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Congenital prosopagnosia without object agnosia? A literature review

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ABSTRACT

A longstanding controversy concerns the functional organization of high-level vision, and the extent to which the recognition of different classes of visual stimuli engages a single system or multiple independent systems. We examine this in the context of congenital prosopagnosia (CP), a neurodevelopmental disorder in which individuals, without a history of brain damage, are impaired at face recognition. This paper reviews all CP cases from 1976 to 2016, and explores the evidence for the association or dissociation of face and object recognition. Of the 238 CP cases with data permitting a satisfactory evaluation, 80.3% evinced an association between impaired face and object recognition whereas 19.7% evinced a dissociation. We evaluate the strength of the evidence and correlate the face and object recognition behaviour. We consider the implications for theories of functional organization of the visual system, and offer suggestions for further adjudication of the relationship between face and object recognition.

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One of the longstanding controversies in the neuropsychology literature concerns the functional organization of high-level vision, and the extent to which the recognition of different classes of visual stimuli (for example, faces, words, and common objects) engages a single domain-general mechanism or multiple, independent underlying psychological and neural mechanisms. The distributed view of cortical function suggests that object discrimination depends on dispersed regions spread across visual cortex, some of which may support the recognition of more than one stimulus class (e.g., Behrmann & Plaut, 2015; Haxby et al., 2001; O'Toole, Jiang, Abdi, & Haxby, 2005; Robinson, Plaut, & Behrmann, 2017). In contrast, the more modular account proposes that different categories of objects are represented in and processed by functionally distinct cortical regions (e.g., Kanwisher, 2017; McKone, Crookes, Jeffery, & Dilks, 2012; McKone & Kanwisher, 2005). Of course, there are also various alternatives that fall in between these extreme positions—for example, it is possible that the organization is one in which subclusters of visual classes are subserved by the same underlying mechanism (for example, configural processing) or is one in which inputs from a single visual class are processed by a small cluster of adjacent regions perhaps interleaved with other subclusters mediating other classes of input, as evident from high-resolution functional imaging studies (e.g., McGugin, Gatenby, Gore, & Gauthier, 2012a).

This domain-specific versus domain-general controversy has played out in almost all domains of cognitive neuroscience, oftentimes with vigorous debate (Gauthier, 2017a; Kanwisher, 2017), and many investigations have addressed this issue using neuroimaging (e.g., Gauthier, Skudlarski, Gore, & Anderson, 2000; Tarr & Gauthier, 2000; Yovel & Kanwisher, 2004), electrophysiological measures (e.g., Allison, McCarthy, Nobre, Puce, & Belger, 1994; Carmel & Bentin, 2002), imaging studies in non-human primates (e.g., Arcaro & Livingstone, 2017; Chang & Tsao, 2017; Landi & Freiwald, 2017), and investigations of neuropsychological cases. Full coverage of this debate is beyond the scope of this review but many comprehensive papers are available (Grill-Spector & Weiner, 2014; Kravitz, Saleem, Baker, Ungerleider, & Mishkin, 2013).

With respect to neuropsychological investigations, this topic has received especially pointed attention in discussions of acquired prosopagnosia (AP), an impairment of face recognition in premorbidly normal individuals following a brain lesion, with the critical question being whether this disorder is limited to the

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recognition of faces or is, instead, more general, affecting the recognition of other non-face visual classes as well. On the one hand, many investigations of AP have argued for domain specificity in which the impairment is restricted to the perception of faces (Barton, 2008; Busigny & Rossion, 2010; Riddoch, Johnston, Bracewell, Boutsen, & Humphreys, 2008), and 27 cases of prosopagnosia without an accompanying deficit in object recognition (object agnosia) are listed in the literature review by Farah (1991). On the other hand, the results of many studies favour a more domain-general explanation for the prosopagnosia deficit and have reported an impairment not only for face recognition but for the recognition of other stimuli, as well (e.g., Bukach, Bub, Gauthier, & Tarr, 2006; Gauthier, Behrmann, & Tarr, 1999; for recent review, see Barton & Corrow, 2016b) and 37 cases of prosopagnosia with an additional recognition deficit are identified in the review by Farah (1991). Whereas the former finding of domain-specificity is more compatible with the brain being organized into modules, each with a circumscribed function as proposed by, for example, Fodor (1983) or Lenneberg (1967), the latter is more suggestive of an organization that may be contingent on a more general mechanism, such as the sensitivity to curvature (Nasr, Echavarria, & Tootell, 2014; Ponce, Hartmann, & Livingstone, 2017) or spatial frequency (Woodhead, Wise, Sereno, & Leech, 2011) or the reliance on holistic processing (Richler, Palmeri, & Gauthier, 2012). Understanding the functional organization of the visual system is critical from a theoretical point of view but also from a translational perspective in that a precise characterization of the deficits and their underlying mechanism may be of value in customizing rehabilitation approaches for those with visuoperceptual disorders (e.g., Woodhead et al., 2013).

In an effort to shed further light on the question of structure–function relations in high-level vision, the current paper examines the visual recognition behaviour of individuals with congenital prosopagnosia, a disorder that, although recognized several decades ago (e.g., Temple, 1992), is currently receiving considerable scientific attention. Congenital prosopagnosia (CP) is a lifelong neurodevelopmental disorder in which face recognition is impaired, despite otherwise normal vision and intelligence. Importantly, in contrast with AP in which the face recognition deficit is a direct consequence of brain damage such as traumatic brain injury or stroke, CP patients have no history of brain damage or any other obvious neurological disorder (for recent reviews of this disorder, see Barton & Corrow, 2016a; Cook & Biotti, 2016; Grill-Spector, Weiner, Kay, & Gomez, 2017).

Some authors use the term “developmental prosopagnosia” (DP) to refer to these cases but because some of the reported DP cases do have brain damage, we have opted for the term CP instead. However, we do use DP as an abbreviation in the text or appendices if other authors have used that designation to refer to their participants. Also, because, in the majority of cases, we cannot confirm the hereditary nature of the deficit (which is usually labelled as “hereditary prosopagnosia”; HP), we opt for CP rather than HP, as CP is agnostic with respect to an explicit hereditary component (for papers on heritability of face perception, see Shakeshaft & Plomin, 2015; Wilmer et al., 2010; Zhu et al., 2010).

The aim of the current paper, then, is to provide a survey of the existing literature on CP to elucidate the nature of the relationship between impairments in face and non-face object recognition and, in so doing, to characterize the functional architecture of visual recognition. In addition to addressing this scientific question, we also evaluate the methodological approach to data collection in such individuals, carry out a meta-analysis of the findings, and offer some suggestions that might allow for a more directed approach to testing the hypotheses. We start by providing some context from neuropsychology and identifying methodological challenges to the survey approach, before presenting the method and findings of our investigation.

The Farah approach

As noted above, neuropsychological investigations have explored the association or dissociation between the recognition of different classes of visual stimuli. For example, the relationship between the recognition of faces versus other visual stimuli such as objects and words has been assessed in several cases of AP (e.g., Busigny, Graf, Mayer, & Rossion, 2010; De Renzi, 1986; McNeil & Warrington, 1991, 1993; Sergent & Signoret, 1992; and for review see Barton & Corrow, 2016b; Young & Perrett, 1992). In a meta-analysis of the literature in the early 1990s, Farah (1991, 1992, 1994) examined the co-occurrence of deficits in the recognition of faces, words, and objects in 99 published reports of acquired agnosia. The pattern that emerged from this review was that there were no reported cases of prosopagnosia *without* concurrent object agnosia or of alexia (acquired reading deficit in premorbidly literate individuals) *without* concurrent object agnosia; that is, there was no three-way dissociation. Based on these findings, Farah proposed that visual recognition relies on two, rather than three, underlying representational capacities: one that processes visual input in a more gestalt fashion and engages in holistic recognition, and the other that processes input in a more segmental or part-based manner. These findings led to the specific prediction that there should never be a case of object agnosia without either prosopagnosia or alexia (as object recognition will always engage either the more holistic or more part-based system). This prediction, however, has not been borne out, and studies of such cases have subsequently been published (e.g., Behrmann, Moscovitch, & Winocur, 1994; Buxbaum, Glosser, & Coslett, 1998; Moscovitch, Winocur, & Behrmann, 1997; Rumiati & Humphreys, 1997). Although the theory does not account for all the cases, the Farah meta-analysis offered a testable hypothesis regarding the functional organization of visual object recognition, and inspired the current meta-analysis.

One might ask, then, whether the laborious analysis of the CP cases, as done here, is warranted given the extensive review of the AP cases. We suggest that it is for a number of reasons. It is not obvious that findings from a meta-analysis of CP cases will mirror those of AP. While there are similarities across the two disorders, there are also some differences including the fact that CP, but not AP (Bentin, Degutis, D'Esposito, & Robertson, 2007; Fox, Hanif, Iaria, Duchaine, & Barton, 2011), individuals can evince preserved recognition of emotional expression even in fine-grained morphed paradigms (Humphreys, Avidan, & Behrmann, 2007). There are also differences in the way face inputs are sampled by the two groups as reflected by their differing eye movement patterns (for review, see Behrmann, Avidan, Thomas, & Nishimura, 2011). It is also possible that because of the neurodevelopmental nature of CP, brain organization has been sculpted differently from that of AP individuals who were premorbidly normal and then suffered brain damage. Given these differences (and possibly others), one cannot simply infer that findings from AP directly generalize to CP.

Aside from these empirical group differences, there is also a difference in the way in which recognition is typically assessed in these two populations. In the acquired disorders literature, object recognition deficits are often, although not always, assessed with basic-level recognition ("It's a car" or "it's a shoe", etc.) whereas in the CP literature, the emphasis is shifted toward assessing within-category, subordinate-level recognition ("It's a Volvo/Mini" or "It's a Nike/Adidas"). Similarly, whereas the acquired literature often draws a distinction between familiar face recognition and unfamiliar face matching (see, e.g., Young, 1993), the CP literature typically elides this distinction into an overall assessment with perhaps more emphasis on the former than on the latter. However, the distinction between performance on familiar versus unfamiliar faces is central to theories of normal face recognition (Bruce & Young, 1986; Young & Burton, 2017) and may have different neurobiological bases (Landi & Freiwald, 2017), and these differences also motivate further evaluation of the recognition disorders in CP. Last, a distinction between AP and CP arises with respect to the nature of the underlying disorder:[1] The lesions are large in AP and almost certainly affect multiple perceptual systems with the result that any associated deficit in object recognition might be due to damage across systems besides the one involved in face processing. While we do not yet know exactly how diffuse the developmental anomaly is in CP, it appears not to be the result of widespread damage, and hence there is the possibility that it has a more limited pathologic effect, limited to the system involved in face processing. Taken together, these observations indicate that there may be much to be learned from a review of existing CP cases.

Having justified the rationale for the current analysis, this paper adopts the same approach as the Farah meta-analysis and reviews the existing literature on CP as a means of examining segregation or overlap in mechanisms for face and object recognition. Because there are very few investigations that systematically assess the word recognition skills of CP individuals, we do not take word recognition deficits into account. As an aside, though, the findings from four recent papers that do examine the word recognition skills in CP offer consistent evidence that few, if any, individuals with CP have an impairment in word recognition (Burns et al., 2017; Collins, Dundas, Gabay, Plaut, & Behrmann, 2017; Rubino, Corrow, Corrow, Duchaine and Barton, 2016); Starrfelt, Klargaard, Petersen, & Gerlach, 2017). As additional data become available, further investigation of this dissociation is warranted, and this is likely to be of great relevance.

To foreshadow our results: Of the reported data that permit a satisfactory evaluation of the scientific question ($n = 238$ cases), there are roughly four times more individuals with an impairment in both face and object recognition ($n = 191$; 80.3%) than with a deficit limited to the recognition of faces ($n = 47$; 19.7%). We discuss the weight of the evidence and implications of the pattern of frequent associations and less frequent dissociation.

Methodological considerations

In the course of our survey, we encountered several methodological issues that presented challenges. The first issue was that approximately one third of the reviewed studies ($n = 257$; 35.9%) either do not report any data on the object recognition status of the CP individual/s or do report findings from non-face tests but the measures are not well equated to the demands of face recognition. The second complication is that, in roughly an additional third of the papers ($n = 221$; 30.8%) in which comparable face and object recognition data are included, the dependent measures employed may not have sufficient sensitivity, thus precluding definitive conclusions about recognition status. We elaborate on these issues below.

Assessing face versus non-face recognition

The validity of reaching conclusions about associations or dissociations rests on data from assessments of face and non-face recognition that ought to be matched in complexity and processing demands. However, many tests of non-face recognition do not tap into object recognition and, instead, evaluate some other (usually lower order) aspect of visual perception (for additional discussion of this point, see Barton & Corrow, 2016b). As an example, in several studies, participants were tested on the Birmingham Object Recognition Battery (BORB; Riddoch & Humphreys, 1993), a standardized test that measures low-level aspects of visual perception (using same–different matching of basic perceptual features, such as orientation, length, position, and object size), intermediate visual processes (e.g., matching objects across viewpoint), access to stored perceptual knowledge about objects (object decision), access to semantic knowledge (function and associative matches), and access to names from objects (picture naming). Accuracy is typically recorded, with no measure of reaction time (RT). Most subtests do not tap into pattern recognition, with the exception of the object naming task, and we consider data just from this task to be informative about object recognition. However, the image format of the BORB (black-and-white line drawings) differs from the format (photographs oftentimes even in colour) typically used in measures of face recognition. Such a difference might lead to a greater deficit in object agnosia than in prosopagnosia (Behrmann & Nishimura, 2010; Chainay & Humphreys, 2001; Jankowiak, Kinsbourne, Shalev, & Bachman, 1992) and, as such, confounds the comparison of the two stimulus classes.

The critical challenge in assessing non-face recognition, then, is in coming up with another category of objects, which is equated to faces and which can be tested using the same experimental paradigm. In an attempt to do just this, Farah, Levinson, and Klein (1995) compared the discrimination of faces with the discrimination of chairs and of eyeglasses in an AP individual. She noted, however, that, despite her best efforts, these comparisons might still not have been ideal: Differences among exemplars of chairs and eyeglasses may entail different local features whereas local features play a lesser role in face perception. Greebles, on the other hand, have been designed as a control category for faces, with individual instances akin to the recognition of individual faces. Although some have challenged the legitimacy of this control condition by arguing that Greebles are too face-like (Kanwisher, 2000), at least one patient, C.K., who has preserved face recognition abilities, performs poorly on discriminating between Greebles (Gauthier, Behrmann, & Tarr, 2004). This finding suggests that the recognition of faces and Greebles can be dissociated, and, thus, Greebles might serve as a useful control category. For further discussion on equating tasks of recognition across classes, see Barton and Corrow (2016b); Barton, Hanif, and Ashraf (2009).

Another confound in equating face and object assessment is that observers have more experience with faces than with any other class of objects, rendering it difficult to find another category for which experience is equated. Additionally, faces are typically identified at the individual level ("Elvis Presley") whereas other objects are typically identified at the basic level ("an apple"; Gauthier et al., 1999), and the increase in specificity for individuation of face images might disproportionately affect face versus object recognition. It is particularly noteworthy and perplexing then that CP individuals who presumably have had normal or almost normal exposure to faces and, in most cases, normal motivation to recognize them still do not benefit from this extended experience with faces in everyday life.

A final issue that confounds efforts to compare face and non-face recognition performance is that face and non-face tests differ in their task demands. The key characteristic of CP is the lack of familiarity of previously encountered faces. Objective tests of face processing usually (a) entail the participants viewing a single face for naming ("recognition"), (b) deciding whether two displayed faces are the same or different ("discrimination"), or (c) learning a small number of faces and then, when subsequently shown a face (or set of faces), deciding which is new and which is old —that is, is a studied target. The last type of task is gaining in popularity both because it measures the familiarity of previously studied faces and because of the availability of standardized measures such as the Cambridge Face Memory Test (CFMT; Duchaine & Nakayama, 2006a). Also, this type of task is now available for diagnosing prosopagnosia in other populations—namely, in East Indian individuals (McKone, Wan, Robbins, Crookes, & Liu, 2017). To test for the exact same deficit for non-face objects, one would need to test for familiarity of previously encountered non-face objects, but how to do this is not obvious. Fortunately, good progress has been made in recent years to produce non-face tests that have the same task demands as face recognition: Tests similar to the CFMT in which an item is first studied and then tested, including the Cambridge Car Memory Test (Dennett et al. 2012) and the Cambridge Bicycle Memory Test (Dalrymple & Palermo, 2016), are now in circulation and are gaining in popularity.

Accuracy as a dependent measure in studies of prosopagnosia

A further challenge we confronted is that, in the assessments, accuracy is predominantly used as the sole dependent measure. This is perhaps unsurprising given its ease and convenience, but accuracy alone, especially in cases of neuropsychological disorders, provides only a partial estimate of performance especially when participants trade speed against accuracy or show differences in bias (criterion level) relative to control subjects (for discussion, also see Busigny, Joubert, Felician, Ceccaldi, & Rossion, 2010; Farah et al., 1995). Note that even normal observers can fail to show the well-established face inversion effect (decrement in performance for inverted over upright faces) when accuracy alone is used as the dependent measure (Richler, Mack, Palmeri, & Gauthier, 2011).

As an example, when accuracy alone was used as the dependent measure in a forced-choice task of headless bodies, the CP and control groups performed equivalently (Rivolta, Lawson, & Palermo, 2016) but the RT data diverged significantly, revealing that the CP individuals were impaired at face recognition as well as body perception. Similarly, when CP and AP individuals made same/different judgments on pairs of novel faces, the CP participants scored 85%, which was not different from the control data but was significantly better than the 70% accuracy of the AP individuals (Behrmann, Avidan, Marotta, & Kimchi, 2005). The RTs of the CP group, however, were significantly slower than those of the AP group, with both groups slowed relative to the control group. These results clearly point to a speed–accuracy trade-off (also see Bate, Haslam, Tree, & Hodgson, 2008), and using a combination of accuracy and RT, as in inverse efficiency (mean RT divided by the proportion of correct responses; Akhtar & Enns, 1989; Townsend & Ashby, 1983), might be better in such circumstances. Last, testing of recognition with stimuli presented for limited viewing duration would also be advantageous: Accuracy alone would suffice as a measure in such a data-limited scenario, and this would obviate the need for the measurement of RT. To our knowledge, there is no study that uses this approach with CP.

