The Autism Spectrum as a Source of Cognitive and Cultural Diversity
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Abstract

Individual differences in perception and in social cognition are products of both biology and cultural experience. Many of the same differences that typify autism when they occur in extremes also underlie normal human cognitive variation when they occur to more subtle degrees. In particular, autism spectrum conditions are characterised by low degrees of two linked capacities: *level of construal,* meaning the tendency to represent percepts as individual details rather than as whole contexts; and *psychological distance,* meaning the tendencies to perceive objects and events in distant rather than peri-personal *space,* to recall or to anticipate past or future *time* rather than the here-and-now, to approach *social* interactions in the allocentric frame of other people rather than one's own egocentric frame, and to represent hypothetical, counterfactual, or fictional *beliefs* that are at odds with actual facts. Significantly, culture also exerts linked effects on level of construal and psychological distance, which are relatively increased in more contextual, socially focussed cultures and decreased in more individualistic, self-focussed cultures. A question for cross-cultural psychological research, then, is how might lifelong exposure to South Asian cultures, in contrast to North American or European cultures, modify the phenotype of Asperger syndrome, and in general the phenotypes of those individuals at or just beyond the mild end of the autism spectrum. This mild extreme is the most likely locus of difference, as individuals with mild Asperger syndrome or the "broader autism phenotype" are not immediately visibly abnormal, and therefore are more easily accepted by the surrounding society, interact more with it, and are more effectively influenced by it. Furthermore, when their social communicative deficits do become manifest, the resulting social disabilities may be to some extent scaffolded and filled in by a surrounding society in which many social goals and relationships are explicit and algorithmic rather than implicit and underspecified. The relationship between autism-spectrum severity and the effects of a social-contextually focussed culture may be a parabolic one, with increased social scaffolding ameliorating the autistic phenotype at the mild end of the spectrum and social exclusion aggravating it at the severe end. Perhaps most significantly, gender roles may interact with Asperger syndrome, in an environment in which less empathising and social communicative skill is demanded of males, and females with deficits in these social cognitive domains therefore are placed at an inordinate disadvantage. Our current work is exploring these questions and theses, using both questionnaire and experimental behavioural measures to assay perception, attention, executive function and social cognition, both in individuals with Asperger syndrome and in clinically unaffected family members with high loadings for the broader autism phenotype.

1. Autism in India

In a very short span of years, autism has leapt to the awareness not only of Indian child development professionals but also the Indian public. As India's culture is very much reflected in – and in turn shaped by – its media, it's perhaps no surprise now to see autism featuring on the daily television programme *Aapki Antara* whose title character is an autistic girl, or to see Shahrukh Khan portraying Asperger syndrome in the cinema hit *My Name Is Khan.* Significantly, these Indian narratives construe autism within a more social frame than do Western accounts: What is the effect of autism on family and personal relationships? What can people with autism spectrum conditions teach us about the way we relate to each other and to the world around us? This is a point of view that has been largely missed out by the highly medicalised study of autism in North America, Europe and the UK. Bringing scientific scrutiny of autism together with a quintessentially Indian social awareness of autism will create an understanding from which Indian and non-Indian science and cultures can benefit.

Our and others' work during the past two decades has helped form the basis of a current theory of autism as a perturbation of neural *connectivity* – that is, the ways in which individual neurones and groups of neurones transfer information amongst themselves (Brock et al., 2002; Belmonte et al., 2004a; Müller et al., 2011). The central notion is that perturbations of connectivity within local neural networks – either surfeits or deficits of cells, synapses, excitatory/inhibitory ratio, or neuromodulatory activity (Belmonte & Bourgeron, 2006) – cause a decrease in local network entropy, which then hamstrings activity-dependent development of long-range connections that support cognitive integration, cognitive flexibility, and centralised cognitive control (Belmonte et al., 2004b). Supporting this notion, and extending it from the pathological to the normal range of human neurophysiological and cognitive variation, recent findings show that disrupted excitatory/inhibitory balance lowers local network entropy in animal models (Shew *et al.,* 2011), and that individual variations in local

network entropy within brain regions translate developmentally into individual differences in long-range transfer of information between brain regions (Vakorin *et al.,* 2011). The more closely we examine the subtleties of such differences in neural wiring, the more we find that they underlie not only clinical disease states such as autism, but also human difference and diversity in general. In this guise, when we study autism we really are studying human cognitive diversity, and by understanding autism we can gain a deeper understanding of humanity (Belmonte, 2008, 2011).

