Cognitive Neuropsychology

ISSN: 0264-3294 (Print) 1464-0627 (Online) Journal homepage: http://www.tandfonline.com/loi/pcgn20

Face specificity of developmental prosopagnosia, moving beyond the debate on face specificity

Beatrice de Gelder & Jan Van den Stock

To cite this article: Beatrice de Gelder & Jan Van den Stock (2018) Face specificity of developmental prosopagnosia, moving beyond the debate on face specificity, Cognitive Neuropsychology, 35:1-2, 87-89, DOI: 10.1080/02643294.2018.1441818

To link to this article: https://doi.org/10.1080/02643294.2018.1441818

Published online: 16 Apr 2018.

COGNITIVE NEUROPSYCHOLOGY, 2018
VOL. 35, NOS. 1–2, 87–89
https://doi.org/10.1080/02643294.2018.1441818

COMMENTARY

Face specificity of developmental prosopagnosia, moving beyond the debate on face specificity

Beatrice de Gelder[a] and Jan Van den Stock[b]

[a]Faculty of Psychology and Neuroscience, Department of Cognitive Neurosciences, Maastricht University, Maastricht, The Netherlands; [b]Department of Neurosciences, Laboratory for Translational Neuropsychiatry, Leuven, Belgium

ARTICLE HISTORY Received 7 January 2018; Accepted 9 January 2018

Geskin and Behrmann present a literature review and meta-analysis focused on the face-specificity of congenital prosopagnosia (CP). They report that 80% (191/238) of CP cases had an associated face and object recognition deficit and conclude that their findings favour an interpretation of a single mechanism that might support the recognition of more than one, but not all, visual classes (Geskin & Behrmann, 2017).

Since the landmark review of acquired prosopagnosia (Farah, 1990), we have witnessed a major leap forward in research on congenital or developmental prosopagnosia. Yet the very fact that the classic debate on face specificity is still alive testifies to how much remains to be understood about the neural basis of face perception.

The authors restate some important methodological guidelines that we have put forward from the very beginning in our work with acquired (de Gelder, Bachoud-Levi, & Degos, 1998) and developmental prosopagnosics (de Gelder & Rouw, 2000a, 2000b, not covered by the target article), namely that a valid assessment of the face-specificity of visual deficits in CP requires that face and non-face recognition tasks be matched for stimulus complexity and processing demands. These include ensuring that all recognition tasks are at the exemplar level, and that processing taps into the major dimensions that are important for face recognition, based on the state of the art (configural processing, inversion effect, part–whole matching). Using test batteries such as the Birmingham Object Recognition Battery (BORB) (Riddoch & Humphreys, 1993) allows evaluation of low-level to higher level vision and visual cognition, but obviously does not address what could be the core deficit of prosopagnosia. After many testing sessions with acquired and developmental prosopagnosics, we standardized this approach. The Facial Expressive Action Stimulus Test (FEAST) combines parallel procedures to assess faces and several object categories (shoes and houses) under several parallel tasks (upright and inverted identity matching and part-to-whole matching) (de Gelder, Huis in 't Veld, & Van den Stock, 2015). The FEAST also includes an assessment of facial emotion processing, which can be compared to identity recognition, but also to recognition of emotions in body stimuli. This is of particular relevance for faces, as bodies constitute a visual object category that shares many dimensions with faces, such as gender, emotion and identity (de Gelder & Van den Stock, 2011). In line with this, the assessment of the nature of the face deficit—that is, whether it relates to perception or memory of identity, emotion, gender, etc.—requires procedures with similar sensitivity (Biotti & Cook, 2016; Van den Stock, 2017). Other instruments have focused on comparing face memory with memory for other objects categories, such as cars (Dennett et al., 2012; Duchaine & Nakayama, 2006).

All of the above issues relate to putative subtypes of prosopagnosia—e.g., apperceptive and associative prosopagnosia. While the former is typically associated with deficits in face discrimination, the latter reflects deficits in accessing stored representations of individual faces, such as familiarity or name. This distinction has been put forward based on anecdotal reports of subjects with acquired prosopagnosia, and there is evidence that apperceptive prosopagnosia is associated with damage to posterior occipito-temporal regions, while associative prosopagnosia typically results from anterior temporal lesions (de

CONTACT Beatrice de Gelder b.degelder@maastrichtuniversity.nl; Jan Van den Stock jan.vandenstock@med.kuleuven.be

Gelder & Van den Stock, 2015; De Renzi, Faglioni, Grossi, & Nichelli, 1991). There is emerging evidence that similar phenotypes may be present in CP (Biotti & Cook, 2016).