In light of the above, then, we differentiate between studies whose conclusions are based on accuracy alone and consider these findings less compelling than studies in which both accuracy and RT are reported. If only one dependent measure is reported, where possible, we compute additional dependent single-case measures to provide a more comprehensive profile of performance (Crawford, Garthwaite, Azzalini, Howell, & Laws, 2006).

Our approach

With these considerations in mind, we conducted an extensive review of the published reports of CP individuals with two major aims: (a) to determine whether there is evidence of normal/abnormal object recognition in individuals with a diagnosis of CP, and (b) to evaluate the relative frequency of patterns of normal versus abnormal object recognition in CP. Before presenting the findings, some caveats are warranted. Although we have strived for complete rigour in our methods, we recognize that we may have made errors and, in some cases, generated interpretations that differ from those of the original authors. We have provided an extensive set of appendices of all the reviewed cases, and our hope is that this database might present the opportunity for the future archiving of other CP and AP data as well as other neuropsychological data.

Method

Participants

We surveyed papers of individuals with CP published from 1976 through to the data freeze, which was set for July 2016 (see Appendices 1–5 for listing of the papers, description of the cases and available data). A very small number of 2017 papers are also included as we had access to them prior to July 2016—at that time their definitive publication date was unknown. We identified the candidate papers by (a) searching PubMed with the term "prosopagnosia" and/or (2) using the forward search function in Web of Science, taking as the seed four relatively early but key papers in the CP literature reporting behavioural findings: Behrmann et al. (2005); Ariel and Sadeh (1996); Duchaine (2000); and Galaburda and Duchaine (2003). We assumed that at least one of these papers would be cited by any subsequent article. After assembling a long list of candidate papers, we excluded those studies in which the individuals had a documented lesion, acquired either early (for examples of cases with AP with a lesion early in development, see Grueter et al., 2007, Table 1) or later in life. We also set aside those papers describing studies of children below 18 years of age. We excluded cases in whom there was a comorbid disorder such as autism or Asperger's syndrome (for example of such cases, see Grueter et al., 2007, Table 2). Difficulties in face recognition are not uncommon in individuals with social developmental disorders (Humphreys et al., 2008) but only a subgroup of these individuals appear to have a disorder that resembles that of prosopagnosia (for further discussion of this point, see Barton et al., 2004; Barton & Corrow, 2016c). Moreover, studies that have evaluated social anxiety (Social Interaction Anxiety Scale, SIAS) and autistic traits (Autism-Spectrum Quotient, AQ) have shown that neither SIAS nor AQ scores differ between controls and CPs (Palermo et al., 2017) but that these scores typically differentiate between individuals with social developmental disorders and controls. Most papers on CP, therefore, exclude participants with autism spectrum disorder (ASD; e.g., Corrow et al., 2016; Dalrymple et al., 2014a).

Our close scrutiny of the candidate papers revealed some papers in which the diagnosis of CP itself was questionable. It is noteworthy that there is, at present, no gold standard for identifying CP; the condition is not listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM–5), and no formal diagnostic criteria exist (for quick guide to the disorder, see Barton & Corrow, 2016c; Cook & Biotti, 2016; Dalrymple & Palermo, 2016). We have included all published cases even when the criteria for formal diagnosis may not be fully met, but have marked with an asterisk in the appendices those papers in which this is the case. For example, in some cases, face recognition was not objectively assessed, and self-report of difficulty with face recognition was sufficient for inclusion (face testing was usually conducted afterwards but these individuals were still included in the sample). We know that self-report can result in false alarms: For example, the son in De Haan (1999) self-reported as prosopagnosic but no objective evidence of a deficit was uncovered by the formal evaluation. Additionally, individuals do not always have insight into their face recognition skills (Bindemann, Attard, & Johnston, 2014; Bowles et al., 2009; Palermo et al., 2017), making self-report unreliable. There is great interest amongst researchers to develop a more formal set of criteria for inclusion and to specify a set of generally approved tests that might be widely used for diagnosis (a group of researchers met at the Vision Sciences Society in Florida, May 2017, to discuss this very issue, and progress is already underway).

We then divided the papers into five categories corresponding to Appendices 1–5. If an individual case's name or code/number was provided in the paper, we listed the individual using this marker, but if the paper only included the aggregated group data, we simply reported the number of participants and the result of the group. We were fortunate to obtain the single-case data in a subset of studies in which the published data reported only the group average. In such cases (e.g., Esins, Schultz, Wallraven, & Bulthoff, 2014; Zhao et al., 2016; and several papers that include the same CP participants: Furl, Garrido, Dolan, Driver, & Duchaine, 2011; Garrido et al., 2009; Lohse et al., 2016; Y. Song et al., 2015), we re-analysed the data for each participant and assigned them to a category.

In our listing of the individual cases (see Appendices), when we were able to discern that the same individual appeared in more than one paper, we included that individual only once in the Appendix and aggregated all the data from the multiple papers into a single entry [note also that some individuals are tested by more than one lab, such as the individual labelled "NM" (Duchaine lab) and "MN" (Behrmann lab)]. We determined that a CP case had participated in more than one study if consecutive or related studies by the same researcher/s used the same initials for the CP individual, or if the paper made this known explicitly (e.g., in Tanzer, Weinbach, Mardo, Henik, & Avidan, 2016, the superscripts in the participants' table indicate the other studies in which the participants had participated). In some studies, CP participants were not identified by initials, but by number. If the number and other demographic factors matched across studies, we also aggregated the data. A final challenge we faced is that the same initials for a single case were used in more than one study, and the individuals seemed unrelated. We verified, as far as possible, that these were indeed separate individuals who happened to share initials (by noting different age and/or sex) and counted them separately. This duplication of initials is an ongoing challenge in neuropsychological studies, and perhaps some other convention might be adopted in the future. This procedure resulted in a total of 716 cases.

Procedure

Once we had identified the participants for inclusion, we scrutinized the papers and entered into the database which face and non-face tests (if any) were used and their results. We include a glossary of the abbreviation of the various tests in Appendix 6. Our criterion for diagnosing a deficit in non-face recognition was based on the criterion often adopted in neuropsychological studies—namely, when performance deviates from that of the control group mean on any dependent measure by at least two standard deviations: Whether this criterion is stringent enough may be debatable, of course, as performance may simply fall in the lower tail of the normal distribution, and non-CP individuals obviously fall in this tail as well (we raise this issue in the Discussion section too). We do note that some researchers consider individuals as impaired even if this criterion is not fully met: Some studies have suggested that 2 standard deviations is an unreasonable criterion as a neurodevelopmental disorder might not result in such a severe deficit (Grueter et al., 2007) and that a cut-off of 1.5 or 1.7 standard deviations from control means might suffice (1.7-*SD* cut-off is also used by Palermo et al., 2017). We have therefore separated the cases into those whose object recognition differs from the control mean by ±2 standard deviations and for whom we use the term "definite object recognition deficit" and those whose performance falls ±1.7 standard deviations from the control mean and we consider to have a "mild object recognition deficit".

Of note, if a CP individual was included in more than one paper, and the individual was categorized as "not tested for object recognition" in the context of one paper but happened to be tested for object recognition in a second paper and was shown to have a clear deficit in object recognition, we included the individual in the "definite object recognition deficit" category. The logic was to base our classifications on the most information possible.

We then assigned each of the 716 adult CP cases to one of five categories:

1. *Not tested for object recognition:* If only face recognition was assessed/reported in the paper, the participant was placed in this category.
2. *No object recognition deficit but no RT data:* Object recognition abilities were assessed, and, based on the accuracy score, the individuals were deemed not to have an impairment in object recognition.
3. *No object recognition deficit (normal accuracy and RT)*: Individuals in this group evinced a dissociation between face and object recognition. These cases

were tested on measures of face and object recognition, and both the RT and accuracy data fell within the normal range.

4. *Mild object recognition deficit, on either accuracy or RT:* Individuals were tested on measures of object recognition, and performance on any dependent measure equalled or differed by 1.7 standard deviations from the mean of the control participants.
5. *Definite object recognition deficit, on either accuracy or RT:* Individuals were tested on measures of object recognition, and performance, on any dependent measure equalled or differed by 2 standard deviations from the mean of the control participants.

Table 1. Number and percentage of CP individuals falling in each category.

	Category	Number	Percentage %
1	Not tested for object recognition	257	35.9
2	No object recognition deficit but no RT data	221	30.9
3	No object recognition deficit (normal accuracy and RT)	47	6.5
4	Mild object recognition deficit, on either accuracy or RT	32	4.5
5	Definite object recognition deficit, on either accuracy or RT	159	22.2
	Total	716	100

Note: CP = congenital prosopagnosia; RT = reaction time.

Results

Below, we discuss the categories in greater detail (see Appendices 1–5). Note that each appendix is organized alphabetically by first author of the paper. If an individual participated in more than one paper, the findings from the different studies are aggregated under a single entry (with the various papers alphabetically arranged in a single cell of the table). The number and percentage of participants falling into each category are shown in Table 1.

Not tested for object recognition

The 257/716 CP individuals who were classified in this category (35.9% of the total; see Appendix 1) fell into one of two types: Either the individuals were assessed only on their face recognition ability, or the non-face recognition measures did not target object recognition. For example, a number of individuals were tested on the BORB with subtests including length, size, orientation, and position of gap judgments, none of which are directly informative about object recognition skill. We did not consider object decision in the BORB to be a formal indicator of object recognition, and there is ongoing discussion about whether a structural description of an object (thought to be the basis on which real/non-object decisions are made) is tantamount to recognizing it (see Gerlach, Klargaard, & Starrfelt, 2016). Additional individuals, mostly from Grueter et al. (2007) and Schwarzer et al. (2007), were tested on the Vividness of Visual Imagery (Marks, 1973). Because this test assesses imagery rather than perception (although there may well be similarities in mechanism; Behrmann, 2000), we did not use these data as a measure of object recognition. We also did not consider performance on the Rey Complex Figure Test (RCFT; Meyers & Meyers, 1995) as informative. Poor performance on this task could arise for a host of reasons such as a spatial or motor impairment or, on the delayed version, a memory impairment, and not just from a deficit in perception of the figure.

We also did not consider measures of holistic or configural processing to be informative with respect to object recognition (for example, Avidan, Tanzer, & Behrmann, 2011; Schmalzl, Palermo, & Coltheart, 2008; Tanzer, Freud, Ganel, & Avidan, 2013; Tanzer et al., 2016). Although there is much discussion about the extent to which there is a deficit in configural processing in CP (e.g., see Avidan et al., 2011; Biotti et al., 2017; Duchaine, Yovel, & Nakayama, 2007; Kimchi, Behrmann, Avidan, & Amishav, 2012), the global–local test or other such measures are generally thought to be relevant to the derivation of shape formation, which precedes the derivation of a percept for recognition (Kimchi, 2015; Navon, 2003).

Last, 11 CP cases completed the Faces, Seashells, and Blue Objects tasks of Esins et al. (2014). In this experiment, participants first learned four target exemplars in frontal view with no time limitation. At test, participants saw images of the learned targets in new orientations as well as new objects (from same category) and made an old/new decision. RT was not reported in the paper but the authors kindly shared their data with us, and so we had d' as well as RT data for each participant. Close examination of the data indicated that the mean d' in the control subjects on the Blue Objects was substantially poorer than that for the Sea Shells (mean d' and *SD* for controls: Blue Objects = 0.61, 0.47; Seashells 1.9, 0.84), and the possible floor effect for Blue Objects versus Sea

Shells was also evident in RT (mean RT for controls, Blue Objects = 2.7 s, $SD = -0.54$; Seashells 1.9 s; $SD = 0.3$). Many CPs performed similarly to the controls (i.e., fell within the normal limits) and so, by definition, should be included in the "no object recognition deficit" Category 3. Because of the concern over the floor effects in the controls, however, it is difficult to evaluate the status of the CP individuals, and we therefore include these cases here in Category 1.

No object recognition deficit but no RT data

In a further 221/716 individuals (30.9%; see Appendix 2), object recognition was tested but only accuracy scores were available. One representative example is participant A.A. (Bate et al., 2008; Tree & Wilkie, 2010) who completed several BORB subtests tapping both lower level and more complex aspects of perception, including object naming. Her performance is highly accurate on all tests but because no RT is available, it is difficult to conclude whether performance is entirely normal.

In another study, 38 DP individuals were assessed on the FOBPT (faces–objects–bodies perception test), and accuracy scores were obtained. There are no control data reported (as far as we can determine; DeGutis, Cohan, Mercado, Wilmer, & Nakayama, 2012). Thus, although the tests are appropriate, in the absence of accuracy from controls and any RT data, definitive conclusions about object recognition are not possible. The same is true for the study by DeGutis et al. (2014) with 24 participants. Some studies evaluated the performance of the CPs on house (Carbon, Grueter, Grueter, Weber, & Lueschow, 2010) or eye-glass matching (Dobel, Bolte, Aicher, & Schweinberger, 2007), and the CP individuals all performed within the normal range on accuracy. Again, the absence of RT data results in their inclusion in this category.

Note that visual impairments have been uncovered in some individuals in this category, such as poor performance on the Visual Object and Space Perception Battery (VOSP) or on the BORB: for example, L.O. and B.T. (Dobel, Putsche, Zwitserlood, & Junghofer, 2008, 2011) and R.W. (Bate, Haslam, Jansari, & Hodgson, 2009). Given how simple these basic tests are, one wonders whether these individuals have a more severe form of visual agnosia. Close scrutiny also suggests that some cases may have had some neurological basis for their disorder. Minnebusch, Suchan, Ramon, and Daum (2007) notes that "All subjects may have some early brain damage or insult to the brain", and R.S. in Yovel and Duchaine (2006, p. 589) might have acquired visual deficits in childhood. Together, caution might be exercised in examining the profile of some of these individuals.

No object recognition deficit (normal accuracy and RT)

A number of individuals 47/716 (6.5%) evinced a dissociation between face recognition, which was impaired, and object recognition, which was intact based on both RT and accuracy data. Because these cases represent the strongest evidence for a dissociation between face and non-face recognition, we examined their data carefully.

Two participants in this category come from studies by Stollhoff, Jost, Elze, Kennerknecht, and Baker (2010, 2011) in which participants were initially familiarized with four target stimuli (faces or shoes) and then, at test, were required to identify the target amongst distractors in a two-alternative forced-choice paradigm (target vs. non-target) from either frontal or rotated view (shoes in Experiments 2 and 4). One of the two cases with normal object recognition, F.P., is reported to have had perceptual, associative, and mnemonic difficulties but only with faces and not shoes, while the second, M.G., appeared to have a deficit in long-term recognition memory but no perceptual or associative deficits with either faces or shoes (perhaps even ruling him out as CP; see Stollhoff, Jost, Elze, Kennerknecht, & Baker, 2011, p. 4). This category also included 40 out of the 64 participants from Zhao et al. (2016) who performed within normal limits on accuracy and RT in a same/different discrimination on pairs of flowers, birds, and cars.

One case included here with a particularly clear dissociation of face and non-face recognition is O.H. (O.F. in Kimchi et al., 2012). O.H. is a "horse expert" and has acquired substantial visual knowledge of horses beginning at age 7. O.H. is impaired on multiple tests of face perception and yet performs within normal limits on many tests of horse perception. Of particular interest, on a test of horse perceptual expertise, O.H. performs as well as horse experts and significantly better than non-expert controls. O.H. also scored within normal limits on the Cambridge Cars Memory Test (CCMT).

Taking all these cases into account, there is rather limited evidence for a clear dissociation between impaired face and normal non-face recognition aside from these cases: Note, however, that the Zhao et al. (2016) paradigm might have been relatively easy (2/3 of participants performed normally) and at least one of the Stollhoff (2010) cases has widespread memorial deficits.

Mild object recognition deficit (on either accuracy or RT)

A further 32/716 (4.5%) of the CP individuals were classified as having mild object processing problems: The object perception abilities of these individuals diverged from the control mean by more than 1.7 standard deviations but less than 2 standard deviations (if available or if possible to calculate, we include the *z*-score for each case in Appendix 4). For example, both T.Z. and S.I. scored more than 1.7 standard deviations from the control mean on the CCMT (Tanzer et al., 2016). Seven individuals from Zhao et al. (2016) were also included in this group, and four individuals from Esins et al. (2014) performed more than 1.7 standard deviations from the control mean on RT on the Sea Shells and/or Blue Objects Task.

Definite object recognition deficit, on either accuracy or RT

In this final category were 159/716 (22.2%) individuals whose performance on tests of object recognition diverged from the control mean by more than 2 standard deviations on accuracy and/or RT. The data from this group constitute the strongest evidence for an association between a deficit in face recognition and a deficit in object recognition. For example, individuals K.M., K.E., I.T., M.T., and W.S. all performed more than 2 standard deviations from the control mean on common object and/or greeble discrimination (Avidan & Behrmann, 2008; Behrmann, Avidan, Gao, & Black, 2007; Behrmann et al., 2005), and nine additional individuals scored abnormally on old/new judgments of cars and/or horses (Dalrymple, Garrido, & Duchaine, 2014b).

E.B. (Edward) from Duchaine et al. (2004, 2006a, 2006b; Bukach & Gauthier, 2017) (multiple studies) performed more than 2 standard deviations from controls in RT for horses and more than 1 standard deviation from controls on house and scene discrimination although his performance was within normal limits on discriminating other categories such as tools and guns. Interestingly, E.B. learned to differentiate between 10 greebles normally (Duchaine, Dingle, Butterworth, & Nakayama, 2004), leading the authors to conclude that the deficit was restricted to face perception, but recent data show that E.B. was also able to learn 10 faces under the same training regimen (Bukach & Gauthier, 2017). That E.B. could learn to individuate greebles then is insufficient to conclude that he had a face-selective impairment, and his inclusion in this category supports an association between face and object recognition abilities.