2. The autism spectrum and human cognitive diversity

"Autism" spans a broad array of phenotypes, and the saying (popularised by Stephen Shore) amongst special-education teachers and other autism professionals and caregivers is "If you've seen one person with autism, you've seen one person with autism." Autism is defined clinically by deficits in social interaction, communication, and behavioural and cognitive flexibility (American Psychiatric Association, 2000). These general classifications, though, are quite broad: a deficit in social interaction might be as subtle as a decreased repertoire of pretend play or as pronounced as a total inability to play socially; a deficit in communication might manifest as an inability to jump into fast-moving conversation at a party or as a total inability to speak; restricted and repetitive behaviours might be as abstract as the case of a child with Asperger syndrome who spends all her time programming computers or as concrete as a the case of a child with autism who spends all his time gazing at a spinning fan or flicking a light switch on and off.

How is it that a single clinical condition can come in so many varieties? We know that autism is strongly influenced by genes (Belmonte & Bourgeron, 2006), and by their interaction with environmental and experiential factors. Amongst monozygotic twins, if one twin is autistic there is a 60% chance that the other twin will be autistic too, and a 90% chance that the other twin will be somewhere on the "autism spectrum" which encompasses autism and milder variants such as Asperger syndrome. Key to understanding this highly variable phenotype is the recognition that autism arises not just from one or a few genes, but from many interacting genes, each of which can be mutated or modified in many ways. In this regard autistic cognitive traits are a bit like skin colour: each is strongly genetically influenced, but each comes in a diversity of shades.

Recent work in our laboratory and others has begun to show that this spectrum of variation in autistic personality and cognitive traits extends beyond the clinical autism spectrum, and underlies much of human cognitive diversity. Autism can be characterised as a deficit in "empathising," that is, the ability to understand others' emotions and to respond in kind, along with a surfeit of "systemising," that is, the ability to understand and to predict the behaviour of physical or logical systems that act according to deterministic rules (Baron-Cohen, 2002). Occupations that attract high systemisers include science and engineering; those that attract high empathisers include counselling, marketing, and diplomacy. Measures of empathising and systemising in the general population show that these traits are partly heritable (Constantino & Todd, 2003, 2005; Ronald et al., 2006), and that high systemising is more common amongst the family members of people with autism (Baron-Cohen et al., 1997), and autism is slightly more common amongst the family members of high systemisers (Baron-Cohen, 1998). Importantly, the distribution of these traits throughout the general population is unimodal; there is no empirically discernible dividing line between a person with mild autism or Asperger syndrome and an extreme-normal individual on the high end of normal systemising and the low end of normal empathising. These population data again show that the same set of genetic variations and environmental interactions that gives us autism also gives us a wealth of human cognitive diversity – and in many senses, people with autism can be described as "human, but more so" (Belmonte, 2008); that is, they carry the same cognitive traits that all of us do, except to greater degree.

Starting from this recognition of humanity's essential connectedness to autism, we have studied normal human cognitive variation by applying to non-autistic people some of the same experimental tools developed to measure cognitive skills in people with autism. We were interested in the question of whether strength at systemising tends always to come along with weakness at empathising, as it does in autism, or whether in the broader population, beyond the autism spectrum, these traits might be independent of each other. The answer, we found (Valla et al., 2010) – at least in the American culture from which we sampled – depends on sex: men who are good systemisers tend to be poor empathisers, whereas many women are strong at both empathising and systemising independently. Men seem to compensate for such deficits in empathising by applying systemising skills to problems of empathy - for example, in men but not in women, the *systemising* ability to analyse a geometric figure in detail is associated with the *empathising* ability to recognise faces. Furthermore, in male undergraduates, being in a highly systemising field of study (*e.g.* maths or physics as opposed to government or literature) is more closely related to weak empathising skills than to strong systemising skills, whereas in undergraduate women, systemising fields are more related to strong systemising abilities - so it seems that when it comes to selecting an occupation men's choices may be determined more by their weaknesses than by their strengths! (It's crucial to note that all these relationships exist not necessarily for individual men and women, but rather describe in very broad strokes the whole population of men and the whole population of women.)