Furthermore, a third variant has been proposed that displays selective deficits in face memory—that is, prosopamnesia—and this has also been reported in CP cases (Ulrich et al., 2017). Interestingly, perceptual configural processing abilities are associated with face memory performance in CP (Huis in 't Veld, Van den Stock, & de Gelder, 2012). Of note here, one of the most severe cases of prosopagnosia we encountered appeared to show reduced volume in the cerebellum, more specifically in a region that has been associated with face memory (Van den Stock, Vandenbulcke, Zhu, Hadjikhani, & de Gelder, 2012). It could be argued that abnormalities in upstream visual areas result in more general and hence less category-specific deficits than do abnormalities in downstream visual areas. In line with this, we had previously observed abnormal functional specificity in CP in posterior category sensitive areas. The extrastriate body area (EBA) responded more to faces in the CP group than in the control group (Van den Stock, van de Riet, Righart, & de Gelder, 2008). This reduced posterior selectivity in CP is supported by reports of abnormal configural processing of body postures (Righart & de Gelder, 2007) and impaired body recognition in CP (Biotti, Gray, & Cook, 2017; Moro et al., 2012).

As we noted at the outset, we still do not fully understand the neural basis of face perception in normal adults. And as long as that is the case, the search for a sufficiently sensitive and valid test is still on. Recent studies, so far mainly conducted in animals, have shown convincingly that face perception is sustained not by a single face module in fusiform cortex, nor by a second/secondary face area (OFA), but by a whole range of cortical face patches (Tsao, Schweers, Moeller, & Freiwald, 2008). Future research needs to understand the respective functions of these different patches and their network organization and how each contributes to what, on the surface, seems like a homogeneous face recognition skill. It is to be expected that this will throw an entirely novel light on the neural basis of face perception and its deficits. Progress in understanding the neural network basis of face perception will require a range of comparisons, task contrasts, and control object categories that are different from those currently used, which are taken from common-sense ontology. Furthermore, a more complex situation may emerge when the field moves from the use of still images to dynamic and more naturalistic stimuli. We may be on the verge of a whole new perspective on face (and object) perception.

As a consequence, the traditional association–dissociation methodology will likely need to be revised. Presumably, at the behavioural level and at the level of traditional neuropsychological tests, everyday object categories now in use (tools, shoes, glasses, houses, cars, etc.) will remain useful, as they allow people with deficits to describe their experiences and their troubles subjectively and phenomenologically. Our traditional continuum from mild to severe face vs. object deficit is fine as a subjective description, but not as a pointer to underlying processes. As distinctions at the sub-category or feature level that are much closer to the neural mechanisms become better understood, more targeted comparisons will hopefully become the norm. For instance, increasing insight in hierarchy and transparency in the neural correlates underlying object identification may drive test development assessing more specific behavioural mechanisms corresponding to neural processing. For instance, understanding the neural computations that support object segregation in visual scenes, the coding of viewer-independency of either faces or non-face objects, or the matching of visual input to memory registry, may be evaluated using stimuli and tasks that maximally tap into specific sub processes with minimal dependency on upstream or parallel processes. This will then also entail a new perspective on developmental deficits. These may be related not only to abnormal trajectories in infancy, but equally to changes occurring in old age of skills that were normally developed throughout infancy and adulthood (Murray, Halberstadt, & Ruffman, 2010).

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

BdG is supported by the European Research Council (ERC: Advanced Grant FP7/2007-2013: 295673) and JVdS is supported by KU Leuven (Starting Grant).

References

Biotti, F., & Cook, R. (2016). Impaired perception of facial emotion in developmental prosopagnosia. *Cortex*, *81*, 126–136. doi:10.1016/j.cortex.2016.04.008

Biotti, F., Gray, K. L. H., & Cook, R. (2017). Impaired body perception in developmental prosopagnosia. *Cortex*, *93*, 41–49. doi:10.1016/j.cortex.2017.05.006

de Gelder, B., Bachoud-Levi, A. C., & Degos, J. D. (1998). Inversion superiority in visual agnosia may be common to a variety of orientation polarised objects besides faces. *Vision Research*, *38*(18), 2855–2861.