Participants M.H. and X.G. performed more than 2 standard deviations from controls on a delayed match-to-sample eye glasses test (Dobel et al., 2007), and 17 participants in Zhao et al. (2016) performed more than 2 standard deviations from the control mean on non-face objects. Last, six of the individuals from Esins et al. (2014) performed more than 2 standard deviations from the mean of the controls on RT on the Seashells and/or Blue Objects Task.

As evident, we have included in this category individuals who fall more than 2 standard deviations from the control mean on accuracy and/or RT. It might be argued, however, that this category encompasses two different populations: those who fail at recognition (as shown in accuracy) and those who may be accurate but require a long time to achieve recognition. One possible interpretation of this difference concerns severity: Those who are accurate but require longer are perhaps more mildly affected whereas those whose accuracy is poor are more severely affected. To separate these two groups, we assigned all Category 5 cases into either those with normal accuracy (with slowed RTs) or those with abnormal accuracy (some of whom also have slowed RTs). Of the 159 cases, 58 had normal accuracy, and 101 had abnormal accuracy scores. This roughly 1:2 ratio indicates that the majority of the cases were of the more severe type, and, as such, the abnormal recognition on both accuracy and RT scores provides confirmation of the association between an impairment in face and that in object recognition.

In sum, we classified the 716 adult CP cases into one of five possible categories based on the reported evidence of their object recognition abilities. Of these, the data from 478 cases do not offer sufficient evidence to adjudicate the issue (Appendices 1 and 2). Once these cases are set aside, of the remaining 238 cases for whom evidence is presented, 19.7% (47/238) evinced a dissociation between their object and face recognition skills, and the remaining 80.3% (32/238 + 159/238 = 191/238) revealed an association, performing abnormally on measures of both face and object recognition to a greater or lesser degree. To explore whether the distribution of the deficit across these three categories was significantly different from chance, we performed a χ^2 test in which we assumed a random distribution of the cases to the three final categories (no object recognition deficit; mild object recognition impairment on either accuracy or RT; definite object recognition deficit on either accuracy or RT). Since there is no a priori reason to expect a particular distribution, the unbiased distribution should yield an equal number of cases in each cell (that is, 238/3 = 79.3; that is, "Expected")[2]. We then used the observed data to complete the test, and the outcome ($\chi^2_2 = 11.05$, $p < .001$) clearly reveals that there are significantly more cases in the association groups, and fewer in the dissociation group, than one would expect by chance. This imbalance offers some statistical support for the association between face and object recognition deficit.

Reclassification of cases

One of the major drawbacks thus far concerns the large number of "left out" cases not included in the adjudication of the association/dissociation. The criterion for the assignment of a case to Category 2 was that accuracy on object recognition (appropriately tested) must be normal, and no RT data must be available. If we relax the standard of having both accuracy and RT being required for diagnosis, then we can fold the Category 2 cases into Category 3—that is, indviduals with normal object recognition performance. Doing so yields 268 CPs with normal object recognition versus 191 with impaired object recognition. A better approach, however, might be to estimate the number of Category 2 cases who would likely be impaired in RT had RT data been collected at the time. Because we were fortunate to obtain RT data from three published studies, all of which had a substantial number of participants and for whom RT was available but not reported in the publication, we could estimate the likelihood of Category 2 cases falling into the dissociation (Category 3) or association (Categories 4–5) profile. The data we obtained included 17 participants from Duchaine and Garrido et al. (Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015), 21 from Esins et al. (2014), and 64 from Zhao et al. (2016), along with the matched control data. We calculated the mean and standard deviation of the controls' RT in each study and then classified each CP participant's performance (normal or differs by 1.7 *SD* from control mean).[3] Of these 102 cases, 54 (53%) performed outside the normal range on RT (beyond 1.7 *SD*). This retrospective calculation provides an independent estimate of the number of individuals from Category 2 who might have been impaired had RT been measured: Of the 221 cases in Category 2, this leads to 103 cases in whom accuracy and RT probably fall within the normal range, which can be added to the tally of Category 3, and the remaining 118 cases with object recognition impairment can be added to the tally of Categories 4 and 5.

We can also use these estimates to reclassify the cases in Category 1 although this may be less reliable because we do not have accuracy scores on object recognition for these individuals (with the exception of those from Esins et al., 2014). Nevertheless, of the 257 cases in Category 1, an additional 137 cases are estimated to have a recognition impairment, and 120 are estimated to have preserved object recognition. A revised classification of the CP cases using the new estimates leads to the numbers shown in Table 2.

Last, because, in some individuals the evidence for the diagnosis of CP was less clear, we checked that these cases were not biasing the conclusions. There were 15 such cases (9 in Category 1, 4 in Category 2, 1 in Category 3, and 1 in Category 4). The numbers are not large, and most of them fall in the less informative Categories 1 and 2, and so it is unlikely that these cases are affecting the classification of the cases.

Analysis of classification of cases by year of publication

The analyses conducted thus far include all cases identified from 1976 to 2016. In recent years, however, the diagnosis and testing of CP have become more standardized and stringent. It remains a possibility, then, that if we were to limit our categorization to studies conducted only in more recent years, the distribution of cases to the five categories might differ. To evaluate this, we split up all 716 cases as a function of year of publication and then analysed

Table 2. Number and percentage of CP cases per category following re-assignment of cases in Appendices 1 and 2.

	Category	Number	Percentage
3	No object recognition deficit	270	37.7
4/5	Mild/definite object recognition deficit	446	62.3
	Total	716	100

Note: CP = congenital prosopagnosia.

the distribution. For cases whose data are reported in more than one paper, we take the year of the most recent publication as relevant with the view that more recent testing might be most informative. Figure 1 shows the proportion of cases assigned to Categories 1–5 (using the actual assignments, see Table 1) divided into five time periods: prior to 1999; between 2000 and 2005; between 2006 and 2009; between 2010 and 2013; and after 2014.

A 5 × 5 contingency table using the proportion of cases per category in each time bin shows an interaction of Time Bin × Category ($\chi^2 = 74.9145$, $p < .00$). The partitioning of the overall chi-squared, using the method of Lancaster (1949) and Irwin (1949) (as cited in Everitt, 1977) reveals that there are fewer Category 1 cases not tested on object recognition measures in 2014 onwards than in previous time periods. There is no difference in the proportion of cases with mild object recognition impairment or definite object recognition deficit over the time periods. Most relevant for the current discussion is that the identification of CP individuals with some level of deficit in object recognition is stable over the time bins, and so the assignment to Categories 4 and 5 is not altered by more recent methods. There is a slight increase over later bins in the proportion of cases identified as not having an object recognition impairment, suggesting that the improved diagnostics may possibly be better at separating out those cases with and without a deficit in object recognition.

Weight of the evidence

Unsurprisingly, the evidence that permits the evaluation of object recognition status for a case varies substantially from study to study. In some studies, only a single measure of object recognition is used—for example, the data from the CCMT, as in the CP cases in Shah, Gaule, Gaigg, Bird, and Cook (2015). Other studies use two measures such as the Seashells and the Blue Objects tasks (Esins et al., 2014) or object naming from Snodgrass and Vanderwart and Recognition of Cars task as in Dobel et al. (2007) and Lange et al. (2009). Yet other studies report multiple measures such as old/new recognition task with scenes, houses, horses, tools, guns, and cars as in Duchaine and Nakayama (2005) and Duchaine et al. (2006b), or the Boston Naming Test and across-class and within-class object recognition as in Malaspina,

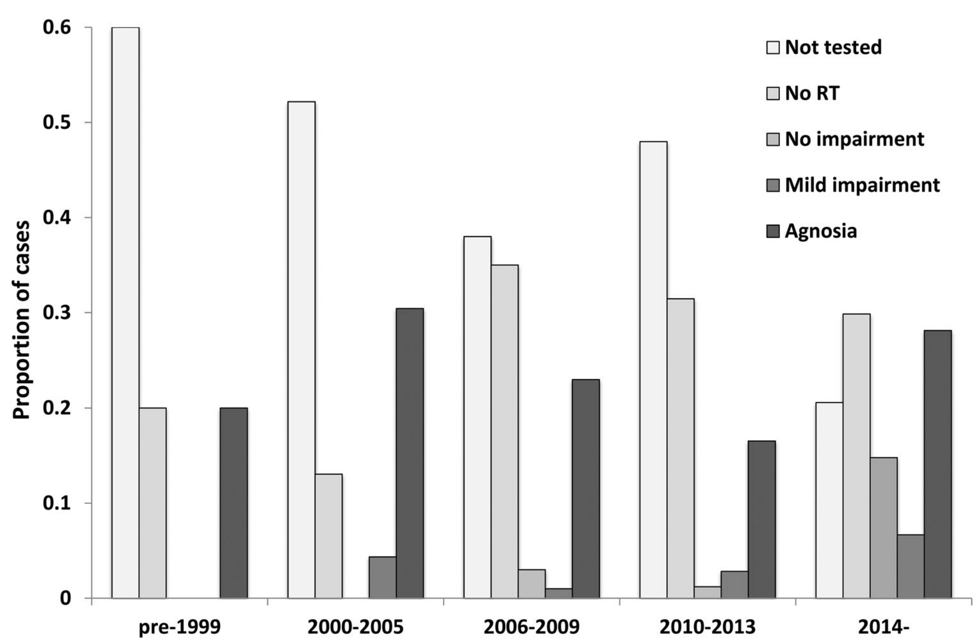

Figure 1. Proportion of congenital prosopagnosia (CP) cases classified into five categories as a function of time bin of publication date. RT = reaction time.

Table 3. Number of tests used for diagnosis of object recognition status of cases per classification category.

	Classification category		
No. tests	No object recognition deficit	Mild object recognition deficit	Definite object recognition deficit
1	33	26	49
2	14	3	41
>2	0	3	69
Total	47	32	159

Albonico, Toneatto, and Daini (2017). Note that, in some papers, even though multiple object categories were tested, only a single aggregated score is reported (e.g., Zhao et al., 2016).

Table 3 shows the number of CP cases for which one, two, or more than two tests were used to make the diagnosis of no object recognition impairment, mild impairment, and object agnosia. Most striking is that when two or more tests were used, there are no cases who are not impaired at object recognition, and there are relatively few cases with mild deficits. The majority of cases where more than two tests are used are diagnosed as having an object recognition deficit. Note that this classification was done merely on the number of tests utilized rather than on the number of tests used that uncovered a deficit. The latter might be a better way to reveal the strength of the evidence, and this would be of value in future research.

Quantitative correlation

The data thus far have been primarily analysed by category (how many cases per category, change in category assignment over time) but one might ask whether, within an individual, there is a correlation between face and object recognition performance. Evidence favouring a correlation was reported by Malaspina et al. (2017) revealing that performance of CP individuals in the face matching task and the flower matching task was correlated, leading to the conclusion that the CPs' impairment probably involves more general subordinate-level processing, extending beyond face recognition.

Because we had access to the data of the 64 cases from Zhao et al. (2016), consisting of RT and accuracy from comparable match-to-sample face and object tests, we were able to correlate performance on these tasks. Pearson correlation across faces and objects was .23, $p = .057$, on the accuracy scores, and .524 on the RT measure, $p < .0001$. These findings converge with those of Malaspina et al. (2017) and support the claim that performance on face and on (within-class) object recognition are related and may potentially arise from a single underlying mechanism. Additional data for correlational analyses would be very helpful in the future in obtaining a more precise statistical picture.

Discussion

The central goal of this paper was to examine patterns of association and dissociation in neuropsychological data acquired from individuals with congenital prosopagnosia (CP) to address two questions: (a) Is the deficit in CP specific to face recognition? And, if not, (b) does a single system or multiple, independent underlying systems mediate the recognition of faces and non-face objects? After assessing the empirical data and showing that the deficit is not face-specific in the majority of cases of CP, the logic to address the second question was as follows: If CP individuals are impaired at both face and object recognition, and, moreover, if these deficits are correlated in severity, a single mechanism that supports both visual classes may explain the behavioural profile. If, however, the deficit is limited to the recognition of faces, and object recognition is entirely normal, an account of independent or segregated systems for the recognition of different visual classes might be favoured. Of course, other possibilities exist but these two hypotheses represent the extreme bounds of the argument. This question of domain specificity has occupied cognitive neuroscientists for decades—an answer to this question is critical, however, as it has the potential to shed light on CP and, consistent with the overarching goal of cognitive neuropsychology and for elucidatong the organization of the normal visual system.

Here, we adopted a survey approach, identifying 716 adult individuals with CP reported in 119 papers published between 1976 and mid-2016. After careful review of the data, the individuals were classified into one of five categories, as follows: Category 1: Object recognition was not tested (and, in a few cases, in whom it was, the findings were not interpretable); Category 2: The individual performed normally on tasks of object recognition, but this was determined based only on accuracy and not on RT measures; Category 3: There was no evidence for a deficit in object processing based on both accuracy and RT; and, last, there was evidence of a deficit in object recognition on either dependent measure that was either Category 4, mild (>1.7 *SD*s from control mean) or Category 5, more severe (>2 *SD*s from control mean) with the data in these last two categories being either accuracy scores or RT.

Of the 716 adult cases, no clear conclusion could be reached in 66.8% (478/716) of the cases (combination of Categories 1 and 2 above). In most of these instances, the focus of the study was not on the domain specificity of the disorder but, rather, on characterizing the nature of the face recognition impairment in CP (e.g., exploring associations between face identity and facial expression recognition; Humphreys et al., 2007; Yovel, Wilmer, & Duchaine, 2014), or on measuring aspects of visual perception aside from object recognition, such as featural versus configural processing (e.g., Tanzer et al., 2013). Unsurprisingly, then, most of these papers do not contain data regarding object recognition (or contain only accuracy scores if object recognition is assessed at all). For the remaining categories, 6.5% of the individuals did not exhibit an object recognition impairment, 4.5% had a mild impairment, and 22.2% had a more marked impairment. If one calculates the percentage of individuals with and without impairment when object recognition was carefully tested (i.e., just out of 238 cases, Categories 3–5), 19.7% (47/238) evinced a dissociation between their object and face recognition skills, and the remaining 80.3% (32/238 + 159/238 = 191/238) revealed an association, performing abnormally on measures of both face and object recognition to a greater or lesser degree. We also noted that the number of cases diagnosed with impaired object recognition remained relatively stable across the year of the report, although there were slightly more cases identified without an impairment in more recent years.

We then estimated the number of cases with or without an associated object recognition deficit from the "left out" cases (Categories 1 and 2), based on independent estimates obtained from published studies where both accuracy and RT were measured but only accuracy was reported in the publication (Esins et al., 2014; Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; Y. Song et al., 2015; Zhao et al., 2016). The final estimates were that, of the 478 "left out" cases, 223 were probably not impaired on object recognition, and 255 were probably impaired (either mildly or more markedly). When these estimates are added to the existing tally, the final sum is that, of the 716 cases, 446 were impaired (62.3%), and 270 were not (37.7%). Finally, we examined the correlation between the face and object scores in a group of 64 CP individuals from Zhao et al. (2016) and uncovered a significant association in performance, especially in RT. This latter result is highly suggestive of an associated underlying mechanism although we do consider other options below. Taking all the data into account, the key finding might be summarized as follows: Independent of which calculation is adopted (out of 716 cases, out of 238 cases or estimated cases tallied), there is always a majority of cases who evinced an association between their object and face recognition skills and a minority who showed a dissociation between measures of both face and object recognition; that is, there are frequent patterns of associations between an impairment in face and object recognition and less frequent patterns of dissociation.

An obvious question one might pose is why, unlike cases with acquired object agnosia, CP individuals with impairments in object recognition do not report difficulty in recognizing objects. To be sure, many cases of CP do not report difficulty in face recognition either, until they learn about the disorder by word of mouth or through the media, and then gain awareness of their own condition. Setting aside the possibility that individuals may not always be asked about their subjective experience, one possibility is that a failure in face recognition has considerably more negative impact on daily function than a failure in object recognition. Failures in object recognition usually do not have serious adverse consequences (especially when the failures are within category such as identifying a daisy as a gerbera versus a crown or a car as a Nissan versus a Honda), and, perhaps, because the deficit has been lifelong, compensatory strategies might be in place (see case A.W. who put stickers of flowers on her car to assist in identification; Germine, Cashdollar, Duzel, & Duchaine, 2011). Direct comparison between the congenital versus acquired neuropsychological disorders is clearly warranted to establish differences in severity and in subjective experience.

Double dissociation: Impaired object recognition and intact face recognition

The discussion thus far has been based on the presence of absence of a dissociation between object and face recognition in individuals who are impaired at face recognition. To argue forcefully for the segregation of the two processes, however, data for a double dissociation are considered critical. To our knowledge, there is only one individual, A.W., with a neurodevelopmental disorder who exhibited preserved face recognition and impaired object recognition in the absence of any cognitive or perceptual impairment and with no neurological concomitant (Germine et al., 2011). A.W., who appeared to function normally in daily life, showed substantial impairment in within-class visual recognition memory across multiple (guns, horses, scenes, tools, doors, and cars) but not all (upright faces, eyeglasses, and houses) visual categories, and she had normal low-level perception and normal basic-level recognition and memory. Accounting for A.W.'s particular pattern of preservation and impairment is not simple. Germine and colleagues (2011) considered the possibility that the recognition of eyeglasses, houses, and upright faces all rely on a common perceptual mechanism, perhaps related to configural or holistic representation, and also suggested the possibility of a memory mechanism for these categories that developed normally in A.W. Yet another possibility is that the three preserved categories, but not any of the others tested, might each rely on an independent mechanism, which developed normally.[4] There are a few other cases showing the same dissociation of objects versus faces but these have all occurred following brain damage (Feinberg, Schindler, Ochoa, Kwan, & Farah, 1994; McMullen, Fisk, Phillips, & Maloney, 2000). One well-known case, C.K., who suffered a traumatic brain injury (Behrmann, Winocur, & Moscovitch, 1992; Moscovitch et al., 1997; Rivest, Moscovitch, & Black, 2009), exhibited normal face recognition but an impairment in object recognition (see also De Renzi, 1986). It is, perhaps, surprising that there are so few cases with this particular dissociation. Although it is not possible to know the base rate of a particular disorder, the relative paucity of individuals with preserved face recognition and impaired object recognition is striking compared with the reverse dissociation (incidence studies suggest that roughly 2% of the population have CP, Kennerknecht et al., 2002, 2008) and, by our estimates, two thirds of them probably have an impairment in object recognition too. This asymmetry of findings is difficult to understand if faces and objects are recognized by independent modules, but is more tractable if face recognition is an especially difficult instance of object recognition where both systems rely on a common mechanism.

