COGNITIVE NEUROPSYCHOLOGY, 2018
VOL. 35, NOS. 1–2, 80–82
https://doi.org/10.1080/02643294.2017.1414691

Routledge
Taylor & Francis Group

Check for updates

COMMENTARY

What do associations and dissociations between face and object recognition abilities tell us about the domain-generality of face processing?

Martin Eimer

Department of Psychological Sciences, Birkbeck, University of London, London, UK

ARTICLE HISTORY Received 1 November 2017; Revised 23 November 2017; Accepted 30 November 2017

Individuals with congenital or developmental prosopagnosia (CP/DP) find it hard to recognize faces. How face-specific is this deficit? The extensive review of research on CP by Geskin and Behrmann (G&B) addressed this question, and produced three main insights. A large proportion of individuals with CP also show (sometimes mild) object recognition impairments. The severity of face and object recognition deficits appears to be correlated across individuals. But about one third of all CPs do not show any evidence of impaired object recognition. Given this complex pattern of associations and dissociations between face and object processing in CP, G&B are appropriately cautious in drawing any firm conclusions about the modularity or domain-generality of the underlying systems. However, their observation that associations between face and object recognition problems appear to be more common than dissociations leads them to suggest that a shared domain-general recognition system may be involved in most cases. Demonstrating the existence of such associations is important, and the factors that produce them need to be carefully investigated. In this commentary, I will discuss reasons why associations and correlations between individual face and object recognition impairments do not necessarily imply that the underlying systems are domain-general.

The data reviewed by G&B come from behavioural tests of face and object recognition, and inferences drawn from such tests can always be challenged on methodological grounds. One problem is that there is as yet no general agreement as to which tests are best suited to assess face recognition impairments in individuals with CP. Efforts are currently under way to develop a standardized set of diagnostic criteria for CP which can be applied consistently in future investigations (e.g., Barton & Corrow, 2016). To demonstrate links or dissociations between face and object recognition deficits in CP, it is equally important to agree on an analogous set of test procedures for the assessment of object recognition abilities. Here, we face the obvious difficulty of equating face and object recognition tests with respect to general factors that are unrelated to the core mechanisms of face and object recognition. As noted by G&B, such tests may differ in their demands on low-level visual mechanisms, memory, and decision-related processes, although these problems could be overcome by developing new face and object recognition tests that equate these demands as closely as possible. On such example is the Cambridge Car Memory Test (CCMT; Dennett et al., 2012) which was designed to match the format of the widely used Cambridge Face Memory Test (CFMT). But there are other factors such as the effects of expertise on visual processing or the ability of particular object categories to engage attention that are harder if not impossible to match fully. When interpreting associations or dissociations between face and object recognition deficits revealed by behavioural tests, it is always prudent to consider the possibility of systematic biases introduced by these measurement tools.

To minimize the risk of such biases, we not only need more data from carefully designed and matched behavioural tests, but also different measures of intact and impaired face and object processing. For example, eye tracking studies can be useful to assess how CPs visually explore faces and objects, and can identify atypical gaze patterns that may or may not be specific to faces (e.g., Schwarzer

CONTACT Martin Eimer m.eimer@bbk.ac.uk
© 2017 Informa UK Limited, trading as Taylor & Francis Group

et al., 2007). Using on-line electrophysiological recordings (EEG or MEG), neural processes involved in face and object perception and recognition can be tracked with high temporal precision in real time to identify face-selective and domain-general processing impairments in CP. Behavioural measures can only document the existence of face or object recognition deficits, but electrophysiological markers such as face-sensitive event-related potential (ERP) components have the potential to dissociate different perceptual or post-perceptual stages where these deficits emerge. ERP studies have revealed systematic differences between CPs and control participants at the group level (see Towler, Fisher, & Eimer, 2017, for a review), but also considerable differences between individual CPs. Such individual differences in ERP markers of face processing can be informative: Correlating them with behavioural patterns of associations and dissociations between face and object processing may help to identify the roles of domain-specific versus domain-general factors, and to determine whether distinct subtypes of CP exist. Generally, additional on-line measures of face processing deficits obtained with eye tracking or ERPs will be most valuable when they are combined with well-designed behavioural tests.

