Horizontal cues enable viewpoint tolerant recognition of human face identity

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Résumé

The recognition of individual identity despite variations in face appearance is a core and challenging function of the human visual system. Past evidence shows that humans are particularly sensitive to horizontally oriented cues when identifying faces. It is generally assumed that face identification is tuned to horizontal cues because most of the energy (i.e., contrast) in the face image is contained in this orientation range, due to the horizontal structure of the main features (eyes, mouth...). The horizontal range of orientation is also where the front views of faces of different identities differ the most.
Here, we examined whether the preference for horizontal cues when recognizing identity is resistant to changes in viewpoint. Human observers performed an identity recognition task with face stimuli presented under seven different viewpoints by rotating yaw (from full-front view to profile views) and filtered to preserve contrast in selective orientation ranges (from 0○ to 157.5○ in steps of 22.5○). We found that the Gaussian function describing human identification performance as a function of orientation always peaked around the horizontal angle, irrespective of viewpoint.

Using MATLAB-coded model observers, we further show that contrast in the horizontal range conveys the richest cues to identity in full-front views, but less so in 3/4 and profile views. However, we found evidence that the horizontal range provides the identity cues that are the most stable across viewpoints. The comparison of model and human observers' performance shows that the stability of horizontal cues across viewpoints uniquely predicts a significant part of human identification performance.
These results suggest that the horizontal signal in the face enables its viewpoint-tolerant representation and yield novel insight on the strategies developed by the human visual system to achieve invariant face recognition.

Mots-Clés: visual recognition, viewpoint tolerance, identity recognition, face processing

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