Types of dissociation

Traditionally, as is also the case in this paper, cognitive neuropsychology has distinguished between associations and dissociations but there are, in fact, different types of dissociations (Shallice, 1988). In a *trend dissociation*, the patient's score on Task I is markedly lower than that on Task II, but performance is not compared to that of a control group. In a *strong dissociation*, neither task is performed at a normal level, but Task I is performed better than Task II. In this case, performance is commonly compared to that of a normal control group, but a patient's performance on tasks where normal controls would be expected to perform at ceiling may also constitute evidence for a strong dissociation. Finally, in a *classical dissociation*, performance on Task I is impaired—relative to normal controls—and performance on Task II is within normal limits; an extreme example of this absolute dissociation is accuracy at 0% on Task I and at 100% on Task II. While trend dissociations constitute a weak form of evidence, both strong and classical dissociations have been taken as evidence for specialized functions or modularity.

Adjudicating between strong versus classical dissociations in the context of face and object recognition in the 716 CP cases is almost impossible. Setting aside the fact that some of the existing data are not especially strong (and diagnosis is sometimes made on the basis of a single test that may have relatively few items), many challenges arise. Probably the greatest challenge comes from the difficulty in measuring face and object recognition on a level playing field. Even in those instances in which the data for face versus object processing come from comparable paradigms that tap the same level of processing (e.g., within-category or subordinate level, as is the case in Zhao et al., 2016, or Dobel et al., 2007; Dobel et al., 2011), prior experience is so much greater for faces than for other objects (flowers or shoes or eyeglasses) that it is not possible to equate experience across visual classes (except in rare instances, as in O.H.; Weiss, Mardo, & Avidan, 2016). Currently, attempts to match standardized paradigms (CFMT and CCMT) are emerging, and, in addition to acquiring data for norming each test, within-individual norms across both paradigms might be helpful as well. Interestingly, in a recent paper investigating macaque face recognition, the activation profile in response to personally familiar faces (animals from same cage) versus personally familiar toys (toys from home cage) revealed differences in the perirhinal cortex and temporal pole (Landi & Freiwald, 2017). A similar contrast between personally familiar faces and personally familiar belongings might be adopted to study prosopagnosia in future. Last, notwithstanding the Herculean efforts by experimenters to equate tasks, particular kinds of objects might simply engage different types of processes disproportionately (e.g., configural vs. feature based). Without ensuring engagement of the same process by, for example, training to expertise on another visual class, as in greeble training (Gauthier, Williams, Tarr, & Tanaka, 199; Gauthier & Tarr, 1997), with the necessary controls (Bukach & Gauthier, 2017), the pursuit of the modularity question may still be doomed to failure.

Given current limitations, then, it is likely that conclusions regarding the modularity of face processing may be drawn only from a pattern of cases where "strong" dissociations are the norm and "classical" dissociations the exception. Reaching more persuasive conclusions regarding modularity might also entail (a) performing correlations and determining whether rank order severity for the two classes correspond within individual (say relative to controls); and perhaps (b) exploring whether the performance profiles are equal under separate modifiability (Sternberg, 2011). Separate modifiability determines whether some experimental manipulation of the stimuli affects performance in both classes to an equal extent: For example, if face and object recognition depended on a particular process, a manipulation such as reduced contrast or spatial frequency filtering might affect the processing of both face and object classes to an equal extent (on strict Sternbergian logic, this is an assumption based on additive factors without regard for possible non-linearities that may indeed be present; see Henson, 2011). Additionally, using discriminability and criterion parameters from signal detection theory to further scrutinize the impact of the manipulation on performance can offer further concrete evidence to adjudicate the single/multiple mechanism question, and demonstrating the tight integral relationship between faces and objects would further shed critical light on the question of domain- or mechanism-specificity.

Last, a promising domain for further exploration is that of assessing the recognition of another visual class, aside from objects. Word recognition is especially suitable as, like faces, words are constructed from a set repertoire of features, and also, as with faces, words come to be recognized holistically with increased experience. It is especially interesting, then, that the findings from four recent papers on word recognition in CP are all suggestive of preservation of word recognition in CP. Additional data do need to be obtained, however, as the number of CPs in these studies is rather small ($n = 11$, Burns et al., 2017; $n = 7$, Collins et al., 2017 i; $n = 10$, Rubino et al., 2016; and $n = 10$, Starrfelt et al., 2017). It is also interesting to note that accuracy and RT for word recognition are statistically equivalent across the CP and control groups, and that an experimental manipulation such as increasing the number of letters in a string (word length effect) has comparable effects across the two groups (i.e., not separate modifiability). Should word recognition be preserved in CP, the locus of the visual recognition deficit is further delimited, and the challenge then is to explain the specific relationship between face and object recognition.

What determines the pattern of association versus dissociation within individual?

What accounts for the frequent association of CP and an object recognition impairment with seemingly preserved word recognition? Several possible explanations arise, some more neural and some more psychological.

An obvious neural explanation for the association concerns anatomical identity: Whatever neural perturbation has affected development and given rise to CP in the first instance might affect a large enough brain area subserving multiple distinct processes. This would favour a single mechanism interpretation for faces and objects (although it is still possible that some high-resolution examination of the structure or function might reveal the adjacency but non-overlap of the systems; see McGugin et al., 2012a, and McGugin, Van Gulick, & Gauthier, 2016). In contrast, the segregation of faces and words would implicate separable mechanisms and, by inference, anatomically distant regions.

Another neurally inspired explanation that might account for both the relatively frequent association of impaired faces and objects and the face–word dissociation appeals to the hemispheric lateralization for these different visual classes. In individuals with the face–object association, both visual classes may engage the same cortical region/s in the same (probably right) hemisphere. Faces and words would be segregated, however, with the latter (fully or largely) preserved in the left hemisphere in the well-established visual word form area (Behrmann & Plaut, 2015; Cohen et al., 2000; Yeatman, Rauschecker, & Wandell, 2013). Those individuals who reveal the dissociation between objects and faces may have stronger right lateralization for face representations but somewhat more bilateral or left lateralized representation for objects. The impairment that gives rise to CP may then affect one hemisphere to a greater degree, leaving the recognition competence of the other hemisphere intact. A concrete example concerns the possible reduction of a key white matter tract, the inferior longitudinal fasciculus (ILF), which projects through the visual system—the reduction of structural integrity of this tract is correlated with the severity of CP, and, although the ILF in both hemispheres is affected, this is so to a greater degree in the right than in the left hemisphere (Thomas et al., 2009; a correlation with performance and fibre integrity in the right hemisphere was also noted in S.Song et al., 2015, although this was in the fibres local to face-specific funtional Regions of Interest in the fusiform gyrus; see also Gomez et al., 2015). Thus, speculatively, slightly different asymmetrical weighting of the hemispheric contributions from individual to individual coupled with a neural perturbation may suffice to account for all cases. As is well known from the language literature, lateralization is variable across individuals (Whitehouse & Bishop, 2009), and the same might be true here for visual recognition. Ideally, some independent biological marker that would permit characterization of these laterality effects would make predictions about which CP individuals might have a concomitant impairment in object recognition (and also ensure that the laterality differences are the cause rather than the effect of the pattern of impairment). Relatedly, face selective brain regions, as revealed by functional magnetic resonance imaging (fMRI), can vary in both anatomical location and extent across normal individuals as well as in function (Thiebaut de Schotten & Shallice, 2017), offering some empirical support for individual differences in functional lateralization.

One psychological explanation for the face–object association and face–word dissociation, which is not mutually exclusive with the above model of lateralization, is compatible with the ideas proposed by Farah (1991) in her meta-analysis of the patients with acquired disorders. Farah argued for a two-component system with one system being more holistic and engaged in face and object processing and the second being more featural and engaged in word and object processing. Preservation of the latter component might also account for the well-preserved word recognition and a less severe, even possibly dissociable, deficit for objects than for faces in CP. Pertinent for the current paper, as is true in probably all cognitive domains, is the finding that there are individual differences amongst normal individuals in face perception (Ross, 1980; Wilmer et al., 2012; Wilmer, Germine, & Nakayama, 2014). In addition, the type of tests used to measure face perception can sometimes elicit different profiles even within an individual (Yovel et al., 2014). As variation across (and within) individuals comes to be considered a relevant (rather than nuisance) factor (Gauthier, 2017b), the variability, which may be exaggerated following brain injury or neurodevelopmental alteration, must be considered further.

Another explanation for the frequent co-occurrence of deficits in face and object recognition might derive from the presence of a “positive manifold”, which refers to the robust finding in which individual differences in different cognitive domains tend to be positively intercorrelated (Rabaglia, Marcus, & Lane, 2011). This positive correlation has generally been interpreted as reflecting the influence of a domain-general cognitive factor, which, in the case of CP, is affected adversely, resulting in correlated face and object recognition deficits. In such a situation, in order to derive a strong conclusion from the observed correlations, there would need to be some third performance variable (like verbal IQ, or simple response time speed) that might be partialled out to remove general patterning across subjects. The presence of a correlation after this partial regression would offer stronger evidence for a single mechanism underlying the two visual classes, independent of the more domain-general factor. The positive manifold, however, cannot obviously account for the data given the preservation of word recognition (which, on this account, should also be adversely impacted) and the observed lack of a correlation between word and face recognition.

A version of the positive manifold idea comes from recent findings showing that there is a single underlying ability, *v*, that governs both object and face recognition as experience with a visual class increases. Computational simulations in which *v* is modelled as the available computational resources (number of hidden units) in the mapping from input to label, and experience (manipulated as the frequency of individual exemplars in an object category during network training) suffice to capture the increase in *v* as a function of experience with a category (Wang, Gauthier, & Cottrell, 2016). Presumably, some curtailing of the available hidden units will result in the association of face and object recognition in CP potentially precluding the acquisition of expertise for either class. As noted above in relation to the positive manifold, though, some adjustment to the model would be required to account for the preservation of word recognition, especially since experience with word recognition is substantial (and hence the level of *v* should account for the relationship between face and word recognition to a great extent). For further discussion of a domain-general account of visual recognition that is independent of general intelligence, see Gauthier (2017b).

Last, we might consider the possibility that the CP cases with an associated object recognition deficit and those without might constitute different subtypes of CP, although what exact mechanism separates these subtypes remains to be determined. An analogy from the domain of acquired prosopagnosia (AP) might be instructive. In some, but not all, cases of AP, there is a strong association with achromatopsia: Detailed inspection reveals that the presence or absence of association is indicative of lesion site, with the achromatopsia and prosopagnosia association present in the occipitotemporal type of AP but not in the anterior temporal mnemonic variant of AP (Bouvier & Engel, 2006; Moroz et al., 2016; similar to the apperceptive–associative distinction made in object agnosia; De Renzi, Faglioni, Grossi, & Nichelli, 1991). A similar distinction might hold for CP in that the deficit may result from a perturbation in either perceptual or mnemonic systems or both (Behrmann, Lee, Geskin, Graham, & Barense, 2016). For example, in a recent paper (Ulrich et al., 2016), of the 11 individuals with face recognition impairments, six failed to show any evidence of perceptual impairment, leading the authors to suggest that the basis of the disorder in these individuals might have been mnemonic, rather than perceptual, in nature (for other reported cases of prosopamnesia, see Tippett, Miller, & Farah, 2000; Williams, Berberovic, & Mattingley, 2007). There is ongoing debate about the inclusion of mnemonic function as a signature marker for CP (as real-world recognition requires matching to a long-term representation) and ongoing debate whether there are different subtypes of CP, one more perceptual and one more mnemonic. There is clearly a pressing need to determine whether there are subtypes of CP and whether these subtypes are differentiable on some neurobiological and/or psychological marker.

Single cases versus distribution of the population

A standard argument in cognitive neuropsychology is one in which just a single case with a dissociation is sufficient to challenge an existing account of a shared mechanism. Indeed, in Category 3 we have 47 single cases of dissociation, any one of which might contest a common mechanism for face and object recognition. Had we been evaluating any of these single cases, the conclusion might have favoured entirely normal object recognition behaviour along with an impairment in face recognition and perhaps even a classical dissociation in some severe cases of CP. If the single case came from Category 4 or 5, however, we would have concluded that both face and object recognition were deficient and sometimes severely and equally so. Clearly, reaching conclusions from any single case would have been misleading.

The potential danger of making inferences from a single case is also well illustrated in studies investigating the association between a reading deficit and semantic dementia. For example, one case study describes the patient, E.M. (Blazely, Coltheart, &

Casey, 2005), who was semantically impaired but read low-frequency exception (LFE) words normally, suggesting that exception word reading does not depend on semantics. However, when the distribution of a group of semantically impaired cases was reviewed, including 100 observations of 51 patients (some longitudinally), it appeared that a patient very much like E.M. was simply an outlier within a distribution that, overall, showed the predicted relationship between semantics and reading LFE words (Woollams, Ralph, Plaut, & Patterson, 2007).

As theories confront the complexities of individual differences, traditional neuropsychological inference based solely on single-case studies becomes less viable (Lambon Ralph, Patterson, & Plaut, 2011; Patterson & Plaut, 2009) just as inference based on a group mean may obscure significant dissociations amongst the single cases (for example, between action recognition and action production, Negri et al., 2007). Furthermore, although dissociations have generally been considered to carry more theoretical weight than associations, a theory based on explaining the distribution of all the data will probably provide the best account of the phenomenon. Also, of note, there have been a number of successful accounts in which the gold-standard double dissociation, taken as weighty evidence for independent systems, has been explained within a unitary system: For example, the double dissociation between the reading of concrete words and the reading of abstract words, taken as evidence of independent systems for these two classes of lexical items, can be simulated with different lesions to a single, interactive, and graded system of lexical representations (Plaut & Shallice, 1993). Provocatively, then, even the face–object dissociation need not compel the proposal of segregated systems and might be captured in the context of a single, shared system.

What will constitute trenchant evidence in the future?

Despite the growing literature on the subject of CP (21 CP/DP papers in PubMed in 2017 at the end of September), the assessment and diagnosis of the disorder remains highly variable, as are the data to address the association/dissociation issue. Barton and Corrow (2016c), in their Table 1, report the variability in diagnostic criteria and assessment methods used to date. They highlight two aspects that are critical for future investigations: (a) a clear, solid diagnosis of DP, and (b) a clear solid evaluation of object recognition. Reaching consensus on the inclusion and exclusion criteria and a means of identifying potentially differing phenotypes within the CP population (Bate et al., 2008) is very important. At the very least, individuals should not have an identifiable neurological aetiology, and a general memory problem or other cognitive deficits should be excluded (see Dalrymple & Palermo, 2016).

Barton and Corrow (2016c) also set out two primary inclusion criteria—namely, the subjective complaint of difficulty in everyday face recognition that is lifelong, and objective evidence of an impairment based on two or more tests of face familiarity (they also propose four additional secondary criteria that are useful). Rigorous experimental practices include the recruitment of carefully matched control participants and statistical comparison of the single case's profile vis à vis the matched group (Crawford & Garthwaite, 2002, 2006). Multiple dependent measures (accuracy, RT d' or A', inverse efficiency) ought to be recorded and analysed (see also Duchaine & Garrido, 2008), and in cases where RT is used, because RT can be influenced by reduced acuity or motor slowing, acquisition of some additional measures to rule out (or covary) these factors might be useful. Additionally, the use of data-limited presentation (brief exposure duration) might circumvent the decision of which is the optimal dependent measure, and accuracy alone might suffice under this condition.

A further consideration that has received substantial attention in neuroimaging studies but not in neuropsychology concerns "double dipping".[5] The same measure of face recognition is sometimes used both for categorization of a case as a CP and for the comparison of face processing and object processing. Using the score in these two non-independent ways biases the likelihood of finding a dissociation, because participants are only included in the analysis if their face scores were impaired at the outset. CPs should first be categorized as CP on some measure/s and then evaluated with different face tests (ideally matched) for comparison to object tests.

Consensus on a cut-off that warrants a diagnosis of CP would be helpful, too. Indeed, there is still ongoing debate as to whether CP is a disorder at all or whether the poorer face performance of these individuals merely places them at the lower end of the normal distribution (>2 *SD*s from control mean). In complementary fashion, some have suggested that "super-recognizers" make up the upper tail of the normal distribution (Russell, Duchaine, & Nakayama, 2009; Russell, Chatterjee & Nakayama, 2012), and that the lower end is composed of individuals with CP (Biotti et al., 2017). However, individuals might share the exact same low quantitative score on a visual recognition test and fall into the lower tail of distribution but they might do so for different reasons: A poor score and an identifiable neurobiological deviation might warrant the label CP whereas a profile of a poor score but a neural profile in the normal neurobiological distribution might not (see also Barton & Corrow, 2016c, on this point). A purely quantitative indicator might not ultimately be sufficient for inclusion, and further determination of mechanistic differences is pressing.

A final source of evidence that might permit an understanding of the associations and dissociations of face and object recognition in CP might come from imaging and electrophysiological investigations. In the last decade, many functional (fMRI) and structural magnetic resonance imaging (sMRI) studies have been conducted with individuals with CP, but these findings, like the behavioural data, remain inconsistent, and no clear picture has emerged as yet. The advent of new acquisition protocols and analysis approaches might assist in the discovery of an independent biological marker for CP (see Rivolta et al., 2014).

Where do we go from here?

In addition to the suggestions for future research in CP outlined above, further evidence concerning the relationship between face recognition and object recognition might come from examining other neuropsychological populations. Studies with questions similar to those posed here are already underway with super-recognizers. For example, of the six super-recognizers tested (Bobak, Bennetts, Parris, Jansari, & Bate, 2016), three show superior abilities in object processing as well, and five of the six presented with enhanced holistic processing, suggesting that there may well be a unitary mechanism (perhaps related to holistic processing or *v*) that supports highly skilled face and non-face object recognition.

