Face learning strategies in typical observers and in developmental prosopagnosia

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Background

- People with developmental prosopagnosia (DP) struggle to recognise people from faces and rely on non-facial cues (e.g. clothing, hairstyle, voice)[1].
- They show poor performance on standard face recognition tests (e.g. Cambridge Face Memory Test) but object recognition is usually preserved[1,2].
- They can perform within normal range on artificial tests that allow simple matching of hairline or eyebrows (e.g. Benton Face Recognition Test)[3].

- Typical observers are not necessarily infallible with faces either: their performance is disrupted by mere changes in appearance between learning and test, even with very familiar faces. Further, they can be fooled by superficial resemblances between people[4,5].

- Subpar performance of both typical and poor recognisers could be explained by cost-efficient face learning mechanisms whereby facial representations rest upon coarse information and are refined (more or mess successfully) if needed to meet task demands (e.g. incorporate changes in appearance over episodic encounters or recognise faces out of context)[5].

Aims & Hypotheses

Aims:

- Compare recognition performance of DP and typical observers after learning faces in rich and dynamic conditions.

- Assess the role of peripheral information (i.e. hairstyle and head shape)

Hypotheses: Both groups should be disrupted by changes in appearance/removal of peripheral information and fooled by foils that resemble learned faces.

Three identities to learn - Viewing of nine 4-second videos, blocked per identity

Learning phase

Methods

Participants

- 30 DP (23F, 7M; $M_{Age} = 37.2 \pm 8$).
- 35 controls (26F, 9M; $M_{Age} = 34.8 \pm 6$), not including 5 with low CFMT scores.

Materials

- Targets: videos and screenshots of 3 youtubers.
- Foils: screenshots of 6 other youtubers, 3 similar and 3 dissimilar looking.

Learning phase: 3 ID x 9 video clips of 4 seconds each + one review slide.
Recognition test: 4 images per ID and condition (Face status, Similarity) shown on the right.

Procedure

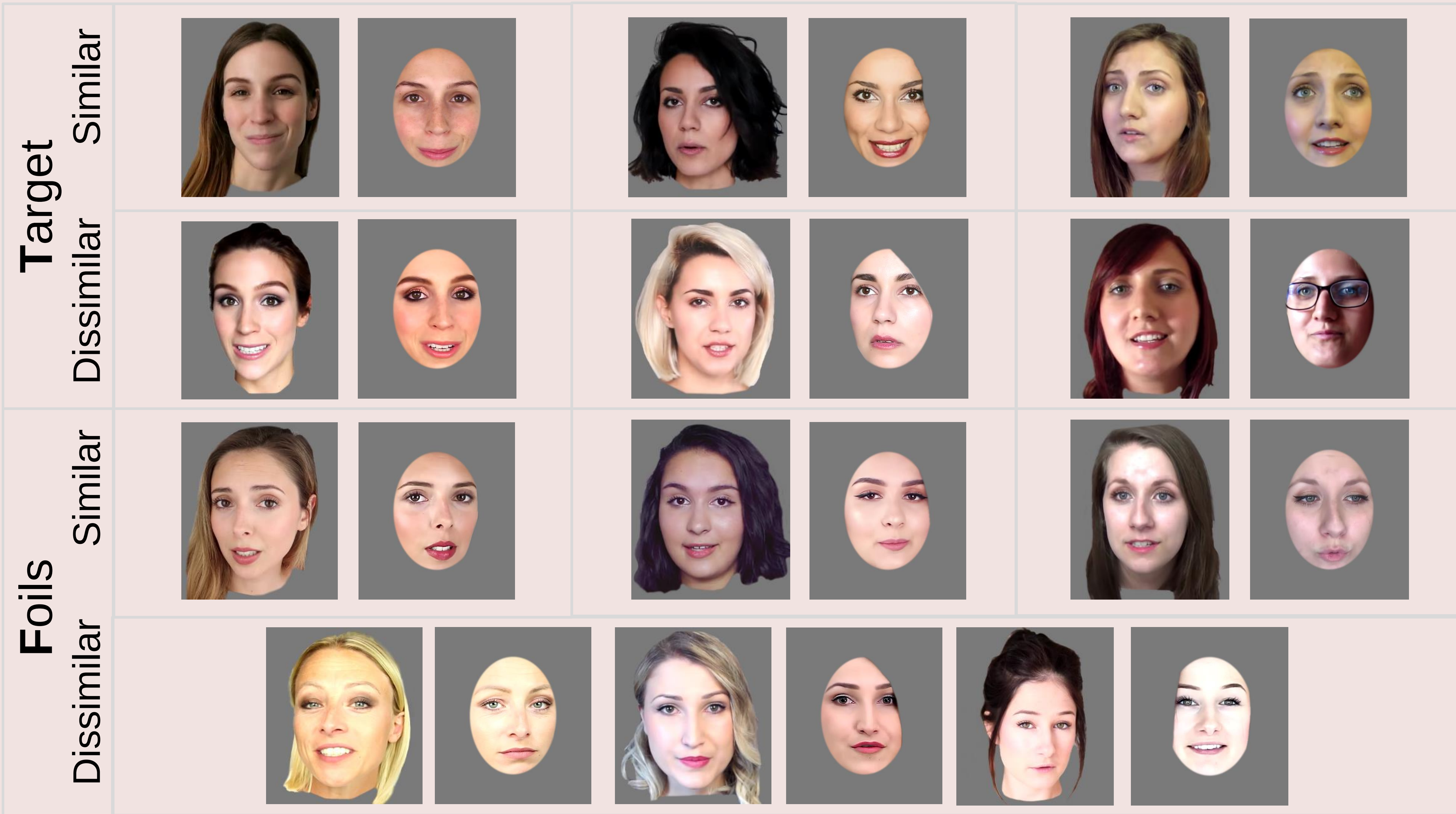
- 3 ID x (Learning block + ratings (agreeableness, attractivity* and memorability*))