This collection of our and others' findings on the relation of autism to cognitive diversity ought to pose a caution for biomedical efforts towards a cure for autism. Autism is its severest forms, in which people are largely

unable to interact with society or even to speak, is unequivocally a disease and a proper object of medical scrutiny. In the case of milder variants on the autism spectrum, though, the difficulty may be at least as much a flaw in society as it is any shortcoming in the individual: a culture's inability to appreciate the skills and to accommodate the cognitive and social style of people with autism spectrum conditions is a failing of that culture, and not of the individual. This recognition of the significance of cultural environment in the outcome for people with mild autism spectrum conditions, or even extreme-normal levels of autistic traits, sets the stage for the discussion following.

3. Autism's interaction with culture

To what extent is autistic behaviour a property of the individual, and to what extent is it determined in interaction with the culture in which that individual is immersed? Different cultures focus more or less on analytical, detail-oriented understanding of things-in-themselves and social framing of persons as independent individuals, versus holistic understanding of things-in-context and social framing of people as members of social groups and relationships. This axis of variation between individualistic, detail-oriented Western cultures and societal, context-oriented Asian cultures is relevant because an essential feature of autism is a cognitive bias towards details and individuals, and away from contexts and groups. How might lifelong exposure to one or another culture either accentuate or mollify this cognitive phenotype of autism?

Autism has been characterised as a weakness of "central coherence" (Frith & Happé, 1994) – in Frith's terms, "the tendency to draw together diverse information to construct higher-level meaning in context." This description is consistent with autistic superiorities at tasks that exercise local, detailed-oriented rather than global, contextual processing, as measured by the skill of people with autism at the Embedded Figures Test (Shah & Frith, 1983), the Wechsler Block Design subtest (Shah & Frith, 1993) and other tasks of perceptual disembedding (Plaisted et al., 1998; Mottron et al., 2003). In addition to these autistic *superiorities* at low-level encoding or analysis, weak central coherence describes autistic *deficits* at essentially contextual tasks such as narrative comprehension. A perennial difficulty, though, has been the relation of these *non-social perceptual* aspects of weak central coherence to autism's *social* deficits, which are its most evident, most debilitating, and most diagnostic symptoms. It's easy for the concept of weak central coherence to describe the child who incessantly spins the wheels on a toy car – but how can weak coherence also describe that same child's inability to join in pretend play with a group of peers? Recent work outside of autism research links social and non-social perception and cognition, showing that the way we respond to *people* has much to do with the way we respond to *things,* and that culture therefore can be a powerful determinant of both social and non-social cognition.

The concept of *psychological distance* (Liberman & Trope, 2008; Trope & Liberman, 2010) links four general areas of perception and cognition all of which are perturbed in autism: children with autism can be delayed in developing the *spatial* ability to refer (e.g. by pointing) to objects that do not occupy immediate, peri-personal space; or the *temporal* ability to refer to a memorable happening or to look forward to a planned occasion; or the *social* ability to take the perspective or to "put oneself in the shoes of" another person; or the ability to attribute or to maintain *hypothetical* or counterfactual beliefs or fictional accounts. (In fact each of these scenarios is addressed by at least one question in the Autism Diagnostic Interview – Revised (Lord et al., 1994), one of the standard diagnostic instruments for autism.) In the same way that we can speak of a long way, a long time, long odds, or a long gap between social classes, these spatial, temporal, hypothetical and social forms of distance may share neural representations (Bueti & Walsh, 2009; Boroditsky, 2000). The ability to see objects, events or people mainly as they relate statically to each other, rather than as they relate currently to oneself and one's vantage at this moment, depends on a brain that can transform proximal, *egocentric* percepts to more distal, *allocentric* representations (Frith & de Vignemont, 2005). This difference between egocentric detail and abstract context is termed by Trope "level of construal" – and it is exactly the same property that Frith has termed "central coherence." Trope's construal level theory is the missing social/non-social link that autism researchers have been looking for: it joins social distance to perceptual distance under a common neuro-cognitive mechanism, by relating both to level of construal. And very significantly for cross-cultural perspectives on autism, level of construal is profoundly affected not only by autism, but also by culture.