We may also gain insights from studying children with CP (Bennetts, Murray, Boyce, & Bate, 2017; Brunsdon, Coltheart, Nickels, & Joy, 2006; Dalrymple et al., 2014a, Dalrymple et al., 2014b), who can shed light on the early origins of the disorder. Because CP has a familial component, examining at-risk children and then monitoring the microgenesis of the development of face recognition might reveal trajectories that differ for those children who are later diagnosed with CP versus those who are not. A note of caution, however, is that because face recognition in children has a prolonged developmental trajectory (de Heering, Rossion, & Maurer, 2012; Scherf, Behrmann, Humphreys, & Luna, 2007), the diagnosis of CP in children is not straightforward (and a large, well-matched control group is key). The functional organization of the underlying mechanisms for faces and non-faces may also differ between non-CP adults and children. Last, taking into account an individual's expertise may be helpful. For example, adjusting for premorbid expertise in lesion cases (by, for example, assessing verbal semantic knowledge) has been critical in revealing associations and dissociations especially in cases with substantial premorbid expertise (Barton et al., 2009) and is also useful in evaluating recognition performance in normal individuals (McGugin, Richler, Herzmann, Speegle, & Gauthier, 2012b; Van Gulick, McGugin, & Gauthier, 2016) and those with CP as well (as in Weiss et al., 2016).

Conclusion

Numerous studies, engaging a host of different methodologies, have been conducted in an attempt to elucidate the cognitive and neural architecture that underlies the accurate and seemingly effortless recognition of classes of visual objects. In an extensive review of individuals with congenital prosopagnosia, we have determined that there is a preponderance of cases in whom non-face object recognition is also impaired (but in whom, provocatively, word recognition is preserved). These findings favour an interpretation of a single mechanism that might support the recognition of more than one but not all visual classes. Many questions remain, and future research using better criteria, assessment tools, and performance measures along with more nuanced hypotheses regarding the severity of the deficit and different patterns of dissociation will help sharpen the theoretical blade of neuropsychology. Understanding the integrated/specialized nature of visual recognition mechanisms remains an ongoing enterprise, and the neuropsychological evidence can contribute productively to this broad debate.

Notes

1. We thank Jason Barton for raising this important distinction.
2. The assumption of equal distribution to categories is made given that we have no a priori expectations of such a distribution. Simply having parity across the three categories then is an assumption-free approach to the χ^2.
3. Note that we excluded one outlier from the Esins et al. (2014) data in deriving the mean and standard deviation for RT. This participant had a mean RT of 11.66 s for the Blue Objects task when the mean of remaining controls is 2.7 s.
4. A.W. had a topographical deficit as well as she gets lost often and loses possessions. She scored poorly on the Old/New Scenes test and on the Warrington Topographical Recognition Memory test. A.W. performed normally on all sections of the within-category faces, bodies, and birds test in A' and RT.
5. We thank Brad Duchaine for drawing our attention to this point.

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Appendix 1: Not tested for Object Agnosia

Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Avidan et al., 2011; Avidan et al., 2014)	BT	Famous Faces Questionnaire, CFMT, CFPT, face discrimination task	Various global-local tasks	Normal abilities on all tests.
(Avidan et al., 2011; Tanzer et al., 2013)	JT	Famous Faces Questionnaire, CFMT, CFPT, face discrimination task	Various global-local tasks	Abnormal global processing in Tanzer et al.
(Avidan et al., 2011; Tanzer, Freud, Ganel, & Avidan, 2013; Tanzer et al., 2016)	ID	Famous Faces Questionnaire, CFMT, CFPT, face discrimination task	Various global-local tasks	Performance outside of normal range on global bias index (Table 3, Avidan et al., 2011)
(Awasthi, Friedman, & Williams, 2012)	7 DPs	CFMT, CFPT, MACCS Famous Faces test (MFFT)	Subtests of BORB (not specified) and Raven Colored Progressive Matrices	Within normal limits on all tests.
(Bate, Haslam, Jansari, & Hodgson, 2009)	RW	Famous face task, CFMT, CFPT, facial expression recognition task	BORB subtests including object decision	Between 1 and 2SDs from controls on size match and position gap
(Bate et al., 2009)	WS	Famous face task, CFMT, CFPT, facial expression recognition task	BORB subtests including object decision	Within normal limits on all tests.
(Bate et al., 2009)	MZ	Famous face task, CFMT, CFPT, facial expression recognition task	BORB subtests including object decision	Within normal limits on all tests.
(Behrmann, Avidan, Gao, & Black, 2007)	MX	Famous faces questionnaire, face discrimination task, face detection task	None	
(Bobak, Parris, Gregory, Bennetts, & Bate, 2016)	DP1	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests except 1-2 SDs from controls on Length Match.
(Bobak et al., 2016)	DP2	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests except 1-2 SDs from controls on Length Match and Size Match.
(Bobak et al., 2016)	DP3	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests except 1-2 SDs from controls on Length Match and Size Match.
(Bobak et al., 2016)	DP4	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests.
(Bobak et al., 2016)	DP5	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests.
(Bobak et al., 2016)	DP6	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests except 1-2SDs on object decision (-1.1).
(Bobak et al., 2016)	DP7	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests except 1-2SDs on Length Match.
(Bobak et al., 2016)	DP8	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests.
(Bobak et al., 2016)	DP9	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests.
(Bobak et al., 2016)	DP10	CFMT, CFPT, famous faces, mind in eyes task	BORB low level and object decision	Within normal limits on all tests except 1-2SDs on Size Match.
Bowles et al., 2009	M61	CFMT, CFPT, famous faces	None	
Bowles et al., 2009	F74	CFMT, CFPT, famous faces	None	
Bowles et al., 2009	M21	CFMT, CFPT, famous faces	None	
Bowles et al., 2009	F73	CFMT, CFPT, famous faces	None	

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
Bowles et al., 2009	F21	CFMT, CFPT, famous faces	None	
Bowles et al., 2009	F22	CFMT, CFPT, famous faces	None	
Bowles et al., 2009	M57	CFMT, CFPT, famous faces	None	
(Burns, Tree, & Weidemann, 2014)	8 DPs	Famous faces, CFMT, CFPT	None	
(Chatterjee & Nakayama, 2012)	18 subjects	CFMT, CFPT, Facial Age Perception Task (FAPT), face identity perception task	4 BORB subtests and assume they are same as in other papers by author (length, size, orientation, position of gap)	Within normallimits on house test.
(De Haan, 1999)	Daughter 1	Familiar Face Recognition Task	None	
(De Haan, 1999)	Daughter 2	Familiar Face Recognition Task	None	
(De Haan, 1999)	Father	Familiar Face Recognition Task	None	
(DeGutis, Cohan, Mercado, Wilmer, & Nakayama, 2012)	6 subjects	CFMT, CFPT	None	
(Duchaine & Nakayama, 2004)	11 subjects	BFRT, faces One in Ten, Faces Old/New	None	
(Duchaine & Nakayama, 2006)	F20	CFMT, unfamiliar faces, famous faces	None	
(Duchaine & Nakayama, 2006)	F29	CFMT, unfamiliar faces, famous faces	None	
(Duchaine & Nakayama, 2006)	F41	CFMT, unfamiliar faces, famous faces	None	
(Duchaine & Nakayama, 2006)	M53	BFRT, CFMT, unfamiliar faces, famous faces	None	
(Duchaine & Nakayama, 2006)	M57	BFRT, CFMT, unfamiliar faces, famous faces	None	
(Duchaine & Nakayama, 2006)	F46	BFRT, CFMT, unfamiliar faces, famous faces	None	
(Duchaine & Nakayama, 2006)	M41	BFRT, CFMT, unfamiliar faces, famous faces	None	
(Duchaine & Nakayama, 2006)	M26	BFRT, CFMT, unfamiliar faces, famous faces	None	
(Duchaine, Jenkins, Germine, & Calder, 2009)	F24	CFMT, Famous Faces, CFPT, Inverted/upright faces	BORB: length, size, orientation, position of gap	Normal abilities on all tests.
(Duchaine et al., 2009)	F19	CFMT, Famous Faces, CFPT, Inverted/upright faces	BORB: length, size, orientation, position of gap	Normal abilities on all tests.
(Duchaine et al., 2009)	F61	CFMT, Famous Faces, CFPT, Inverted/upright faces	BORB: length, size, orientation, position of gap	Normal abilities on all tests.
(Duchaine et al., 2009)	M33	CFMT, Famous Faces, CFPT, Inverted/upright faces	BORB: length, size, orientation, position of gap	Normal abilities on all tests.
(Duchaine et al., 2009)	M41	CFMT, Famous Faces, CFPT, Inverted/upright faces	BORB: length, size, orientation, position of gap	Normal abilities on all tests.
(Duchaine et al., 2009)	M57	CFMT, Famous Faces, CFPT, Inverted/upright faces	BORB: length, size, orientation, position of gap	Normal abilities on all tests.
(Duchaine, Yovel, & Nakayama, 2007)	F35	Famous Faces, CFMT, CFPT	BORB: length, size, orientation, position of gap	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007; Yovel & Duchaine, 2006)	M56 (assume this is BK in Yovel paper)	Famous Faces, CFMT, CFPT	BORB, unspecified tests	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	F18	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	F32	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	F39	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	F62	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	M30	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	M32	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	M35	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	M41	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	M45	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	M47	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Duchaine, Yovel, et al., 2007)	M51	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Duchaine, Yovel, et al., 2007)	M54	Famous Faces, CFMT, CFPT	BORB but subtests not specified	Normal abilities on all tests.
(Eimer et al., 2012; Towler et al., 2012)	AM	Famous faces, CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012; Towler et al., 2012)	JA	Famous faces, CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012; Towler et al., 2012)	JL	Famous faces, CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012; Towler et al., 2012)	KS	Famous faces, CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012; Towler et al., 2012)	MC	CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012; Towler et al., 2012)	SW	Famous faces, CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012; Towler, Gosling, Duchaine, & Eimer, 2012)	AH	Famous faces, CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012)	AMC	CFMT, CFPT, ONFRT	None	
(Eimer et al., 2012)	EW	CFMT, CFPT, ONFRT, Famous faces	BORB, unspecified tests	Normal abilities on all tests.
(Eimer et al., 2012)	NE	CFMT, CFPT, ONFRT	BORB, unspecified tests	Normal abilities on all tests.
(Eimer, Gosling, & Duchaine, 2012)	TL	CFMT, CFPT, ONFRT	None	
(Esins, Schultz, Wallraven, & Bulthoff, 2014)	Subject a	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject d	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject e	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject f	CFMT	Seashells and blue object task	Within normal range.
(Esins, et al., 2014)	Subject h	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject k	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject m	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject r	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject s	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject t	CFMT	Seashells and blue object task	Within normal range.
(Esins et al., 2014)	Subject u	CFMT	Seashells and blue object task	Within normal range.
(M. Grueter et al., 2007)*	AN	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Below 2SDs on mean VVIQ and non-face VVIQ.
(M. Grueter et al., 2007)*	GI	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Above 2SDs on VVIQ for non-face objects.
(M. Grueter et al., 2007)*	ER	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Above 2SDs on VVIQ for non-face objects.
(M. Grueter et al., 2007)*	HE	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Below 2SDs on mean VVIQ and non-face VVIQ.
(M. Grueter et al., 2007)*	LI	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Below 2SDs on mean VVIQ and non-face VVIQ.
(M. Grueter et al., 2007)*	MA	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Within normal limits on all tasks.
(M. Grueter et al., 2007)*	TH	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Above 2SDs on VVIQ for non-face objects.
(M. Grueter et al., 2007)*	UL	Warrington recognition task, famous faces, familiar faces, VVIQ for faces	VVIQ for non-face objects	Below 2SDs on mean VVIQ, face VVIQ and non-face VVIQ
(T. Grueter et al., 2009)	37 subjects (not including 16 others from previous studies)	VVIQ	VVIQ for non-face objects, house-matching task on 12 participants (analysis not by individual)	Abnormal mental imagery for non-face objects and scenes. No raw data - all data is based on mean of CPs
(Johnen, et al., 2014)	F19a	CFMT, CFPT	VOSP, Rey-Osterrieth Complex Figure Test (RCFT)	Score -1 on VOSP object decision and -1.08 cube analysis.
(Johnen et al., 2014)	M52	CFMT, CFPT	VOSP, Rey-Osterrieth Complex Figure Test (RCFT)	Score -1.95 on VOSP object decision.
(Johnen et al., 2014)	M18	CFMT, CFPT	VOSP, Rey-Osterrieth Complex Figure Test (RCFT)	Score -1.63 on VOSP object decision.
(Johnen et al., 2014)	M50	CFMT, CFPT	VOSP, Rey-Osterrieth Complex Figure Test (RCFT)	Score -1.42 on VOSP object decision.

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Johnen et al., 2014)	F48	CFMT, CFPT	VOSP (including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Exceeds 2SDs from control mean on VOSP object decision
(Johnen et al., 2014)	F55	CFMT, CFPT	VOSP (including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Exceeds 2SDs from control mean on VOSP object decision and on Rey-Osterrieth Figure Test
(Johnen et al., 2014)	F19b	CFMT, CFPT	VOSP (including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Exceeds 2SDs from control mean on VOSP object decision and on Rey-Osterrieth Figure Test
(Johnen et al., 2014)	F33	CFMT, CFPT	VOSP, Rey-Osterrieth Complex Figure Test (RCFT)	More than 2SDs on VOSP number location.
(Johnen et al., 2014)	F23	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Exceeds 2SDs from control mean on VOSP number location and on Rey-Osterrieth Figure Test
(Johnen et al., 2014)	M21	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	More than 2SDS on Rey Complex Figure
(Johnen et al., 2014)	M28	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	More than 2SDS on Rey Complex Figure
(Johnen et al., 2014)	M54	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	More than 2SDs on VOSP number location and between 1-2SDs on complex figure delayed recall.
(Johnen et al., 2014)	F53	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	More than 2SDs on VOSP number location
(Johnen et al., 2014)	M23	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Between 1-2SDs on complex figure copy and immediate recall.
(Johnen et al., 2014)	M27	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Within normal limits on all tests.
(Johnen et al., 2014)	M46	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Within normal limits on all tests.
(Johnen et al., 2014)	M47	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Within normal limits on all tasks.
(Johnen et al., 2014)	M22	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Within normal limits on all tasks.
(Johnen et al., 2014)	M45	CFMT, CFPT	VOSP including object decision, Rey-Osterrieth Complex Figure Test (RCFT)	Within normal limits on all tasks.
(Kimchi, Behrmann, Avidan, & Amishav, 2012)	FF	Famous faces questionnaire, CFMT	None	
(Kress & Daum, 2003)	GH	Tubinger Affect Battery, face subtest Recognition Memory Test	None	
(Leib et al., 2012)	DP1	BFRT, WRMT, Famous Faces	None	
(Leib et al., 2012)	DP2	BFRT, WRMT, Famous Faces	None	
(Leib et al., 2012)	DP3	BFRT, WRMT, Famous Faces	None	
(Leib et al., 2012)	DP4	BFRT, WRMT, Famous Faces	None	
(Liu & Behrmann, 2014)*	SH	CFMT, Famous Faces	None	
(Moroz et al., 2016)	9 subjects	CFMT, Warrington recognition,	None	No individual raw data, only group effect
(Russell, Chatterjee, & Nakayama, 2012)	10 subjects	CFMT, CFPT	None	No individual raw data, only group effect
(Schmalzl, Palermo, & Coltheart, 2008)	E	Familiar Face Recognition Task, Mooney faces task, Composite effect, Holistic processing	Global-local task	Normal global-local; abnormal on detecting spacing changes (Table 3)
(Schmalzl et al., 2008)	A	Familiar Face Recognition Task, Mooney faces task, Composite effect, Holistic processing	Global-local task	Statistically different from controls on all conditions (Table 2) and on feature changes, viewpoint and facial expression
(Schmalzl et al., 2008)	C	Familiar Face Recognition Task, Mooney faces task, Composite effect, Holistic processing	Global-local task	Normal on global-local but abnormal on judging facial expression
(Schmalzl et al., 2008)	D	Familiar Face Recognition Task, Mooney faces task, Composite effect, Holistic processing	Global-local task	Normal global-local; abnormal on detecting spacing changes, viewpoint and facial expressions (Table 3)

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Schmalzl et al., 2008)	H	Familiar Face Recognition Task, Mooney faces task, Composite effect, Holistic processing	Global-local task	Normal global-local; abnormal on detecting spacing changes, contour changes and viewpoint (Table 3)
(Schmalzl et al., 2008)	I	Familiar Face Recognition Task, Mooney faces task, Composite effect, Holistic processing	Global-local task	Statistically different from controls on Global congruent and Global incongruent (Table 2) and viewpoint (Table 3)
(Schwarzer et al., 2007)	GM	Warrington recognition, RMF, famous faces, familiar faces, internal/external features, mental imagery task	None	
(Stollhoff et al., 2010, 2011)	EB	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	More than 2SDs on object decision BORB.
(Stollhoff et al., 2010, 2011)	HB	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	More than 2SDs on object decision BORB.
(Stollhoff, Jost, Elze, & Kennerknecht, 2010)	HG	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Below 2 SDs from control mean on VOSP subtest 4
(Stollhoff et al., 2010)	HW	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Difficulties across several object recognition tasks
(Tanzer et al., 2013)	FG	CFMT, CFPT, famous faces, unfamiliar faces upright/ inverted	Various global-local tasks and measures of Garner interference	Abnormal global processing in Tanzer et al.
(Tanzer, Weinbach, Mardo, Henik, & Avidan, 2016: Tanzer et al., 2013)	SS	CFMT, CFPT, famous faces, unfamiliar upright and inverted faces	None	SS is the only individual in this sample who has no other non-face testing
(Towler et al., 2012)	CM	Famous faces, CFMT, CFPT, ONFRT	BORB unspecified tests	Within normal limits on all tests.
(Towler et al., 2012)	CP	Famous faces, CFMT, CFPT, ONFRT	BORB unspecified tests	Within normal limits on all tests.
(Towler et al., 2012)	MP	Famous faces, CFMT, CFPT, ONFRT	BORB unspecified tests	Within normal limits on all tests.
(Towler et al., 2012)	MZ	Famous faces, CFMT, CFPT, ONFRT	BORB unspecified tests	Within normal limits on all tests.
(Towler et al., 2012)	RL	Famous faces, CFMT, CFPT, ONFRT	BORB unspecified tests	Within normal limits on all tests.
(Towler et al., 2012)	SC	Famous faces, CFMT, CFPT, ONFRT	BORB unspecified tests	Within normal limits on all tests.
(Towler et al., 2012)	SN	Famous faces, CFMT, CFPT, ONFRT	BORB unspecified tests	Within normal limits on all tests.
(Ulrich et al., 2016)	5 of 11 subjects	Self-report of severe face recognition difficulty; CFMT, famous faces, Schmalzl et al. (2008) test battery, CFPT	Global-local task	Six individuals showed no perceptual impairment. Queries whether deficit is memorial in nature.
(Verfaillie, Huysegems, De Graef, & Van Belle, 2014)	LP	interview, BFRT	BORB, subtests not specified (clustered)	Within normal limits on all tests.
(Verfaillie et al., 2014)	KV	interview, BFRT	BORB, subtests not specified (clustered)	Within normal limits on all tests.
(Verfaillie et al., 2014)	SH	interview, BFRT	BORB, subtests not specified (clustered)	Within normal limits on all tests.
(Verfaillie et al., 2014)	SL	interview, BFRT	BORB, subtests not specified (clustered)	Within normal limits on all tests.
(Verfaillie et al., 2014)	SS	interview, BFRT	BORB, subtests not specified (clustered)	Within normal limits on all tests.
(Verfaillie et al., 2014)	TG	interview, BFRT	BORB, subtests not specified (clustered)	Within normal limits on all tests.
(Williams, Berberovic, & Mattingley, 2007)	C	BFRT, face-memory task from Wechsler memory scale	BORB including object decision	Within normal limits on all tests.
(Yovel & Duchaine, 2006)	JH	Famous faces, old/new faces, CFMT	None	Was not tested on houses like other participants in study
(Zhang, Liu, & Xu, 2015)	7 DPs	Famous faces	None	All included in imaging

Appendix 2: No object recognition deficit, no RT

Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Bate, Haslam, Tree, & Hodgson, 2008; Tree & Wilkie, 2010)	AA	Benton Facial Recognition Test, Warrington's Face/Word Recognition test, CFMT, Hodges and Ward Famous Faces Test, Matched Faces and Object Test, Doors and People (scaled) test; Benton low-level; face naming, face recognition memory CFRT	Subtests of BORB: object decision, foreshortened match, minimal feature match, line orientation, position of gap, object naming, word recognition memory	Within normal limits on all tests.