- Recognition test: 2 blocks (headshots or cropped images), counterbalanced
  3 ID x 4 images x 4 conditions = 48 trials per block, random order

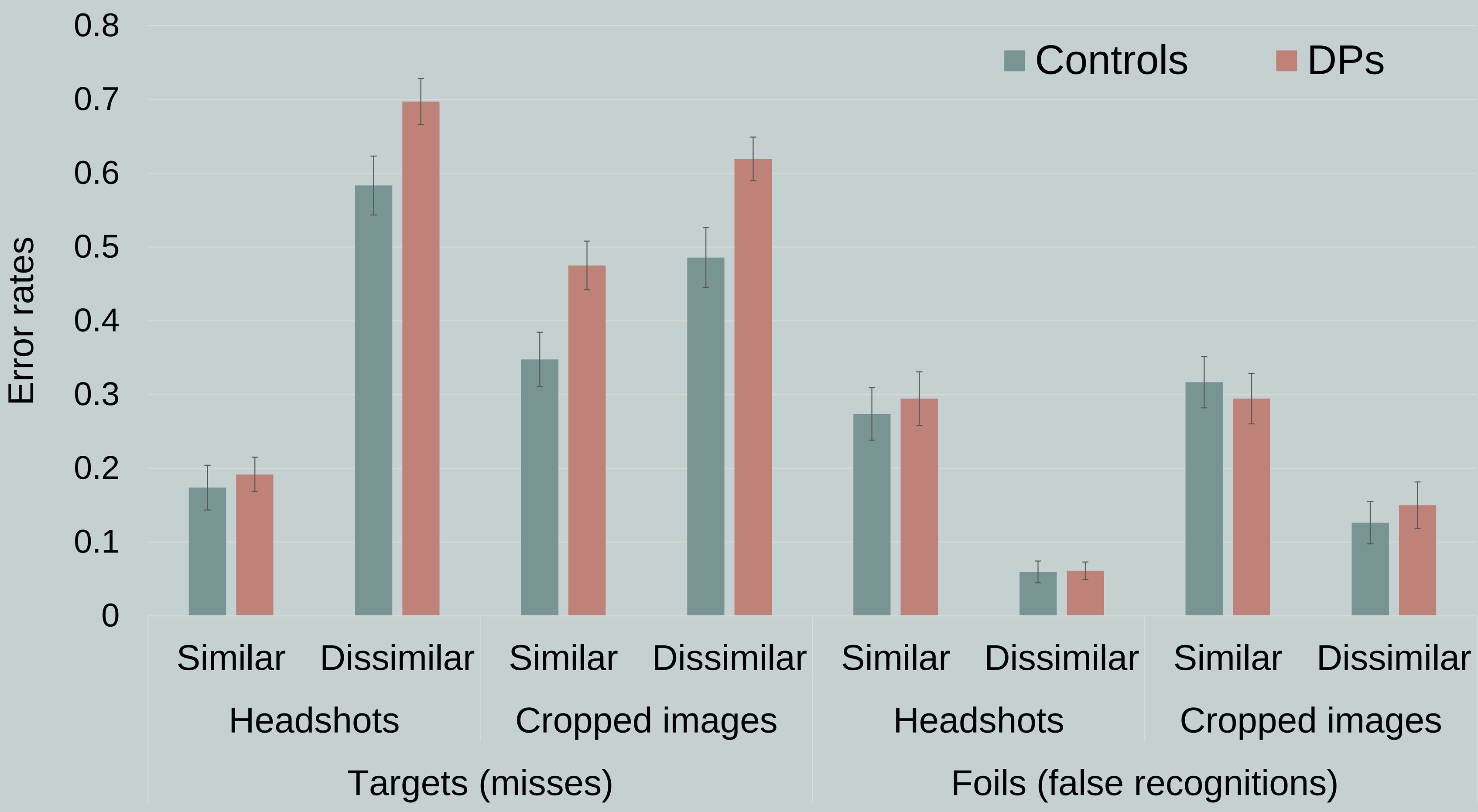
- CFMT*

*DP < controls

Picture conditions in recognition test



Results & Discussion



- **Controls are more accurate** than DP participants, $F(1,63) = 5$, $p = .03$, $\eta_p^2 = .074$

- More errors with cropped images than with headshots, $F(1,63) = 31.4$, $p < .001$, $\eta_p^2 = .333$, but no interaction of Picture type with Group ($F < 2$)

- More errors with dissimilar images than with similar ones, $F(1,63) = 20.02$, $p < .001$, $\eta_p^2 = .241$, but no interaction of Similarity with Group ($F < 2$)

- **More misses than false recognitions**, $F(1,63) = 97.84$, $p < .001$, $\eta_p^2 = .608$, no significant interaction of Face status with group, $F(1,63) = 3.34$, $p = .072$, $\eta_p^2 = .05$

- Face status x Similarity interaction, $F(1,63) = 287.71$, $p < .001$, $\eta_p^2 = .820$, more misses with dissimilar targets and more false alarms with similar foils

→ **People over-rely on gross peripheral information (hairstyle, headshape).**

- Picture type x Similarity interaction, $F(1,63) = 39.65$, $p < .001$, $\eta_p^2 = .386$
- Face status x Picture type x Similarity interaction, $F(1,63) = 78.72$, $p < .001$, $\eta_p^2 = .555$

→ More impact of similarity for target faces, especially when they show peripheral information.

- No significant 4-way interaction, $F(1,63) = 3.395$, $p = .07$, $\eta_p^2 = .051$

Conclusions

Overall, controls are more accurate than people with prosopagnosia.

However, the **pattern of errors is strikingly similar in the two groups**, suggesting that DP represent the tail end of face recognition skills rather than presenting qualitatively different abilities.

In line with a cost-efficient mechanism of face learning[5], **people over-rely on gross information** (e.g. hairstyle) when learning new faces. This is efficient to recognise faces appearing in similar conditions.

People are less likely to recognize known faces when peripheral information changes or is removed. They are also more likely to falsely recognize new faces, based on gross resemblances with known faces.

The specific pattern of errors found here might be due to learning conditions suggesting that peripheral information is reliable : it discriminated identities and was stable across video clips[5].

References

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3. Duchaine, B., & Nakayama, K. (2006). The Cambridge Face Memory Test: Results for neurologically intact individuals and an investigation of its validity using inverted face stimuli and prosopagnosic participants. *Neuropsychologia, 44(4),* 576–585.
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