



Impaired face detection may explain some but not all cases of developmental prosopagnosia

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INTRODUCTION

Developmental prosopagnosia (DP) is defined by severe face recognition difficulties due to the failure to develop the visual mechanisms necessary for processing faces. The Two-Process Theory of face recognition (Morton & Johnson, 1991) implies that DP could result from a failure of an innate face detection system and that this failure could prevent an individual from then developing or tuning higher-level processes for face recognition (Johnson, 2005).

Is developmental prosopagnosia always accompanied by face detection deficits?

PARTICIPANTS

- N=7, 8-12-years-old (M=9.86 years, SD=1.35) from faceblind.org.
- Normal or corrected-to-normal vision, normal or above average IQ, no autism spectrum disorders.
- Parents provided anecdotal reports of face recognition difficulties in daily life.

Participant info		Memory			Perception
ID (Age/Sex)	IQ (WASI-II)	Cambridge Bicycle Memory Test*	Cambridge Face Memory Test- Kids*	Old/New Faces	Dartmouth Face Perception Test
AO (8M)	V: 132 P: 122	79.2% (9.7)	37.5%* (16.1)	56.7%* (10.2)	40.0%* (16.2)
BG (9F)	V: 123 P: 105	91.7% (14.8)	62.5% (12.0)	53.3%* (11.0)	55.0%* (13.3)
HPH (9M)	V: 134 P: 102	84.7% (14.8)	52.0%* (12.0)	76.7% (11.0)	42.5%* (13.3)
DD (10M)	V: 113 P: 105	68.1% (9.4)	56.9%* (7.2)	73.3%* (6.3)	65.0%* (7.7)
NL (10M)	V: 120 P: 117	84.7% (9.4)	34.7%* (7.2)	33.3%* (6.3)	30.0%* (7.7)
SWJ (11M)	V: 154 P: 126	59.7%* (7.6)	44.4%* (13.7)	60.0%* (8.8)	35.0%* (7.9)
MF (12F)	V: 91 P: 86	72.2% (8.7)	51.4%* (8.6)	56.7%* (5.9)	47.5%* (6.4)

* >2SD below control mean; all children compared to at least 14 age-matched controls.
• For the CBMT and CFMT-K, kids 8-9-years-old memorized 4 targets; kids 10-12-years-old memorized 6 targets.
Control means (SD) noted beside each DP score. Chance level performance for CBMT, CFMT-K, DFPT: 33%; Old/New: 50%

ESTABLISHING PROSOPAGNOSIA

Cambridge Face Memory Test - Kids

Children <10 years memorized 4 targets, children 10 years+ memorized 6 targets

Part 1: Introduction (12/18 trials) Memorize (3 seconds per face)

Part 2: Any target (20/30 trials) Memorize (20 seconds)

In the remaining trials, the correct answer can be any of the six faces

Which face did you just view?

Part 3: Noise (16/24 trials)

48 trials total for children <10 years, 72 trials for children 10+
Chance level performance: 33%

Cambridge Bicycle Memory Test - Kids

Children <10 years memorized 4 targets, children 10 years+ memorized 6 targets

Part 1: Introduction (12/18 trials) Memorize (3 seconds per bike)

Part 2: Any target (20/30 trials) Memorize (20 seconds)

In the remaining trials, the correct answer can be any of the six bikes

Which bike did you just view?

Part 3: Noise (16/24 trials)

48 trials total for children <10 years, 72 trials for children 10+
Chance level performance: 33%

Old/New Face Memory Test

Which face is one of the 10 target faces memorized earlier?
30 trials, 1s viewing per trial.
Chance level performance: 50%

Dartmouth Face Perception Test

Which face looks the most like the target face?
40 trials, unlimited response time.
Chance level performance: 33%