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Bentin, Degutis, D'Esposito, & Robertson, 2007)	KW	Famous Faces, CFMT, BFRT	Boston Naming test, Hooper Test, Benton Line Orientation task	Within normal limits on all tests.
(Bentin, Deouell, & Soroker, 1999; Hasson, Avidan, Deouell, Bentin, & Malach, 2003)	YT	Warrington visual memory test for faces, Benton and Van Allen's facial recognition test	Wechsler memory scale, Benton's visual retention test, Rey-Osterrieth complex figure test, verbal part of Warrington's Visual Memory Test, Benton line orientation test, Boston naming test, Loewenstein Occupational Therapy Cognitive Assessment	Some tasks had RT, but seemingly not the ones in which object recognition was required.
(Bowles et al., 1999; Rivolta et al., 2012a; Susilo et al., 2010)	F21	MFFT-08, Famous faces, CFMT, CFPT	BORB including object naming, Raven, CCMT	Within normal limits on all tests.
(Bowles et al., 1999; Rivolta et al., 2012a)	M60	MFFT-08, Famous faces, CFMT, CFPT	BORB including object naming	Within normal limits on all tests.
(Bowles et al., 1999; Rivolta et al., 2012a)	F37	MFFT-08, Famous faces, CFMT, CFPT	BORB including object naming	Within normal limits on all tests.
(Bowles et al., 1999; Rivolta et al., 2012a)	F50	MFFT-08, Famous faces, CFMT, CFPT	BORB including object naming	Within normal limits on all tests.
(Bowles et al., 2009; Rivolta et al., 2012a; 2012b, 2014, 2016)	F47/ GN	MFFT-08, Famous faces, CFMT, CFPT	BORB including object naming, CCMT	Within normal limits on all tests.
(Bowles et al., 2009; Rivolta et al., 2012a, 2012b, 2014, 2016)	F40/LL	MACCS, MFFT-08, Famous faces, CFMT, CFPT	BORB including object naming, CCMT	Within normal limits on all tests.
(Bowles et al., 2009; Rivolta et al., 2012a, 2012b, 2014, 2016)	M53/OJ	MFFT-08, Famous faces, CFMT, CFPT	BORB including object naming, CCMT	Within normal limits on all tests.
(Carbon et al., 2010)	HS	Famous Faces test. Personally familiar faces	Parallel set of houses test (from Grueter et al. (2009))	Within normal limits on house test.
(Carbon et al., 2010)	MB	Famous Faces test. Personally familiar faces	Parallel set of houses test (from Grueter et al. (2009))	Within normal limits on house test.
(Carbon et al., 2010)	MD	Famous Faces test. Personally familiar faces	Parallel set of houses test (from Grueter et al. (2009))	Within normal limits on house test.
(Carbon et al., 2010)	MM	Famous Faces test. Personally familiar faces	Parallel set of houses test (from Grueter et al. (2009))	Within normal limits on house test.
(Carbon et al., 2010)	MU	Famous Faces test. Personally familiar faces	Parallel set of houses test (from Grueter et al. (2009))	Within normal limits on house test.
(Carbon et al., 2010)	RE	Famous Faces test. Personally familiar faces	Parallel set of houses test (from (T. Grueter, Grueter, Bell, & Carbon, 2009))	Within normal limits on house test.
(Carbon et al., 2010)	SA	Famous Faces test. Personally familiar faces	Parallel set of houses test (from Grueter et al. (2009))	Within normal limits on house test.
(Carbon et al., 2010)	SI	Famous Faces test. Personally familiar faces	Parallel set of houses test (from (T. Grueter et al., 2009))	Within normal limits on house test.
(Carbon et al., 2010)	SS	Famous Faces test. Personally familiar faces	Parallel set of houses test (from (T. Grueter et al., 2009))	Within normal limits on house test.
(Carbon et al., 2010)	WB	Famous Faces test. Personally familiar faces	Parallel set of houses test (from (T. Grueter et al., 2009))	Within normal limits on house test.
(Carbon et al., 2010)	HG	Famous Faces test. Personally familiar faces	Parallel set of houses test (from T. Grueter et al. (2009))	Within normal limits on house test.
(Carbon et al., 2010)	AR1	Famous Faces test. Personally familiar faces	Parallel set of houses test (from T. Grueter et al. 2009))	Within normal limits on house test.
(Carbon, Grueter, Grueter, Weber, & Lueschow, 2010)	HM	Famous Faces test	Parallel set of houses test (from Grueter et al. (2009))	Within normal limits on all tests.
(Carbon, Grueter, Weber, & Lueschow, 2007)	14 CPs	Famous Faces test	Silhouette, object decision, progressive silhouettes subtests of VOSP	Within normal limits on all tests.
(Corrow et al., 2016)	DP008	CFMT, WRMT, famous faces	House and scene recognition	Normal abilities on all tests.
(Corrow et al., 2016)	DP014	CFMT, WRMT, famous faces	House and scene recognition	Normal abilities on all tests.
(Corrow et al., 2016)	DP016	CFMT, WRMT, famous faces	House and scene recognition	Normal abilities on all tests.
(Corrow et al., 2016)	DP024	CFMT, WRMT, famous faces	House and scene recognition	Normal abilities on all tests.
(Corrow et al., 2016)	DP033	CFMT, WRMT, famous faces	House and scene recognition	Normal abilities on all tests.
(Corrow et al., 2016)	DP035	CFMT, WRMT, famous faces	House and scene recognition	Normal abilities on all tests.
(Corrow et al., 2016)	DP044	CFMT, WRMT, famous faces	House and scene recognition	Normal abilities on all tests.
(Dalrymple, 2014; Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP10	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in accuracy for bodies (-1.22)

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(de Gelder, Frissen, Barton, & Hadjikhani, 2003; de Gelder & Stekelenburg, 2005)	FJ	whole/part test, matching facial expressions, matching identical face parts; Benton face recognition test, famous faces test	Whole/part test; BORB, Boston Naming test	Normal on BNT (although control data not included)
(DeGutis, Cohan, & Nakayama, 2014) (subject 519 not outside 2SDs?)*	24 subjects	CFMT, CFPT, FOBPT	FOBPT	Seems normal - no reporting of control statistics
(Degutis, Cohan, Mercado, Wilmer, & Nakayama, 2012) (s12 not outside 2SDs of controls)*	38 subjects	CFMT, CFPT	FOBPT	Seems normal - no reporting of control data or RT
(Dobel et al., 2011; Dobel et al., 2008)	LO	BFFT	VOSP, Delayed matching faces/ glasses, Snodgrass picture naming	At cutoff on VOSP screening and progressive silhouettes.
(Dobel et al., 2011; Dobel et al., 2008)	BT	BFFT	VOSP; Delayed matching faces/ glasses, Snodgrass picture naming	Below critical cutoff on progressive silhouettes and position discrimination of VOSP.
(Dobel, Junghofer, & Gruber, 2011; Dobel, Putsche, Zwitserlood, & Junghofer, 2008)	KA	BFFT	VOSP, Delayed matching faces/ glasses, Snodgrass picture naming	Normal abilities on all tests.
(Duchaine, 2000; Duchaine & Nakayama, 2006; Le Grand et al., 2006)	BC/M57	Warrington recognition task, 1 in 10 task, Famous Faces task; CFMT, unfamiliar & famous faces	Gestalt completion task, Snowy pictures task, BORB, Kit of Factor-Referenced Cognitive Tests, Snodgrass Line Drawings	Normal abilities on all tests. Diagnosed with Central Auditory Processing Deficit
(Esins et al., 2016)	Subject 2	CFMT, CCMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Score -1.38 accuracy from controls.
(Esins et al., 2016)	Subject 3	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Score -1.27 accuracy from controls.
(Esins et al., 2016)	Subject 4	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Within normal range.
(Esins et al., 2016)	Subject 5	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Within normal range.
(Esins et al., 2016)	Subject 6	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 8	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 9	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 10	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 11	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 12	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 13	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 14	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 15	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Esins et al., 2016)	Subject 16	CFMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Esins, Schultz, Stemper, Kenerknecht, & Bulthoff, 2016)	Subject 1	CFMT, CCMT, Composite face, Surprise recognition, featural and configural sensitivity task	CCMT	Normal abilities on all tests.
(Harris et al., 2005)	KNL	Famous Faces, old/new faces	BORB, Snodgrass line drawings	Normal abilities on all tests.
(Huis in't Veld et al., 2012)	MR	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces and object matching task	BORB, faces and object matching task	Z-score-1.42 in RT on upright shoe matching.
(Huis in't Veld, den Stock, & de Gelder, 2012)	AR	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces and object matching task	BORB, faces and object matching task	Score -1.42 on house part matching.
(Huis in't Veld, den Stock, & de Gelder, 2012)*	BG	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces and object matching task	BORB, faces and object matching task, face and house part-whole matching	Normal abilities on all tests.
(Kress& Daum, 2003; Minnebusch et al., 2009; Minnebusch et al., 2007)	TP/SO	RMT-F, BFRT, Tübinger affect battery (TAB), Bochum test of face processing, famous-nonfamous faces test	BORB, Benton Battery, Snodgrass line drawings	Paper qualifies these subjects: "All subjects may have some early brain damage or insult to the brain". Within normal limits on all tasks.
(Lange et al., 2009; Lobmaier et al., 2010)	BT	Famous Faces, delayed matching tasks for glasses, BFRT	VOSP, delayed matching tasks for glasses	"Below the critical cutoff level" for VOSP
(Lange et al., 2009; Lobmaier, Bolte, Mast, & Dobel, 2010)	LO	Famous Faces, BFRT	VOSP, delayed matching tasks for glasses	Below 2 SDs for silhouette task of VOSP; very poor at screening section (but no control SD available)
(Y. Lee, B. C. Duchaine, H. R. Wilson, & K. Nakayama, 2010b)	D2	Famous faces, CFMT, CFPT, Face detection	Old/new recognition task: cars, guns, horses, scenes, sunglasses, tools	Within normal limits on all tests.
(Lee, Duchaine, Wilson, & Nakayama, 2010a)	FA	Famous faces, CFMT, CFPT, Face detection	Old/new recognition task: cars, guns, horses, scenes, sunglasses, tools	Within normal limits on all tests.
(Le Grand et al., 2006)	AS	Famous faces test, OIT, RMF, BFRT	BORB, Snodgrass and Vanderwart recognition of common objects	Within normal limits on all tasks.
(Le Grand et al., 2006)	DJ	Famous faces test, OIT, RMF, BFRT	BORB, Snodgrass and Vanderwart recognition of common objects	Within normal limits on all tasks.
(Le Grand et al., 2006)	EN	Famous faces test, OIT, RMF, BFRT	BORB, Snodgrass and Vanderwart recognition of common objects	Within normal limits on all tasks.
(Le Grand et al., 2006)	JH	Famous faces test, OIT, RMF, BFRT	BORB, Snodgrass and Vanderwart recognition of common objects	Within normal limits on all tasks. Severe navigational difficulties.
(Le Grand et al., 2006)	MT	Famous faces test, OIT, RMF, BFRT	BORB, Snodgrass and Vanderwart recognition of common objects	Within normal limits on all tasks.
(Lobmaier, Bolte, Mast, & Dobel, 2010)	SG	Famous Faces, ≈ BFRT	VOSP, delayed matching glasses, BORB, Snograss and Vanderwart	Within normal limits on all tasks.
(Minnebusch, Suchan, Koster, & Daum, 2009; Minnebusch, Suchan, Ramon, & Daum, 2007)	LT	RMT-F, BFRT, Tübinger affect battery (TAB), Bochum test of face processing	BORB, Benton Battery, Snodgrass line drawings	Paper qualifies these subjects: "All subjects may have some early brain damage or insult to the brain". Within normal limits on all tasks.
(Minnebusch et al., 2009; Minnebusch et al., 2007)	NN	RMT-F, BFRT, Tübinger affect battery (TAB), Bochum test of face processing	BORB, Benton Battery, Snodgrass line drawings	Paper qualifies these subjects: "All subjects may have some early brain damage or insult to the brain". Within normal limits on all tasks.
(Minnebusch et al., 2009; Minnebusch et al., 2007)	ET	RMT-F, BFRT, Tübinger affect battery (TAB), Bochum test of face processing	BORB, Benton Battery, Snodgrass line drawings	Paper qualifies these subjects: "All subjects may have some early brain damage or insult to the brain". Within normal limits on all tasks.
(Nunn, Postma and Pearson, 2001)	EP	Mooney faces, Face decision task, Age and gender testing, Facil expression, BFRT, chimeric faces, WRMT, Famous faces, Upright and inverted faces	Boston Naming test, Minimal feature view and foreshortened view from BORB, object decision and silhouettes from VOSP, upright and inverted houses; within-category cars, flowers, famous buildings	Within normal limits on non-face tasks.

