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The Role of Variability in Appearance, Exposure and Learning Procedure in Dynamic Face Learning

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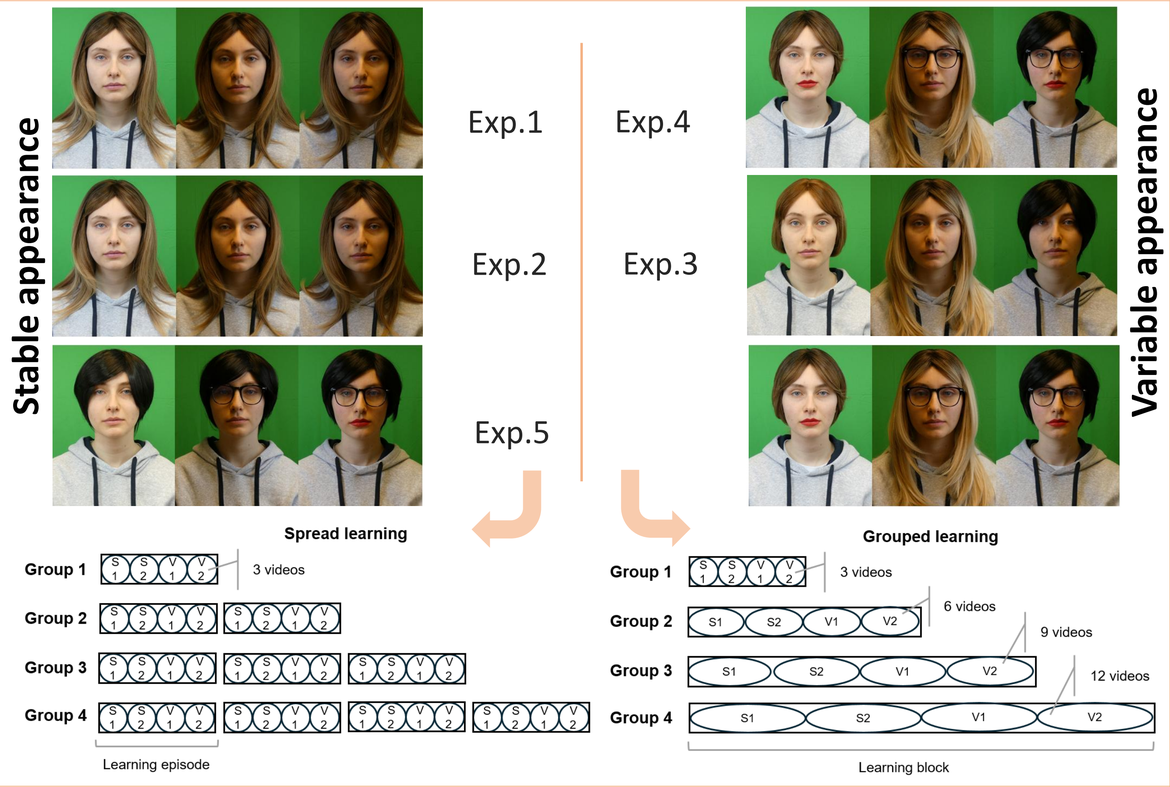
Introduction

- Most face recognition studies with newly learned identities show that exposure to **greater within-person variability enhances recognition**, highlighting variability as a key factor in face learning[1,2] and that face recognition improves with **increasing exposure**[3].
- Building on this, Devue and de Sena (2023) proposed a **coarse-to-fine framework**: stable appearances would help form initial coarse representations, while variable appearances would support gradual refinement[4].
- We tested this framework by manipulating **Appearance variability** (stable vs. variable) across different **Exposure** levels (3 to 12 stimuli). Participants learned faces by means of rich ecological stimuli (video clips involving variations in lighting and gestures), within five experiments using two **Learning procedures** (spread vs. grouped).
- **Grouped learning** matches the tightly controlled blocked presentation style typical of **lab-based face learning**, whereas **spread learning** is more similar to real-world exposure, allowing us to contrast experimental control with ecological validity.
- We expected **a stable face advantage at low exposure**, and hypothesized that **recognition would improve with increased exposure, especially for variable faces**, as more variability encourages costlier, detail-based encoding.