This psychological and cultural relationship between physical distance on the one hand and social distance on the other is familiar to anyone who's had the experience of walking into, say, the Gimme Coffee on Mott Street in Manhattan versus, say, the Indian Coffee House on College Street in Kolkata. In New York where the *physical* space remains a property of the individual rather than the group, to join a stranger's table (*i.e.* to enter their *social* space) and to begin conversation without asking or receiving an explicit social invitation would be uncouth. In Kolkata, at least in some circumstances, it might be uncouth <u>not</u> to join! And it's exactly this transmission and reception of invitations to <u>initiate</u> social interaction (Müller et al., 2008) that can pose the greatest obstacle for people with autism spectrum conditions, who all too often find themselves either having butted in uninvited or having ignored an overture. In an environment in which physical and social spaces are allocentric, invitations become less crucial, and people with Asperger syndrome may find it easier to initiate social contact.

A bevy of experiments has shown that manipulating or priming one form of psychological distance or

level of construal exerts corresponding effects on other forms. Subjects respond more quickly to stimuli that are congruent across types of psychological distance (*e.g.* the word "today" or "us" or "certain" presented in the foreground, or "next year" or "them" or "maybe" presented in the distance) (Bar-Anan et al., 2007), and they tend to use more polite, *socially* distant terms when writing for a *temporally* distant (future) audience or for a *spatially* distant person (Stephan et al., 2010). In the Navon task of global-local visual perception – a task oft applied to demonstrate local-over-global perceptual bias in autism (Plaisted et al., 1999) – subjects primed by writing about what they'll be doing tomorrow (*temporal* proximity) are more biased perceive small *spatial* details faster than those who've written about what they'll be doing next year (Trope & Liberman, 2010), and *vice versa,* subjects primed for global perception exhibit greater positive bias in estimates of spatial, temporal, social, and hypothetical distances (Liberman & Förster, 2009). The categories into which people group objects are fewer, broader and more inclusive (higher in construal, or more centrally coherent) when those objects are imagined in the far future than in the near future, and social interactions as portrayed by animated geometric shapes are grouped into fewer, longer scenes when they're framed as taking place in a faraway rather than a nearby location (Liberman et al., 2002). In an acute demonstration of the link between social and non-social construal, reading personal plural ("we") narratives versus singular ("I") narratives heightens the congruence effect in a visual flanker task (presumably by *broadening* attention across the flanking stimuli, making them more distracting), and also speeds responses to *global* targets in the Navon task (Lin & Han, 2009). The existence of these relationships amongst social and non-social types of psychological distance suggests that the social influence of cultural experience may modify fundamental perceptual processes that extend to both social and non-social cognition.

Thus far, cross-cultural experiments on construal have included East Asians, North Americans and Europeans but not, in general, South Asians. Nor have they included people with autism spectrum conditions or other cognitively atypical individuals. Those results that do exist are suggestive for these groups. Westerners, as Nisbett and Masuda (2003; see also Markus & Kitayama, 1991) summarise, "are inclined to attend to some focal object, analyzing its attributes and categorizing it in an effort to find out what rules govern its behaviour" – translating this description into the terms of Baron-Cohen, Western culture promotes and develops *systemising.* In a change-blindness task, in which two similar scenes are presented and subjects must detect a subtle change between one scene and the next, North Americans more often and more quickly detect changes in focal objects, whereas East Asians are better at detecting changes in the background or context within which an object is presented (Masuda & Nisbett, 2006; Boduroglu et al., 2009) – and this difference in attentional focus corresponds to cultural differences in the targets of gaze fixation (Chua et al., 2005), just as autistic attention to minute features of objects corresponds to gaze patterns (Klin et al., 2003). Even in as purely visual, non-social a task as perceiving straight lines, North Americans practise more disembedding and less contextualisation: they're less distracted by the position of a surrounding frame where the frame is irrelevant to judging a line's orientation, and more impaired by failure to account for the frame when judging the line's relative length (Ji et al., 2000; Kitayama et al., 2003). These differences in perceptual traits are mirrored in relative levels of prefrontal cortical activation (Hedden et al., 2008), just as is the case for differences in autistic perceptual traits (Belmonte et al., 2010). In a categorisation task, contrasting East Asians to North Americans reproduces the same broadening of categories (Norenzayan et al., 2002) that is induced by psychological distance. Many of these effects of culture on perception and attention are far from subtle, with magnitudes almost one standard deviation (Nisbett & Miyamoto, 2005).