In spite of the methodological caveats associated with interpreting behavioural data from face and object recognition tests, it is difficult to dispute G&B's main conclusion that many (but not all) CPs also have problems in recognizing non-face objects. It would clearly be misguided to regard CP as a "pure" condition that specifically and exclusively affects face recognition. But do such links between face and object recognition impairments provide good evidence that a single shared domain-general system is involved, as tentatively suggested by G&B? An obvious counterargument is that such associations could also be produced by domain-general mechanisms that affect both face and object processing. G&B acknowledge this possibility, and discuss the involvement of higher-level cognitive mechanisms. Individual differences in cognitive speed, verbal or spatial IQ, or memory capacity could result in associations of face and object recognition performance. The impact of such general cognitive factors could in principle be assessed independently in order to be excluded from estimates of face and object recognition abilities. However, there are other domain-general processes at earlier sensory-perceptual levels that can affect both face and object recognition. Because these processes provide input to face and object recognition mechanisms, deficits at this early level may result in associated recognition problems. One possibility is that individuals with and without CP show systematically different gaze patterns during the exploration of faces and objects, which would affect the visual input to face and object recognition systems. Of course, such atypical eye movement patterns might themselves be the product of an underlying visual deficit, in which case they would be a symptom rather than the cause of the perceptual problems that eventually result in impaired face recognition. Another possibility is that the early sensory processing of some visual features operates atypically in CP. For example, a recent study from our lab that measured N170 components as ERP markers of perceptual face processing found that individuals with CP were less sensitive than age-matched control participants to changes in the contrast polarity of face images (Fisher, Towler, & Eimer, 2016). This suggests that sensory mechanisms responsible for the extraction of contrast-related signals might be impaired in CP. Such signals are important for successful face recognition (in particular when they come from the eyes; Gilad, Meng, & Sinha, 2009), but are still domain-general because they can also contribute to the recognition of non-face objects. Individuals with CP may be generally impaired in extracting and using these signals, although this has not yet been investigated with non-face objects. This would strongly affect their face recognition which is dependent on contrast-related information, but may also produce some impairment in object recognition, to the degree that contrast information facilitates the recognition of particular types of objects.

More generally, a deficit in domain-general mechanisms (such as eye gaze control or contrast polarity processing) that operate prior to face and object recognition and provide input signals to both of these systems can produce the patterns of associated face and object recognition deficits reported by G&B. The severity of these deficits will depend on how much face and object recognition systems rely on appropriate input provided by these domain-general systems. For example, successful face recognition is likely to depend strongly on specific fixation patterns or detailed contrast signals from the eye region, whereas object recognition may be more robust when these types of perceptual signals are suboptimal. This would result in a pattern of strongly impaired face recognition accompanied by moderate impairments of object recognition, as seems to be the case for many individuals with CP. Moreover, the degree to which face and object recognition are impaired would be expected to be correlated across individuals, reflecting the degree to which domain-general input signals are disrupted. In this case, the associations and correlations between face and object recognition deficits reported by G&B cannot be interpreted as evidence for a single shared system for face and object recognition. The same pattern would be consistent with the existence of separate and strictly modular systems, as long as both systems rely on input signals from the same domain-general sensory mechanisms. Of course, this argument cuts both ways: If face recognition impairments in CP were caused by disrupted domain-general sensory mechanisms, these impairments would not provide any support for the existence of a dedicated face processing module.

The hypothesis that CP is the result of domain-general sensory-perceptual deficits predicts that CP should always be associated with object recognition impairments, reflecting the reduced quality of sensory inputs to both face and object recognition systems. This is clearly not the case, as many individuals with CP do not show any object recognition problems. B&G suggest that about one third of all CPs have typical object recognition abilities. They speculate that individuals with and without associated object recognition impairments may represent two different subtypes of CP. This is an interesting possibility that deserves careful scrutiny, as these subtypes could be linked to the presence versus absence of domain-general deficits. Face and object recognition deficits may be associated in individuals with impaired sensory-perceptual mechanisms, but dissociated in CPs with a genuinely face-specific impairment that affects the post-perceptual detection and discrimination of facial identity. These subtypes may be difficult to distinguish with behavioural tests, but could in principle be dissociated with electrophysiological markers (see Eimer, Gosling, & Duchaine, 2012, for dissociations between individual CPs in their identity-sensitive brain responses to famous faces which they fail to recognize).

The literature review conducted by G&B is certain to stimulate discussion about the profile of impairments that is typically found in CP, and about the modular versus domain-general nature of face and object recognition. It is clear that many individuals with CP have recognition problems that are not entirely face-specific, and the implications of this observation for the functional organization of visual object recognition systems will remain the subject of intense debate.

Disclosure statement

No potential conflict of interest was reported by the author.

References

Barton, J. J., & Corrow, S. L. (2016). The problem of being bad at faces. *Neuropsychologia*, *89*, 119–124.

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*, 587–605.

Eimer, M., Gosling, A., & Duchaine, B. (2012). Electrophysiological markers of covert face recognition in developmental prosopagnosia. *Brain*, *135*, 542–554.

Fisher, K., Towler, J., & Eimer, M. (2016). Reduced sensitivity to contrast signals from the eye region in developmental prosopagnosia. *Cortex*, *81*, 64–78.

Gilad, S., Meng, M., & Sinha, P. (2009). Role of ordinal contrast relationships in face encoding. *Proceedings of the National Academy of Sciences*, *106*, 5353–5358.

Schwarzer, G., Huber, S., Grüter, M., Grüter, T., Groß, C., Hipfel, M., & Kennerknecht, I. (2007). Gaze behaviour in hereditary prosopagnosia. *Psychological Research*, *71*, 583–590.

Towler, J., Fisher, K., & Eimer, M. (2017). The cognitive and neural basis of developmental prosopagnosia. *The Quarterly Journal of Experimental Psychology*, *70*, 316–344.