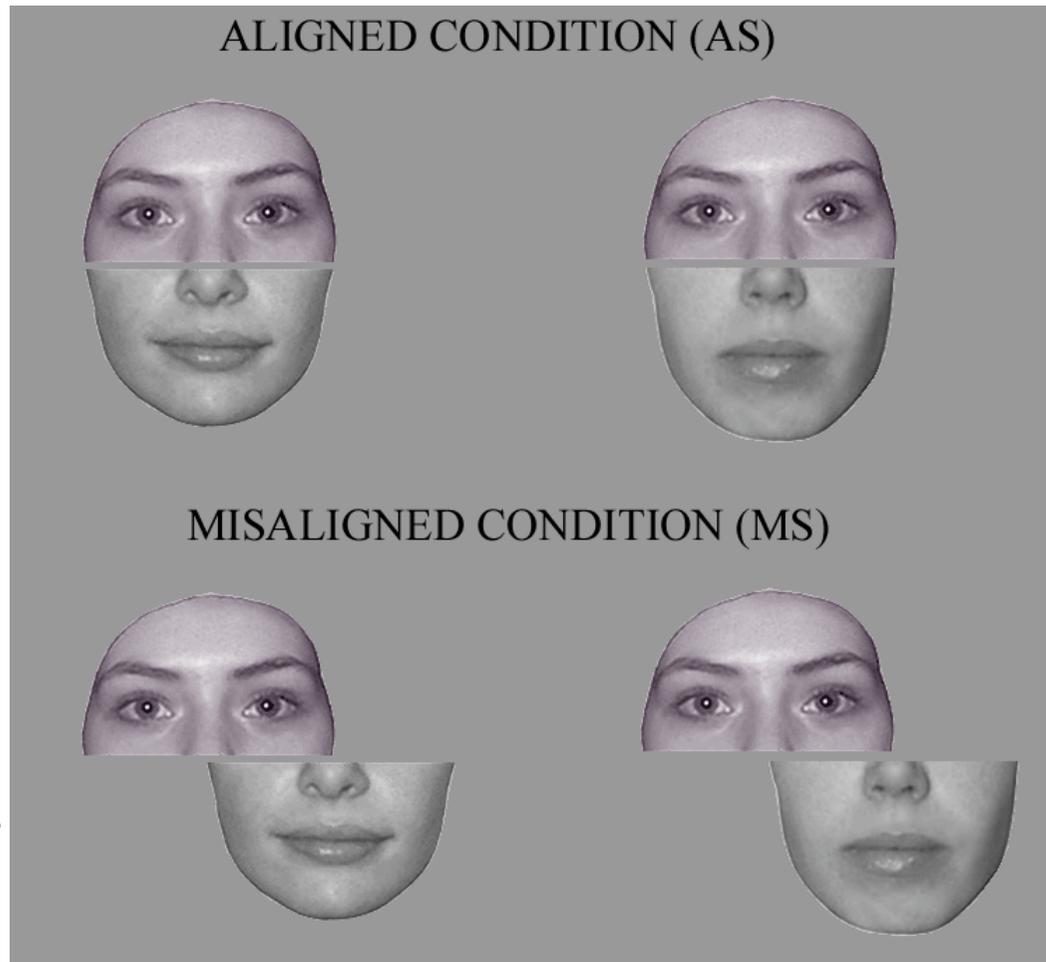
6-year-old children (N = 15; mean age: 77 months; 6 males)

5-year-old children (N = 15; mean age: 69 months; 9 males)

4-year-old children (N = 15; mean age: 55 months; 8 males)

Procedure (~ Similar to Experiment 1, except for the stimuli)

30 'AS' trials
+ 20 'AD' trials



Focus on the colored upper parts of the faces (presented simultaneously) and press as accurately and as fast as possible a green patch if they are identical or a red patch if they are different

30 'MS' trials
+ 20 'MD' trials

Figure 3

Experiment 2

Results

Significant age x test condition interaction, confirmed by significant composite effects (MS-AS) for each age group

No significant difference between these children's groups

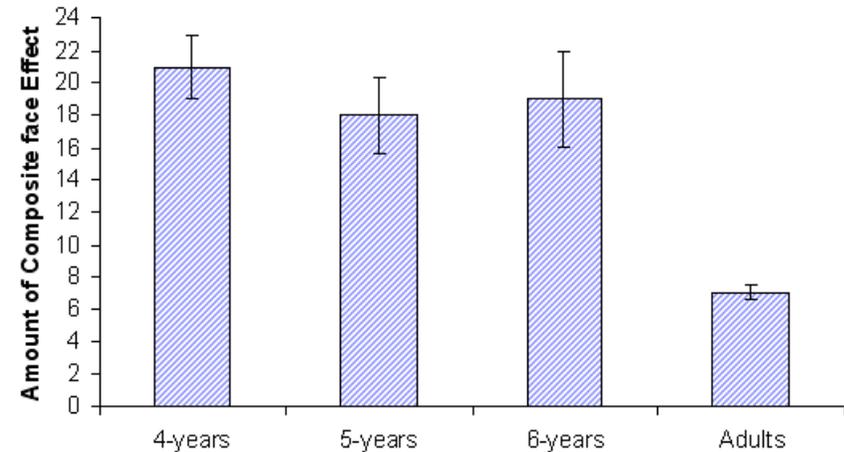


Figure 4

	4-years old		5-years old		6-years old		Adults	
	A	M	A	M	A	M	A	M
Same	69₍₁₅₎	90₍₇₎	74₍₁₆₎	92₍₇₎	73₍₁₆₎	92₍₅₎	88₍₈₎	95₍₆₎
Different	87₍₁₅₎	82₍₁₄₎	90₍₉₎	90₍₇₎	94₍₇₎	93₍₈₎	90₍₉₎	92₍₁₁₎

Table 2

Improvement in performance with age

Experiment 2

Discussion

1. Composite effect across all age groups, showing that they were processing faces holistically
2. These results failed to support the switch processing hypothesis (as suggested by Experiment 1) of a qualitative difference in the way young and older participants process faces
3. Presence of a response bias: children's performance seemed to be extremely sensitive to the absence of format coherence between 2 stimuli presented at the same time, e.g. one aligned and one misaligned face

This might be due to the fact that before a certain age the child's mind is not flexible enough to adapt to an unnatural experimental situation (Piaget & Inhelder, 1966)

Experiment 2

Main conclusions

Overall, our results support the view that children process faces **holistically** by the **age of 4**, perhaps earlier

This is in **agreement** with previous findings of adult-like composite face effect at 6 years of age (Carey & Diamond, 1994) and whole-part advantage effect at 4 (Pellicano & Rhodes, 2003) and 6 years of age (Tanaka et al., 1998)