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Review

Veridical mapping in the development of exceptional autistic abilities

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ABSTRACT

Superior perception, peaks of ability, and savant skills are often observed in the autistic phenotype. The enhanced perceptual functioning model (Mottron et al., 2006a) emphasizes the increased role and autonomy of perceptual information processing in autistic cognition. Autistic abilities also involve enhanced pattern detection, which may develop through veridical mapping across isomorphic perceptual and non-perceptual structures (Mottron et al., 2009). In this paper, we elaborate veridical mapping as a specific mechanism which can explain the higher incidence of savant abilities, as well as other related phenomena, in autism. We contend that savant abilities such as hyperlexia, but also absolute pitch and synaesthesia, involve similar neurocognitive components, share the same structure and developmental course, and represent related ways by which the perceptual brain deals with objective structures under different conditions. Plausibly, these apparently different phenomena develop through a veridical mapping mechanism whereby perceptual information is coupled with homological data drawn from within or across isomorphic structures. The atypical neural connectivity characteristic of autism is consistent with a developmental predisposition to veridical mapping and the resulting high prevalence of savant abilities, absolute pitch, and synaesthesia in autism.

Contents

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1. Introduction: veridical mapping in autism and savant syndrome

The autism spectrum (AS) is characterized by variation across and within domains of functioning, as well as with regard to the specific combination, intensity, and number of traits manifested by diagnosed individuals. This heterogeneity was partly addressed in the DSM-IV and ICD-10 systems with subgrouping of persons across the autism spectrum according to polythetic diagnostic criteria. In the DSM-V, there is instead one categorical autism spectrum diagnosis, with clinical specifiers such as language, intelligence, and associated genetic syndromes (Szatmari, 2011). Although heterogeneity in autism is often considered symptomatic of an inability to delineate the essence of autism and the resultant use of excessively broad criteria or imprecise diagnostic methods, an alternative approach is to consider that heterogeneity might be important to our comprehension of autism. This suggestion is supported by the striking observation of within-subject heterogeneity in performance against a typical baseline, with peaks of ability in certain areas of functioning contrasting with deficits in other areas. Peaks, or exceptional abilities, are heterogeneous across autistics, as they encompass a wide range of superior perceptual abilities in auditory and visuo-spatial tasks, as well as specific focused or restricted interests (e.g., a specific period of history, a specific animal species), and specific savant abilities (e.g., calendar calculation, drawing) that are displayed by some, but not all, persons on the autism spectrum.

According to the enhanced perceptual functioning (EPF) model (Mottron and Burack, 2001; Mottron et al., 2006a), autistic perception involves enhanced low-level (e.g., discrimination) and mid-level (e.g., pattern detection) cognitive processing, and increased autonomy of perception with respect to top–down processes. The mechanism of veridical mapping (VM), an extension of EPF, has been proposed (Mottron et al., 2009) in an attempt to account for the role of perception in the high prevalence of savant syndrome in autism (Bennett and Heaton, 2012; Howlin et al., 2009; Rimland, 1978). Grounded in the enhancement of perception and pattern detection observed in autism, we propose that VM can account for enhanced memory for couplings between homologous parts of similar patterns both within and across perceptual modalities that underpin the genesis and development of savant abilities.

The aim of this paper is to further develop VM and to illustrate how it can account for savant syndrome in autism, but also for other phenomena often observed among persons on the autism spectrum and implicated in its apparent heterogeneity. In the first part of this paper, we argue that savant skills and peaks of ability in autism reflect the same heterogeneity and we review the evidence that they might rely on common cognitive, and possibly cortical, mechanisms. We then present seven components of VM based on observations from savant syndrome. In the second part of the paper, we describe how VM can account for structural commonalities among savant syndrome (using the example of hyperlexia, i.e., the precocious ability to read in advance of comprehension), absolute pitch (AP, i.e., the ability to name notes without reference to an external standard), and synaesthesia (i.e., the triggering of perception in one modality by perception in another modality), all of which are, or are likely, more prevalent in autism than in the typical population (Johnson et al., 2011; Rimland and Fein, 1988). Drawing on the literature about the neurological basis of hyperlexia, AP, and