DETECTION TASKS

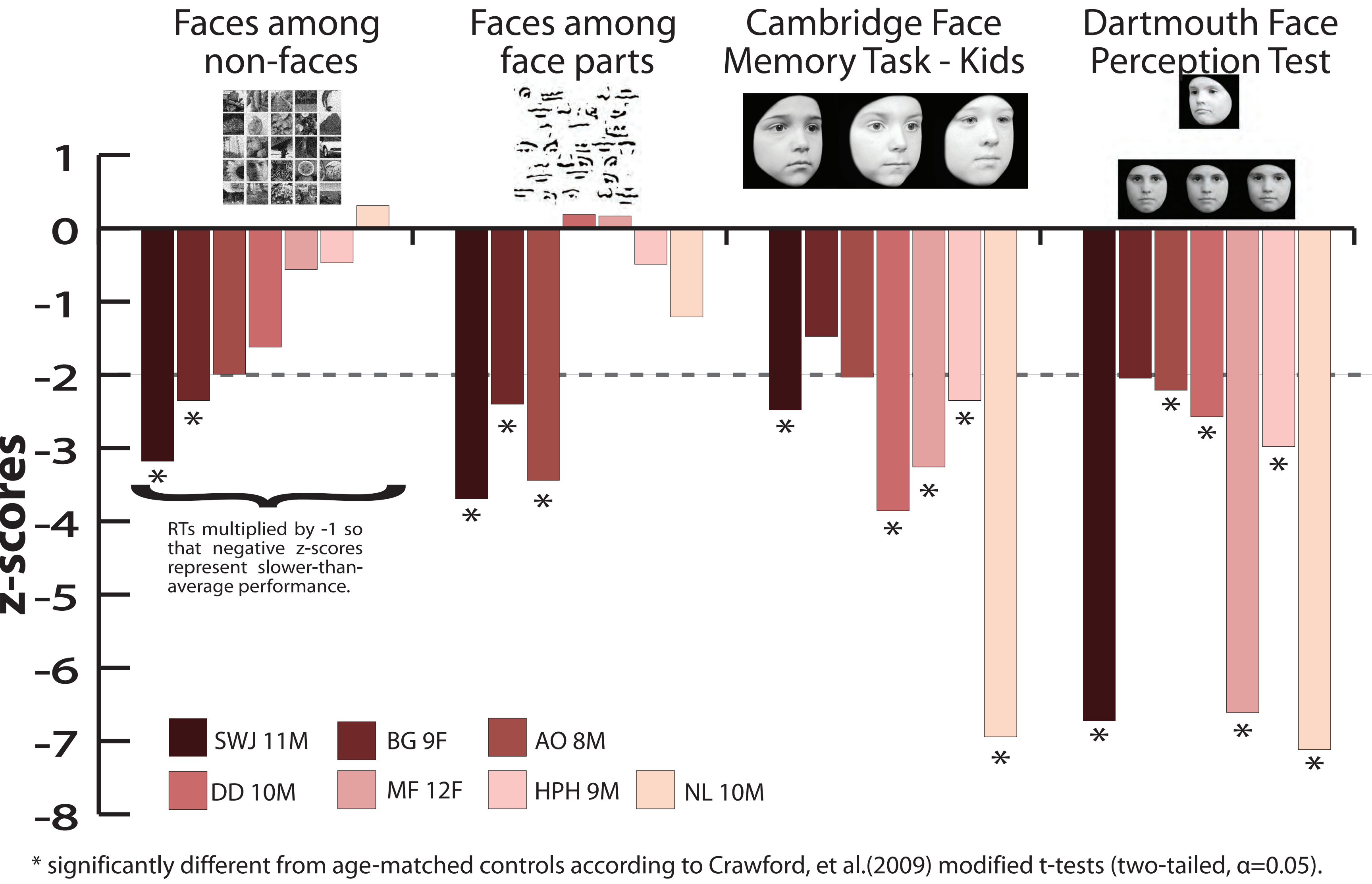
Faces Among Non-faces

Find the face as fast as you can (button press).
If there is no face, don't respond.
36 trials, 24 target-present, 12 target-absent (catch trials).
8s time limit per trial.
Primary measure is reaction time.
Reaction times calculated from correct target-present trials.

Faces Among Face Parts

Is the face on the left or the right side of the screen?
30 trials, 5s time limit per trial.
Chance level performance: 50%

RESULTS



- 4 of 7 children with DP were impaired at face detection to some degree: SWJ, BG, and AO were abnormally slow at finding faces among non-faces, and had poor accuracy for finding faces among face parts. NL had poor accuracy for finding faces among non-face objects (result not pictured).
- The remaining 3 children (DD, MF, and HPH) had normal face detection.

CONCLUSIONS

- The 4 cases with impaired face detection are consistent with the Two-Process Theory account suggesting that DP could result from a failure of face detection.
- The 3 cases with normal detection imply a higher-level origin.
- The dissociation between normal face detection and impaired identity perception also indicates that these abilities depend on different neurocognitive mechanisms.

Dalrymple, K.A. & Duchaine, B. (in press). Impaired face detection may explain some but not all cases of developmental prosopagnosia. *Developmental Science*.