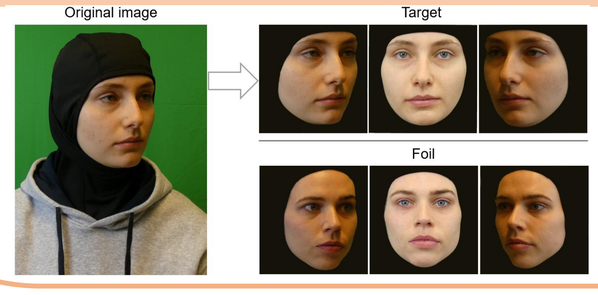
Method

Design Overview: Appearance Stability (2 stable faces and 2 variable faces) x Exposure (3, 6, 9, or 12 learning videos), used in two distinct Learning Procedures (Spread vs. Grouped learning)

Learning phase



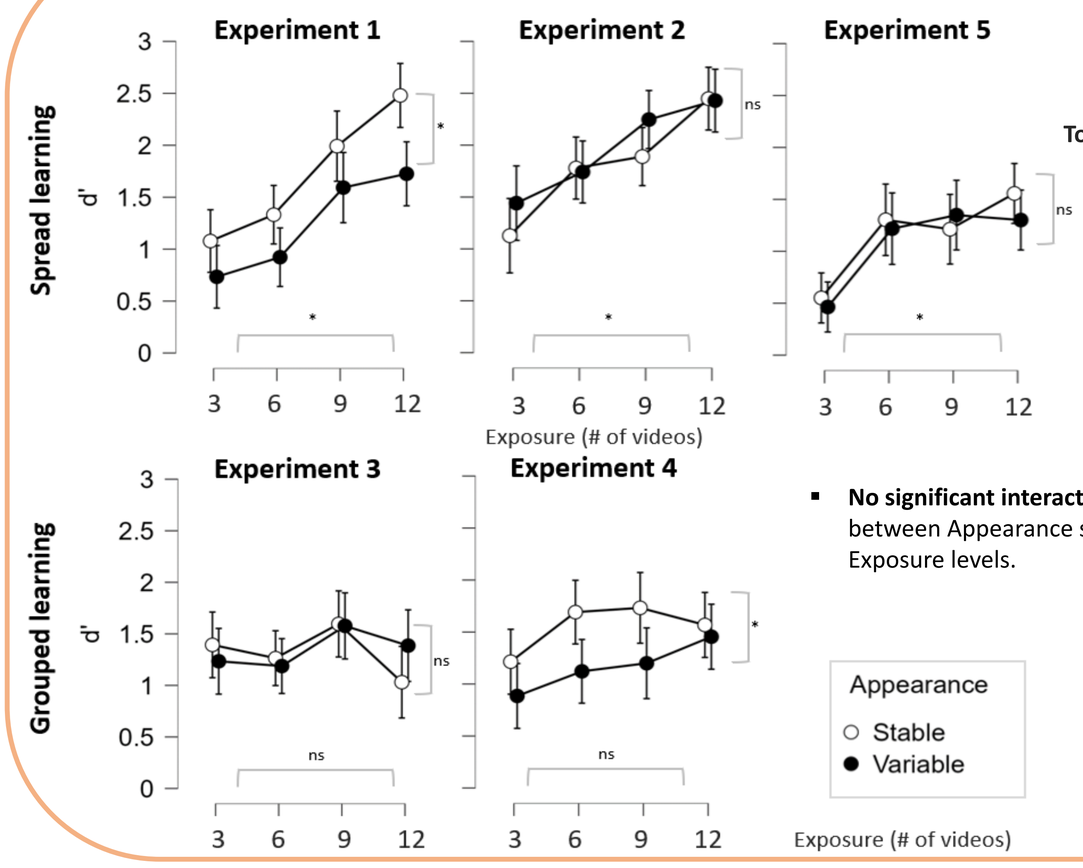
Recognition phase



8 identities (4 targets/4 foils) x 3 images x 3 blocks = 72 trials

Results

Pre-registered analyses

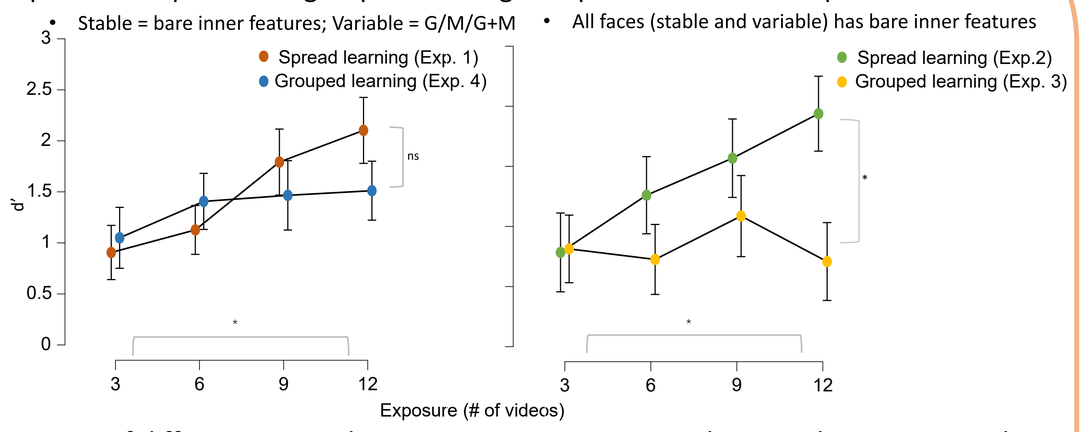


Total sample: 922 participants (≥46 per group)

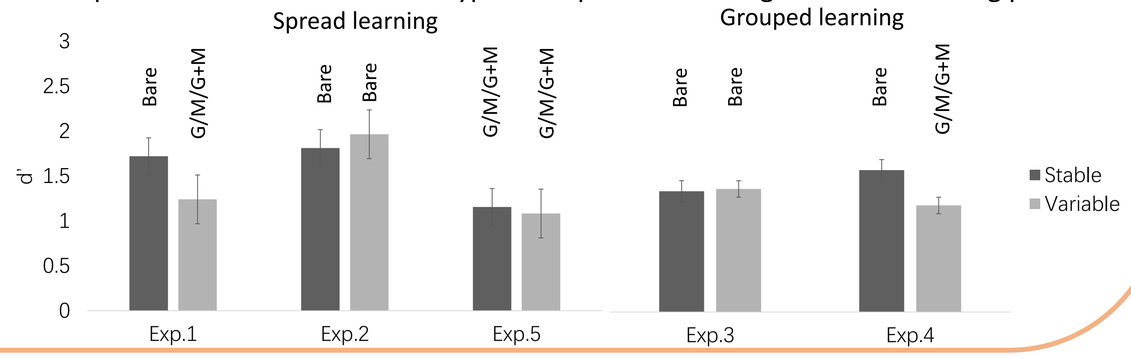
- **No significant interaction** was found between Appearance stability and Exposure levels.

Exploratory analyses

➢ Comparison of spread and grouped learning in experiments with comparable materials.



➢ Comparison of different material types in experiments using the same learning procedure.



Conclusions

- Recognition performance improved with increased exposure but only under a spread learning procedure, which may reflect the fact that distributed encounters foster more durable encoding.
- Unexpectedly, there was no advantage from variations in appearance at higher levels of exposure. Instead, there was a consistent advantage of stability, but only when test images closely resembled the learning materials for stable faces (i.e. bare inner features in both phases).
- These findings highlight the importance of controlling learning procedures and similarity of materials between learning and test in face learning studies.
- Importantly, our findings challenge the assumption that increased within-person variability guarantees better learning outcomes. Rather, stability appears to provide a distinct advantage that goes beyond exposure quantity and interacts with the specific characteristics of the test materials.

1. Koca, Y., & Oriet, C. (2023). From Pictures to the People in Them: Averaging Within-Person Variability Leads to Face Familiarization. *Psychological Science, 34*(2), 252–264.
2. Ritchie, K. L., & Burton, A. M. (2017). Learning faces from variability. *Quarterly Journal of Experimental Psychology, 70*(5), 897–905.
3. Baker, K. A., & Mondloch, C. J. (2023). Unfamiliar face matching ability predicts the slope of face learning. *Scientific Reports*, *13*(1), 5248.
4. Devue, C., & de Sena, S. (2023). The impact of stability in appearance on the development of facial representations. *Cognition*, 239, 105569.

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