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Palermo et al., 2017; Palermo et al., 2011)	M60 (there is a M60 in Bowles et al. 2009; unsure if same case)	MACCS famous faces test, CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	BORB including picture naming, CCMT	Within normal limits
(Palermo et al., 2017)	F40	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Score -1.32 on CCMT.
(Palermo et al., 2017)	M54	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Score -1.13 on CCMT.
(Palermo et al., 2017)	F23	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Palermo et al., 2017)	F33b (33 in Table 2?)	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Palermo et al., 2017)	F42	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Palermo et al., 2017)	F44	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Palermo et al., 2017)	F46	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Palermo et al., 2017)	F33a (also 33 on Table 2?)	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Palermo et al., 2017)	F47	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Palermo et al., 2017)	M59	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Within normal limits.
(Rivolta et al., 2014)	M57/SD	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta et al., 2014)	M22/GE	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta et al., 2016)	F_33	MACCS famous faces test, CFMT, CFPT, CFMT-Australian	BORB including picture naming, CCMT	Within normal limits on all tests.
(Rivolta et al., 2016)	F_42	MACCS famous faces test, CFMT, CFPT, CFMT-Australian	BORB including picture naming, CCMT	Within normal limits on all tests.
(Rivolta et al., 2016)	F_23	MACCS famous faces test, CFMT, CFPT, CFMT-Australian	BORB including picture naming, CCMT	Within normal limits on all tests.
(Rivolta et al., 2016)	F_31	MACCS famous faces test, CFMT, CFPT, CFMT-Australian	BORB including picture naming, CCMT	Within normal limits on all tests.
(Rivolta et al., 2016)	M_20	MACCS famous faces test, CFMT, CFPT, CFMT-Australian	BORB including picture naming, CCMT	Within normal limits on all tests.
(Rivolta, Lawson, & Palermo, 2016)	F_47	MACCS famous faces test, CFMT, CFPT, CFMT-Australian	BORB including picture naming, CCMT	Within normal limits on all tests.
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012; Rivolta, Palermo, Schmalzl, & Williams, 2012)	GE	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012)	EB	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012)	FE	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012)	NN	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012)	TG	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012)	CR	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012; Rivolta, Palermo, Schmalzl, & Williams, 2012)	MG	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta, Palermo, Schmalzl, & Coltheart, 2012; Rivolta, Palermo, Schmalzl, & Williams, 2012)	SD	MFFT-08, CFMT, CFPT	BORB including picture naming, Ravens	Within normal limits on all tests.
(Rivolta, Schmalzl, Coltheart, & Palermo, 2010; Schmalzl et al., 2008)	C	Familiar Face Recognition Task, Famous faces, Global-local, CFMT	BORB including picture naming	Within normal limits on all tests.
(Shah et al., 2015)	3	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	4	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	5	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	6	Famous faces recognition task, CFMT, CFPT	CCMT	z-score -1.62
(Shah et al., 2015)	7	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	8	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	9	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	12	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	14	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	15	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah et al., 2015)	16	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Shah, et al., 2015)	10	Famous faces recognition task, CFMT, CFPT	CCMT	z-score -1.6
(Shah, Gaule, Gaigg, Bird, & Cook, 2015)	1	Famous faces recognition task, CFMT, CFPT	CCMT	Within normal limits.
(Steede, Tree, & Hole, 2007; Tree & Wilkie, 2010)	CS	Benton low-level face, Face naming, face rec. memory, CFRT; Famous faces, unfamiliar faces, CFMT, RMT, face-matching task	BORB, object naming, word recognition memory; VOSP, WRMT, Doors and people test, Self-developed object recognition task	Within normal limits on all tests.
(Stollhoff, Jost, Elze, & Kennerknecht, 2010)*	MB	interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Within normal limits on all tests.
(Striemer, Gingerich, Striemer, & Dixon, 2009)	MA	old/new recognition task, famous faces	Old/new recognition task: cars, guns, houses and tools	Within normal limits on all tests.
(Tanzer et al., 2013; Tanzer et al., 2016)	EM	CFMT, CFPT, famous faces, unfamiliar faces upright/inverted	Global-local task; CCMT	Normal limits on CCMT.
(Tanzer et al., 2013; Tanzer et al., 2016)	OG	CFMT, CFPT, famous faces, unfamiliar faces upright/inverted	Global-local task, CCMT	Normal limits on CCMT.
(Tanzer et al., 2013; Tanzer et al., 2016)	UT	CFMT, CFPT, famous faces, unfamiliar faces upright/inverted	Global-local task, CCMT	Normal limits on CCMT.
(Temple, 1992)	Dr. S	Mooney faces, Warrington Recognition memory battery, famous faces	Wechsler Adult intelligence scale, Benton line orientation task, mental rotation task, Boston naming task, De Haan familiar/ unfamiliar objects	Within normal limits on all tests.
(Todorov & Duchaine, 2008)	JK	Famous faces, CFMT, CFPT	BORB,old/new: cars, funs, tools, sunglasses, scenes	More than 1SD from controls on orientation match.
(Tree & Wilkie, 2010)	AM	Benton low-level face, Face naming, face rec. memory, CFRT	BORB, object naming (Steede et al., 2007), word rec. memory	Within normal limits on all tests.
(Tree & Wilkie, 2010)	ST	Benton low-level face, Face naming, face rec. memory, CFRT	BORB, object naming (Steede et al., 2007), word rec. memory	Within normal limits on all tests.
(Tree & Wilkie, 2010)	CS	Benton low-level face, Face naming, face rec. memory, CFRT	BORB, object naming (Steede et al., 2007), word rec. memory	Within normal limits on all tests.
(Tree & Wilkie, 2010)	AA	Benton low-level face, Face naming, face rec. memory, CFRT	BORB, object naming (Steede et al., 2007), word rec. memory	Within normal limits on all tests.

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(White, Rivolta, Burton, Al-Janabi, & Palermo, 2016)	M59	CFPT, GFMT, Local heroes test, MFFT-08, CFMT	CCMT	Within normal limits.
(White, Rivolta, Burton, Al-Janabi, & Palermo, 2016)	F34	CFPT, GFMT, Local heroes test, MFFT-08, CFMT	CCMT	Within normal limits.
(White, Rivolta, Burton, Al-Janabi, & Palermo, 2016)	M59 (see Figure 3 for repeated initials)	CFPT, GFMT, Local heroes test, MFFT-08, CFMT	CCMT	Within normal limits.
(White, Rivolta, Burton, Al-Janabi, & Palermo, 2016)	F33	CFPT, GFMT, Local heroes test, MFFT-08, CFMT	CCMT	Within normal limits.
(White, Rivolta, Burton, Al-Janabi, & Palermo, 2016)	F49	CFPT, GFMT, Local heroes test, MFFT-08, CFMT	CCMT	Within normal limits.
(Y. Song et al., 2015)	WH	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song et al., 2015)	ZY	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song et al., 2015)	WX	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song et al., 2015)	LJ	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song et al., 2015)	NN	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song et al., 2015)	GX	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song, et al., 2015)	ZP	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song, et al., 2015)	CM	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song, et al., 2015)	SS	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song, et al., 2015)	WW	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song, et al., 2015)	XG	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Y. Song, Zhu, Li, Wang, & Liu, 2015)	LQ	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	Within normal limits.
(Yovel & Duchaine, 2006)	DD	Famous faces, old/new faces, CFMT	Spacing/parts task for houses; object recognition tests but not specified	Normal on all tests.
(Yovel & Duchaine, 2006)	KL	Famous faces, old/new faces, CFMT	Spacing/parts task for houses; object recognition tests but not specified	Normal on all tests.
(Yovel & Duchaine, 2006)	LA	Famous faces, old/new faces, CFMT	Spacing/parts task for houses; object recognition tests but not specified	Normal on all tests.
(Yovel & Duchaine, 2006)	ML	Famous faces, old/new faces, CFMT	Spacing/parts task for houses; object recognition tests but not specified	Normal on all tests.
(Yovel & Duchaine, 2006)	RS (note possibility of acquired deficit in this case)	Famous faces, old/new faces, CFMT	Spacing/parts task for houses; object recognition tests but not specified	Normal on all tests.

Appendix 3: Normal object recognition based on both accuracy and RT data

Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Dobel et al., 2007; Dobel et al., 2011; Lange et al., 2009)	XS	Bielefelder famous faces test (BFFT), Delayed matching to sample faces and eyeglasses, judgment of eye gaze direction, gender judgment, Benton Facial Recognition Test (BFRT)	VOSP, Snodgrass picture naming, Recognition of Cars task, HAWIE-R, delayed matching to sample faces and eyeglasses	Within normal range.
(Duchaine, Germine, & Nakayama, 2007)	F30	Famous faces, CFMT, CFPT, Eyes test, old/new recognition task	Old/new recognition task for cars and guns	Normal. Note that F30 had reading difficulties as a child.
(Duchaine, Germine, & Nakayama, 2007)*	F38	Famous faces, CFMT, CFPT, Eyes test, old/new recognition task	Old/new recognition task for cars and guns	Within normal range.
(Huis in't Veld et al., 2012)	MB	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces and object matching task	BORB, faces and object matching task	Within normal range.
(Kimchi et al., 2012; Tanzer et al., 2013; Tanzer et al., 2016; Weiss, Mardo, & Avidan, 2015)	OH/OF in Kimchi et al.	CFMT, CFPT, famous faces, unfamiliar faces upright/inverted	Horse perceptual expertise test, Horse recognition task, CCMT, Global-local	Subject is a "horse expert". Within normal limits on all tasks.
(Stollhoff et al., 2010, 2011)*	MG	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Normal on all tests but long-term recognition problems
(Stollhoff et al., 2010, 2011)	FP	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Within normal range.
(Zhao et al., 2016)	DP2	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP3	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP4	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP5	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP6	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP7	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP8	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP11	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP12	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP13	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP14	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP15	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP20	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP22	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP24	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP26	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP27	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP31	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	W Within normal range.
(Zhao et al., 2016)	DP32	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP34	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP36	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP37	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.. z-score on objects (1.27 in RT)

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Zhao et al., 2016)	DP39	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range. z-score on objects z-score (1.21 in RT)
(Zhao et al., 2016)	DP40	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP41	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP43	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP44	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao, et al., 2016)	DP45	Famous faces; questionnaire	Discrimination of flowers, birds and cars	Within normal range. z-score on non-face objects (-1.27 in accuracy)
(Zhao et al., 2016)	DP46	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP47	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP49	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP52	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP53	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP54	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP55	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP57	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP58	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP60	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP61	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.
(Zhao et al., 2016)	DP64	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	Within normal range.

Appendix 4: Mild object recognition deficit

Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional notes
(Avidan et al., 2011; Kimchi et al., 2012; Tanzer et al., 2013; Tanzer et al., 2016)	TZ	Famous Faces Questionnaire, CFMT, CFPT, face discrimination task	Global-local task; CCMT	CCMT z-score (-1.76)
Avidan & Behrmann: impaired holistic processing in congenital prosopagnosia (2011); Tanzer et al. (2016)	SI	Famous Faces Questionnaire, CFMT, CFPT, face discrimination task	CCMT	CCMT z-score (-1.88)
(de Gelder & Rouw, 2000)	AV	Warrington, Benton	Benton visual form, Benton line orientation, BORB (line length, size, orientation, gap, overlapping shapes, minimal feature match, foreshortened views, object decision), Boston naming test, Snodgrass and Vanderwart picture naming, Categorization tasks: face, shoes, houses	RT is 2 to 3 times longer than control mean for some object tasks, such as matching shoes. Probably but not definitely outside of 2SDs but including this in mild group
(Esins, et al., 2014)	Subject c	CFMT	Seashells and blue object task	z-score in RT on shells (1.7 in RT).
(Esins, et al., 2014)	Subject g	CFMT	Seashells and blue object task	z-score in RTs on shells (1.7 in RT).
(Esins, et al., 2014)	Subject n	CFMT	Seashells and blue object task	z-score in RTs on shells and blue objects (1.6; 1.7).
(Esins, et al., 2014)	Subject q	CFMT	Seashells and blue object task	z-score in RTs on shells and blue objects (1.7; 1.6).

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional notes
(Esins et al., 2016)	Subject 7	CCMT	CCMT	z-score in accuracy -1.7
(Esins et al., 2016)	Subject 11	CCMT	CCMT	z-score in accuracy -1.7
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP11	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	z-score in bodies accuracy and RT (-1.48 and 1.7), object RT (1.47), cars RT (1.43), horses accuracy and RT (-1.38 and 1.04)
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP12	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	z-score in RT for cars (1.69)
(Huis in't Veld et al., 2012)	IS	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces and object matching task	BORB, faces and object matching task	z-score -1.71 on shoe matching.
(Huis in't Veld et al., 2012)	PV	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces and object matching task	BORB, faces and object matching task	z-score -1.99 on upright shoe matching.
(Huis in't Veld et al., 2012)	BB	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces and object matching task	BORB, faces and object matching task	z-score -1.68 on upright shoe matching.
(Kimchi, et al., 2012; Tanzer, et al., 2013; Tanzer, et al., 2016)	JF	Famous faces questionnaire, CFMT	CCMT	z-score -1.88 on CCMT.
(Palermo et al., 2016)*	F27	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	z-score -1.60 on CCMT.
(Stollhoff et al., 2010; Stollhoff, Jost, Elze, & Kennerknecht, 2011)	MR	Interview	BORB, VOSP, shoe recognition (short and long term)	More than 1SD from control on mnestic shoes measure (Stollhoff et al., 2011). Details of exact score not available.
(Stollhoff et al., 2010, 2011)	HE	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	More than 1SD on silhouettes of VOSP and severe impairment on faces and shoes (2011). Details of score not available.
(Stollhoff et al., 2010; Stollhoff, Jost, Elze, & Kennerknecht, 2011)	JM	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Mild and rather diffuse deficits in face and shoe recognition (2011).
(Stollhoff et al., 2010, 2011)	LL	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Mild and rather diffuse deficits in face and shoe recognition (2011). Details of score not available.
(Shah, et al., 2015)	11	Famous faces recognition task, CFMT, CFPT	CCMT	CCMT z-score -1.83
(Y. Song, et al., 2015)	ZK	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	CCMT z-score -1.87
(Tanzer et al., 2013; Tanzer et al., 2016)	UT	CFMT, CFPT, famous faces, unfamiliar faces upright/inverted	Global-local task, CCMT	CCMT z-score on CCMT (-1.76)
(Todorov & Duchaine, 2008)	TU	Famous faces, CFMT, CFPT	BORB, within-class and scene recognition test	CCMT z-score -1.3 on cars.
(White, Rivolta, Burton, Al-Janabi, & Palermo, 2017)	F43	CFPT, GFMT, Local heroes test, MFFT-08, CFMT	CCMT	More than 1.7SDs from controls but estimated from graph.
(Zhao, et al., 2016)	DP10	Famous faces; questionnaire	Discrimination of flowers, birds and cars	z-score on non-face objects (1.23 RT and -1.69 accuracy)
(Zhao, et al., 2016)	DP16	Famous faces; questionnaire	Discrimination of flowers, birds and cars	z-score on non-face objects (-1.71 accuracy)
(Zhao, et al., 2016)	DP23	Famous faces; questionnaire	Discrimination of flowers, birds and cars	z-score on non-face objects (1.98 in RT and -1.59 accuracy)
(Zhao, et al., 2016)	DP25	Famous faces; questionnaire	Discrimination of flowers, birds and cars	z-score on non-face objects (1.98 in RT and -1.59 accuracy)
(Zhao et al., 2016)	DP35	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	z-score (1.95 in RT)
(Zhao et al., 2016)	DP38	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	z-score (1.99 in RT)
(Zhao, et al., 2016)	DP59	Famous faces; questionnaire	Discrimination of flowers, birds and cars	z-scores on non-face objects (-1.59 in accuracy)

Appendix 5: Object agnosia

Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Avidan & Behrmann, 2008; Avidan et al., 2011; Avidan et al., 2014; Behrmann et al., 2007; Behrmann et al., 2005; Humphreys, Avidan, & Behrmann, 2007; Nishimura et al., 2010)	MT	Famous Faces Questionnaire, Unfamiliar Faces test; CFMT, face discrimination task, CFPT	Object and Greeble discrimination.	More than 2SDs from control mean on RT for Greebles task
(Avidan & Behrmann, 2008; Avidan et al., 2011; Avidan et al., 2014; Kimchi et al., 2012)	KE	Famous Faces Questionnaire, Unfamiliar Faces test, CFMT, face discrimination task, CFPT	Object and Greeble discrimination. Scenes, high/low complexity objects	More than 2SDs from control mean on RT for scenes and high discrimination objects
(Avidan & Behrmann, 2008; Avidan et al., 2011; Behrmann et al., 2005)	BE	CFMT, face discrimination task, CFPT; Unfamiliar Faces test; Famous faces questionnaire, face discrimination task, face detection task	Object and Greeble discrimination.	Beyond 95% control confidence interval on discriminating common objects
(Avidan & Behrmann, 2008; Avidan et al., 2011; Behrmann et al., 2016)	WS	Famous Faces Questionnaire, Unfamiliar Faces test	Object and Greeble discrimination. Scenes, high/low complexity objects	More than 2SDs on object and greeble discrimination and on scene odd-one-out
(Avidan & Behrmann, 2008; Behrmann et al., 2007)	IT	Famous Faces Questionnaire, Unfamiliar Faces test; CFMT, face discrimination task, CFPT; face detection	Object and Greeble discrimination.	More than 2SDs on object and greeble discrimination
(Avidan et al., 2011; Behrmann et al., 2016; Kimchi et al., 2012; Nishimura, Doyle, & Behrmann, 2010)	TD	Famous Faces Questionnaire, CFMT, CFPT, face discrimination task	Scenes, high/low objects	Impaired on many tasks; Most recently more than 2SDs from controls on odd-one-out objects (accuracy) (Behrmann et al., 2016)
(Avidan et al., 2014; Behrmann et al., 2016; Kimchi et al., 2012; Liu & Behrmann, 2014; Nishimura et al., 2010)	WA	CFMT, Famous Faces Questionnaire, face discrimination task	Object and Greeble discrimination. Scenes, high/low objects	More than 2SDs from controls on discriminating scenes, high/low objects
(Avidan et al., 2014; Kimchi et al., 2012; Thomas et al., 2008)	ON	Famous face questionnaire, CFMT, CFPT, discrimination upright/inverted novel faces	Object and Greeble discrimination.	Beyond 95% control confidence interval on discriminating common objects and greebles
(Avidan, Hasson, Malach, & Behrmann, 2005; Behrmann, Avidan, Gao, & Black, 2007; Behrmann et al., 2005; Humphreys et al., 2007)	KM	Famous Faces Questionnaire, Unfamiliar Faces test, CFMT, face discrimination task, CFPT, face detection	Discrimination of Objects, Discrimination of Greebles Task	More than 2SDs on object and greeble discrimination
(Behrmann et al., 2005)	NI	Famous Faces, Familiar Faces, Unfamiliar Faces	Common Object Task, Discrimination of greebles Task; horses, cars, tools, guns (data from Duchaine); Global-local	Outside of 95% confidence interval on exemplar level of common objects; slow RT on all object classes, low d′ on cars, tools and guns
(Behrmann et al., 2007; Behrmann et al., 2005; Humphreys et al., 2007)	TM	Famous Faces, Familiar Faces, Unfamiliar Faces, face detection task	Common Object Task, Discrimination of greebles Task; Global-local	Outside of 95% confidence on common objects
(Behrmann et al., 2016; Liu & Behrmann, 2014)	SC	CFMT, Famous Faces	Scenes, high/low objects	More than 2SDs from controls on discriminating on low objects
(Behrmann et al., 2016; Liu & Behrmann, 2014)	BL	CFMT, Famous Faces	Scenes, high/low objects	More than 2SDs from controls on discriminating low objects
(Bowles et al., 2009; Susilo et al. 2010)	SP/F21	CFMT, MACCS, CFPT	BORB, Raven advanced matrices, CCMT, picture naming	Performance outside normal range on CCMT.
(Dalrymple, Garrido, et al., 2014; Garrido et al., 2009)	DP2	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/new cars
(Dalrymple, Garrido, et al., 2014)	DP14	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/new cars
(Dalrymple, Garrido, et al., 2014)	DP8	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/new cars