de Gelder, B., Huis in 't Veld, E., & Van den Stock, J. (2015). The facial expressive action stimulus test. A test battery for the assessment of face memory, face and object perception, configuration processing, and facial expression recognition. *Frontiers in Psychology*, 6, 1609. doi:10.3389/fpsyg.2015.01609

de Gelder, B., & Rouw, R. (2000a). Paradoxical configuration effects for faces and objects in prosopagnosia. *Neuropsychologia*, *38*(9), 1271–1279.

de Gelder, B., & Rouw, R. (2000b). Structural encoding precludes recognition of parts in prosopagnosia. *Cognitive Neuropsychology*, *17*, 89–102.

de Gelder, B., & Van den Stock, J. (2011). The bodily expressive action stimulus test (BEAST). Construction and validation of a stimulus basis for measuring perception of whole body expression of emotions. *Frontiers in Psychology*, *2*, 181. doi:10.3389/fpsyg.2011.00181

de Gelder, B., & Van den Stock, J. (2015). Prosopagnosia. In J. D. Wright (Ed.), *International encyclopedia of the social & behavioral sciences (second edition)* (pp. 250–255). Oxford: Elsevier.

Dennett, H. W., McKone, E., Tavashmi, R., Hall, A., Pidcock, M., Edwards, M., & Duchaine, B. (2012). The cambridge Car memory test: A task matched in format to the cambridge face memory test, with norms, reliability, sex differences, dissociations from face memory, and expertise effects. *Behavior Research Methods*, *44*(2), 587–605. doi:10.3758/s13428-011-0160-2

De Renzi, E., Faglioni, P., Grossi, D., & Nichelli, P. (1991). Apperceptive and associative forms of prosopagnosia. *Cortex*, *27*(2), 213–221.

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.

Farah, M. (1990). *Visual agnosia: Disorders of visual recognition and what they tell us about normal vision*. Cambridge: MIT Press.

Geskin, J., & Behrmann, M. (2017). Congenital prosopagnosia without object agnosia? A literature review. *Cognitive Neuropsychology*, 29, 1–51. doi:10.1080/02643294.2017.1392295

Huis in 't Veld, E., Van den Stock, J., & de Gelder, B. (2012). Configuration perception and face memory, and face context effects in developmental prosopagnosia. *Cognitive Neuropsychology*, *29*(5-6), 464–481. doi:10.1080/02643294.2012.732051

Moro, V., Pernigo, S., Avesani, R., Bulgarelli, C., Urgesi, C., Candidi, M., & Aglioti, S. M. (2012). Visual body recognition in a prosopagnosic patient. *Neuropsychologia*, *50*(1), 104–117. doi:10.1016/j.neuropsychologia.2011.11.004

Murray, J. E., Halberstadt, J., & Ruffman, T. (2010). The face of aging: Sensitivity to facial feature relations changes with age. *Psychology and Aging*, *25*(4), 846–850. doi:10.1037/a0019864

Riddoch, M. J., & Humphreys, G. W. (1993). *Birmingham object recognition battery*. Hove: Psychology Press.

Righart, R., & de Gelder, B. (2007). Impaired face and body perception in developmental prosopagnosia. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(43), 17234–17238.

Tsao, D. Y., Schweers, N., Moeller, S., & Freiwald, W. A. (2008). Patches of face-selective cortex in the macaque frontal lobe. *Nature Neuroscience*, *11*(8), 877–879.

Ulrich, P. I., Wilkinson, D. T., Ferguson, H. J., Smith, L. J., Bindemann, M., Johnston, R. A., & Schmalzl, L. (2017). Perceptual and memorial contributions to developmental prosopagnosia. *Quarterly Journal of Experimental Psychology*, *70*(2), 298–315. doi:10.1080/17470218.2016.1177101

Van den Stock, J. (2017). Interaction between identity and emotion vs visual basic object recognition deficits: A commentary on Biotti & Cook. *Cortex*, in press.

Van den Stock, J., Vandenbulcke, M., Zhu, Q., Hadjikhani, N., & de Gelder, B. (2012). Developmental prosopagnosia in a patient with hypoplasia of the vermis cerebelli. *Neurology*, *78*(21), 1700–1702. doi:10.1212/WNL.0b013e3182575130

Van den Stock, J., van de Riet, W. A., Righart, R., & de Gelder, B. (2008). Neural correlates of perceiving emotional faces and bodies in developmental prosopagnosia: An event-related fMRI-study. *PLoS One*, *3*(9), e3195. doi:10.1371/journal.pone.0003195