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Dalrymple, Garrido, et al., 2014)	DP13	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/ new cars
(Dalrymple, Garrido, et al., 2014)	DP17	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/ new cars
(Dalrymple, Garrido, et al., 2014)	DP15	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/ new cars
(Dalrymple, Garrido, et al., 2014)	DP16	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/ new cars
(Dalrymple, Garrido, et al., 2014)	DP1	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/ new cars and old/new horses
(Dalrymple, Garrido, et al., 2014)	DP7	CFMT, old/new faces, Cambridge Face Perception Task (CFPT)	Old/NewHouses, Horses, Cars	Statistically abnormal on old/ new cars
(De Haan & Campbell, 1991; McConachie, 1976)	AB	Face decision task, Mooney shadow face task, Benton Facial Recognition Task, Warrington recognition memory test, Familiarity decision task	Object decision task, Object familiarity decision task, Object naming	Exceeds 2 SDs from control mean in Accuracy and/or RT for multiple tests
(Dinkelacker et al., 2011)	24 subjects	Written questionnaire and in-depth interview	Building facades task	Pronounced impairment in recognition of buildings in accuracy (Figure 1).
(Dobel et al., 2007; Dobel et al., 2011; Lange et al., 2009)	XG	Bielefelder famous faces test (BFFT), Delayed matching to sample faces and eyeglasses, judgment of eye gaze direction, gender judgment, Benton Facial Recognition Test (BFRT)	VOSP, Snodgrass picture naming, Recognition of Cars task, HAWIE-R, delayed matching to sample faces and eyeglasses	Exceeds 2 SDs from control mean on RT of glasses task
(Dobel et al., 2007; Dobel, Junghofer, & Gruber, 2011; Dobel, Putsche, Zwitserlood, & Junghofer, 2008; Lange et al., 2009)	MH	Bielefelder famous faces test (BFFT), Delayed matching to sample faces and eyeglasses, judgment of eye gaze direction, gender judgment, Benton Facial Recognition Test (BFRT)	VOSP, Snodgrass picture naming, Recognition of Cars task, HAWIE-R, delayed matching to sample faces and eyeglasses	Exceeds 2 SDs from control mean on RT of glasses task
(Dobel et al., 2007; Lange et al., 2009)	GH	Bielefelder famous faces (BFFT), Delayed matching to sample faces and eye-glasses, judgment of eye gaze direction, gender judgment, Benton Facial Recognition Test (BFRT)	VOSP, Snodgrass picture naming, Recognition of Cars task, HAWIE-R, delayed matching to sample faces and eyeglasses	Exceeds 2SDs from control mean on non-objects (Table IV).
(Dobel et al., 2007)	AB	Bielefelder famous faces test (BFFT), Delayed matching to sample faces and eyeglasses, judgment of eye gaze direction, gender judgment, Benton Facial Recognition Test (BFRT)	VOSP, Snodgrass picture naming, Recognition of Cars task, HAWIE-R, delayed matching to sample faces and eyeglasses	Exceeds 2 SDs from control mean on Object decision of VOSP and RT of difference subtest of faces/eyeglass task
(Dobel, Bolte, Aicher, & Schweinberger, 2007; Dobel et al., 2011)	XS	Bielefelder famous faces test (BFFT), Delayed matching to sample faces and eyeglasses, Judgment of eye gaze direction, gender judgment, Benton Facial Recognition Test (BFRT)	VOSP, Snodgrass picture naming, Recognition of Cars task, HAWIE-R, delayed matching to sample faces and eyeglasses	More than 2 SDs from control on object decision and non-objects on HAWIE
(Dobel, Bolte, Aicher, & Schweinberger, 2007)	KW	Bielefelder famous faces test (BFFT), Delayed matching to sample faces and eyeglasses, judgment of eye gaze direction, gender judgment, Benton Facial Recognition Test (BFRT)	VOSP, Snodgrass picture naming, Recognition of Cars task, HAWIE-R	Exceeds 2SDs from control mean on non-objects (Table IV).

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Duchaine & Nakayama 2005; Duchaine, Parker, & Nakayama, 2003; Harris, Duchaine, & Nakayama, 2005; Le Grand et al., 2006; Avidan et al., 2014; Liu & Behrmann, 2014; Nishimura, Doyle, & Behrmann, 2010)	NM (F3 DuchaineNakayama, 2005; MN in Avidan et al. and Nishimura et al.)	Face one in ten, old/new discrimination, Warrington recognition memory for faces, famous faces, BFRT, face discrimination task	BORB, Snodgrass and Vanderwart object naming task; object and greeble discrimination from Behrmann et al. 2005	Exceeds 2SDs from control in RT for objects; Score -1.27 from controls on RT for cars, -1.02 for houses and -1.18 for scenes in Duchaine and Nakayama but > 2SDs from control mean on object discrimination tests in Behrmann lab (unpublished data)
(Duchaine & Nakayama, 2005; Harris et al., 2005)	ML (M2 in Duchaine, Nakayama 2005)	Famous Faces, old/new faces	Old/new recognition task, BORB	Exceeds 2 SDs from control mean on houses, scenes, horses, tools, guns
(Duchaine & Nakayama, 2005)	F1	Old/new recognition task, Face One in Ten (OIT), famous faces	Old/new recognition task, BORB, Snodgrass and Vanderwart line drawings	Exceeds 2 SDs from control mean in RT on houses, scenes, and horses of old/new recognition tasks
(Duchaine & Nakayama, 2005)	F2	Old/new recognition task, Face One in Ten (OIT), famous faces	Old/new recognition task, BORB, Snodgrass and Vanderwart line drawings	Exceeds 2 SDs from control mean in RT on cars and houses of old/new recognition tasks
(Duchaine & Nakayama, 2005)	F4	Old/new recognition task, Face One in Ten (OIT), famous faces	Old/new recognition task, BORB, Snodgrass and Vanderwart line drawings	Exceeds 2 SDs from control mean in RT on houses of old/new recognition tasks
(Duchaine & Nakayama, 2005)	M1	Old/new recognition task, Face One in Ten (OIT), famous faces	Old/new recognition task, BORB, Snodgrass and Vanderwart line drawings	Exceeds 2 SDs from control mean in RT on old/new recognition tasks
(Duchaine & Nakayama, 2006)	F46/KL (also F2 in Duchaine and Nakayama 2005?)	CFMT, unfamiliar faces, famous faces	Old/new recognition task, spacing/parts task for houses	More than 2 SDs from controls on cars and houses in old/new recognition task.
(Duchaine etal., 2003; Duchaine & Nakayama, 2005)	M3/TA (this case meets criteria for Aspergers)	old/new recognition task, Face One in Ten (OIT), famous faces	Old/new recognition task, BORB, Snodgrass and Vanderwart line drawings	Severe impairments on cars, horses and borderine impairment with guns and sunglasses.
(Duchaine, Dingle, Butterworth, & Nakayama, 2004; Duchaine et al., 2006; Harris et al., 2005; Yovel & Duchaine, 2006)	EB/Edward	Famous face, sequential face matching, various Greeble tasks, old/new faces	Snodgrass and Vanderwart object naming task, BORB. Old/new horses, guns, cars, scenes. Houses, tools, sunglasses	Accuracy: outside normal range on scenes. RT: > 2SDs for horses and > 1SD for houses and scenes. Normal performance on standard greeble training procedure.
(Duchaine, Germine and Nakayama, 2007)	F39	Famous faces, CFMT, CFPT, Eyes test, old/new recognition task	Old/new recognition task for cars and guns	Exceeds 2 SDs from control mean for cars and guns in A′
(Duchaine, Germine and Nakayama, 2007)	F23	Famous faces, CFMT, CFPT, Eyes test, old/new recognition task	Old/new recognition task for cars and guns	Exceeds 2 SDs from control mean for cars A′ and RT for guns and cars
(Duchaine, Germine and Nakayama, 2007)	F43	Famous faces, CFMT, CFPT, Eyes test, old/new recognition task	Old/new recognition task for cars and guns	Exceeds 2 SDs from control mean for cars A′ and RT for guns and cars
(Duchaine, Germine and Nakayama, 2007)	F35	Famous faces, CFMT, CFPT, Eyes test, old/new recognition task	Old/new recognition task for cars and guns	Exceeds 2 SDs from control mean for guns in A′ and RT
(Duchaine, Germine and Nakayama, 2007)	M33	Famous faces, CFMT, CFPT, Eyes test, old/new recognition task	Old/new recognition task for cars and guns	Exceeds 2 SDs from control mean for cars in RT and guns in A′
(Esins et al., 2014)	Subject b	CFMT	Seashells and blue object task	More than 2SDs in RT and/or d′ for shells (
(Esins et al., 2014)	Subject i	CFMT	Seashells and blue object task	More than 2SDs in RT and/or d′ for shells
(Esins et al., 2014)	Subject j	CFMT	Seashells and blue object task	More than 2SDs in RT and/or d′ for shells
(Esins et al., 2014)	Subject l	CFMT	Seashells and blue object task	More than 2SDs in RT and/or d′ for shells
(Esins et al., 2014)	Subject o	CFMT	Seashells and blue object task	More than 2SDs in RT and/or d′ for shells
(Esins et al., 2014)	Subject p	CFMT	Seashells and blue object task	More than 2SDs in RT and/or d′ for shells
(Esins et al., 2016)	Subject 12	CCMT	CCMT	More than 2SDs from control mean in accuracy

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP1	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recog cars & horses	More than 1SD in RT for bodies and objects; more than 2SD in accuracy for cars and horses and in RT for cars
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP2	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in accuracy for objects and horses and in RT for horses; more than 2SD in accuracy for cars
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP3	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in accuracy for objects and horses and in RT for horses; more than 2SD in RT for cars and objects
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP5	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in accuracy for cars; more than 2SD in RT for cars
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP7	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in RT for bodies and cars and in accuracy for horses; more than 2SDs in RT for objects and accuracy for cars
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP8	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 2SDs in RT for bodies, objects, cars and horses and in accuracy for bodies and cars
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP9	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in RT for objects and cars and in accuracy for horses; more than 2SD in accuracy for bodies
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP14	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in accuracy for bodies and in accuracy for bodies and horses; more than 2SDs in accuracyfor cars and in RT for cars and horses
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP17	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, old/new recognition cars and horses	More than 1SD in accuracy for horses; more than 2SDs in accuray for horses and in RT for horses and cars
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP6	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in RT for cars; more than 2SDs in RTs for bodies, objects and horses
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP13	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in accuracy for object; more than 2SDs in RT for bodies, objects and cars and in accuracy for cars
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP15	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, old/new recognition cars and horses	More than 1SD in accuracy for bodies and horse; more than 2SDs in RT for cars

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Furl et al., 2011; Garrido et al., 2009; Lohse et al., 2016; S. Song et al., 2015)	DP16	CFMT, FFT	Length match, Size match, Orientation match and Position of gap subtests of BORB, FOBPT, old/new recognition cars and horses	More than 1SD in accuracy for bodies, objects, cars and horses and in RT for horses; more than 2SDs in RT for bodies, objects and cars
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP04	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Chance performance on silhouettes
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP07	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Not a reliable dissociation
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP09	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Abnormal performance on houses in accuracy
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP10	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Impaired on silhouettes and fragmented drawings. Abnormal accuracy scene memory.
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP13	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Abnormal performance on houses in accuracy. Abnormal accuracy scene memory.
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP17	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Abnormal performance on houses in accuracy and CCMT
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP18	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Abnormal performance on houses in accuracy. Abnormal accuracy scene memory.
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP19	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Abnormal on CCMT.
(Gerlach, Klargaard, & Starrfelt, 2016; Starrfelt et al., 2016)	PP27	CFMT, CFPT, FEQ	ODT regular, silhouette, fragmented drawings, CCMT, scene discrimination, scene memory	Abnormal accuracy scene memory.
(Huis in't Veld et al., 2012)	MG	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces/object matching task	BORB, faces and object matching task	Below 2SDs on accuracy of house part matching
(Huis in't Veld et al., 2012)	LF	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces/object matching task	BORB, faces and object matching task	More than 2SDs above norm for RT of house part-matching
(Huis in't Veld et al., 2012)	ST	BFRT, Facial expressive action stimulus test (FEAST), Face-body compound task, Emotional face memory task, faces/object matching task	BORB, faces and object matching task	Exceeds 2SDs from control mean in RT for shoe matching task
(Lee, Duchaine, Wilson, & Nakayama, 2010)	D1	Famous faces, CFMT, CFPT, Face detection	Old/new recognition task: cars, guns, horses, scenes, sunglasses, tools	Below 2 SDs from control mean in houses, slightly deficient in tools
(Liu & Behrmann, 2014)	BQ	CFMT, Famous Faces	Car discrimination from Dundas et al. (2013)	More than 2SDs from controls in accuracy of car discrimination

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Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Liu & Behrmann, 2014)	KG	CFMT, Famous Faces	Old/new houses, horses and cars (data provided by participant)	More than 2SDs from control mean on horses
Malaspina et al. (2017)	12 CPs	Interview, CFMT, FFRT, BFRT	Matching living and nonliving objects (between class) and matching flowers (within class)	Significantly poorer than control matching between- and within-class objects accuracy and RT.
(Palermo et al., 2016)	M57	CFMT, CFMT-films, BFRT, Kennerknecht questionnaire, MFFT 2008, CFPT	CCMT	Below 2 SDs from control mean on CCMT
(Righart & de Gelder, 2007)	CB	Benton Face recognition, Warrington face memory	Faces, shoes, houses matching task, BORB	Impaired on multiple object tasks
(Righart & de Gelder, 2007)	GR	Benton Face recognition, Warrington face memory	Faces, shoes, houses matching task, BORB	Impaired on multiple object tasks
(Righart & de Gelder, 2007)	HV	Benton Face recognition, Warrington face memory	Faces, shoes, houses matching task, BORB	Impaired on multiple object tasks
(Righart & de Gelder, 2007)	JS	Benton Face recognition, Warrington face memory	Faces, shoes, houses matching task, BORB	Impaired on multiple object tasks; very occasional epileptic seizures (2 to 3 over the last 5 years)
(Rivolta et al., 2016)	M_57	MACCS famous faces test, CFMT, CFPT, CFMT-Australian	Body identity recognition (forced choice), CCMT, BORB	Below 2 SDs from control mean on CCMT
(Rivolta et al., 2016)	11 subjects	Famous faces, CFMT, CFPT	Body identity recognition (forced choice), CCMT, BORB	Impaired on matching headless bodies in RT (see M57 below for 11th case)
(Shah et al., 2015)	2	Famous faces recognition task, CFMT, CFPT	CCMT	Below 2 SDs from control mean on CCMT
(Shah et al., 2015)	13	Famous faces recognition task, CFMT, CFPT	CCMT	Below 2 SDs from control mean on CCMT
(Song et al., 2015)	LX	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	More than 2SDs from control mean in accuracy
(Stollhoff et al., 2010, 2011)	SE	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	Below 1SD on silhouettes; > 2SDS on shoes
(Stollhoff et al., 2010, 2011)	VK	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	More than 2SD from control on shoes measure.
(Stollhoff et al., 2010, 2011)	RK	Interview	BORB, VOSP, face and shoe matching in frontal and rotated views	More than 2SDS from control mean on shoes
(Todorov & Duchaine, 2008)	JP	Famous faces, CFMT, CFPT	BORB, old/new: cars, guns, tool, sunglasses, scenes	More than 2SD from controls on old/new cars.
(Todorov & Duchaine, 2008)	JL	Famous faces, CFMT, CFPT	BORB, old/new: cars, guns, tool, sunglasses, scenes	More than 2SD from controls on old/new cars and 1-2SDs on guns.
(Van den Stock et al., 2008)	LW	Benton Face recognition task, WFMT, faces and shoes task	BORB, faces and shoes task	Impaired on accuracy and RT for shoe task and on RT for house task
(Van den Stock et al., 2008)	HV	Benton Face recognition task, WFMT, faces and shoes task	BORB, faces and shoes task	Abnormal RT on shoes and house parts
(Van den Stock, van de Riet, Righart, & de Gelder, 2008)	AM	Benton Face recognition task, WFMT, faces and shoes task	BORB, faces and shoes task	Significantly impaired on shoes and house parts.
(Y. Song, et al., 2015)	YP	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	More than 2SDs from control mean in accuracy
(Y. Song, et al., 2015)	YM	Self-report questionnaires, Famous Faces test, Faces wholes versus parts	Old/new recognition task for faces, flowers, birds and cars	More than 2SDs from control mean in accuracy
(Yovel & Duchaine, 2006)	AC	Famous faces, old/new faces, CFMT	Spacing/parts task for houses; object recognition tests but not specified	Table in Appendix 1 shows house part matching score outside 2SDs
(Zhao et al., 2016)	DP33	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects accuracy

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Continued.

Article	Subject	Tests for Prosopagnosia	Tests for Object Agnosia	Additional Notes
(Zhao et al., 2016)	DP9	Interview; old/new face task; Famous Faces test; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP17	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP18	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP19	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP21	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP28	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP29	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP30	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP42	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP48	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP50	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP51	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP56	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP62	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao et al., 2016)	DP63	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT
(Zhao, et al., 2016)	DP1	Interview; old/new face task; Famous Faces; Face discrimination	Discrimination of flowers, birds and cars	More than 2SDs from controls on non-face objects RT

Appendix 6: Glossary of Tests

CFMT	Cambridge Face Memory Test
CFPT	Cambridge Face Perception Test
FFQ	Famous Faces Questionnaire
BORB	Birmingham Object Recognition Battery
BFRT	Benton Facial Recognition Test
ONFRT	Old-new Face Recognition Test
FFT	Famous Faces Test
FFRT	Famous Faces recognition Test
RMF	Warrington Recognition Memory for Faces
RMT-F	Recognition Memory Test for Faces
GFMT	Glasgow Face Matching Test
MFFT	Macquarie Famous Face Test,
MAACS Famous Faces Test	Macquarie Famous Face Test
BFFT	Bielefelder Famous Faces Test
FEAST	Facial expressive action stimulus test
VOSP	Visual Object and Space Battery
FOBPT	Faces–Objects–Bodies Test
RCFT	Rey-Osterrieth Complex Figure Test

VVIQ	Vividness of Visual Imagery Questionnaire
HAWIE-R	Hamburg-Wechsler-Intelligenztest für Erwachsene (German Intelligence Test)
CCMT	Cambridge Car Memory Test
OIT	One in Ten
CFRT	Cambridge Face Recognition Test
TAB	Tubingen affect battery
FAPT	Facial Age Perception Task
FEQ	Faces and Emotion Questionnaire
ODT	Object Decision Task
WRMT	Warrington Recognition Test
WFMT	Warrington Face Memory Test
VMI	Standardized test of Visual-motor integration