Several results on the relationship between level of construal and psychological distance in typical persons mirror well known characteristics of autism. As psychological distance decreases, typical individuals become more likely to apply pictorial rather than linguistic representations (Amit et al., 2009), mimicking the autistic tendency to think in pictures (or in general in veridical perceptual terms); they become less able to inhibit behaviours guided by immediate, low-construal goals versus superordinate, high-construal goals (Fujita et al., 2006), mimicking autistic difficulties with behavioural control; and in negotiations they become less able to compromise on subordinate goals in order to attain superordinate goals (Henderson et al., 2006), mimicking autistic inflexibility (and also recapitulating a North American cultural tendency to take sides in interpersonal conflicts (Peng & Nisbett, 1999)). Along the same lines, novel events – which are in a sense counterfactual against a background of common events, and thus more psychologically distant from the perceiver – facilitate global, high-construal over local, low-construal representations (Förster et al., 2009), potentially linking the autistic aversion to novelty to the autistic perceptual bias for local details over global contexts.

4. A Research Agenda

All these effects of culture on the same perceptual and cognitive domains that are affected by autism suggest that independent (prototypically Western) cultures may *synergise* with autistic traits whereas interdependent (prototypically Asian) cultures may *counter* autistic traits. This realisation motivates the following theses:

- Lifelong experience of a South Asian, more interdependent culture may in itself constitute a behavioural intervention for autism, a sort of training both for non-social attention to context and for social attention to intersubjective engagement. Social relations, in particular, may constitute an important case of such

training: South Asian social networks are more highly prescribed and constrained, with well defined roles and relations. As such, South Asian social systems may not only help train individuals to attend to social context, but also may be more forgiving for those individuals who are less socially competent: when one's role is socially defined and scripted, the social structure itself can support and scaffold one's social activities. Paradoxically in a way, in this scenario it would be the West's very individualism and relative absence of social prescription that would scupper the attempts of people with Asperger syndrome at social engagement: where there is no prescribed social role or script to follow, it becomes impossible for the social system itself to constrain social interaction, and the individual is therefore lost in an over-abundance of social choices and decisions.

- This effect of culture is not necessarily the same for mild versus severe degrees of autistic cognitive variation. In fact, the relationship between autism's initial severity and the effect of culture on its outcome may be a parabolic one: Those on the mild end of the autism spectrum, whose very subtle social communicative and other behavioural abnormalities do not render them immediately visibly abnormal, may be readily accepted and scaffolded by a socially focussed culture, leading to a less impaired outcome, whereas those on the severe end may be just as efficiently ostracised and shunned by it, leading to a more impaired outcome. Along the same lines, cultural influences may be most visible not within the autism spectrum but rather just beyond it, in individuals who manifest the "broader autism phenotype," a collection of subclinical, dimensional autistic traits that often manifests in relatives of people with autism spectrum conditions (Piven et al., 1997; Dawson et al., 2002). It is perhaps a feature of the very cultural scaffolding that we address that such mild levels of autistic traits do not generally come to clinical attention in India: ascertainment and recruitment, therefore, may be difficult, and might most efficiently proceed via screening of undiagnosed family members of people with autism spectrum conditions. Such family studies must be approached with tact and care, and an emphasis on the theoretical viewpoint that some of the same genetic variants that can contribute to autism also can contribute to beneficial cognitive traits such as those underlying scientific or engineering skill. Thus studies of family members of people with autism may have much to say about cross-cultural variation, and should be undertaken.
- Sex differences, too, may vary across cultures: South Asian males under cultural influence may be more likely than their North American counterparts to close the typical male gap between empathising and systemising; that is, one could predict an uncoupling of empathising from systemising in the South Asian male population relative to the North American male population. In a complementary effect, South Asia's more rigid gender roles may be less forgiving of low empathising in females, so that low-empathising females may receive less scaffolding than do high-empathising females, accentuating the spread between the low and high ends of the female continuum. Study of cognitive sex differences within and between typical male and female populations, and within and between males and females with Asperger syndrome or the broader autism phenotype, thus will be informative.
- Studies across cultures and studies across cognitive types offer ways to examine the relation between psychological distance and level of construal with long-term experiential rather than short-term experimental manipulations, and across cultural or cognitive groups rather than within individuals. Individuals who have developed within a culture emphasising interdependence can be contrasted to those from a more independent culture. Likewise, individuals who have various "set points" as to level of construal and level of social competence – those who are high-construal or low-construal, and those who are high-empathising or low-empathising – can be contrasted.

The ability to explore these questions cross-culturally depends on the availability of culturally appropriate, quantitative assessments that control for cultural variability whilst leaving intact the cognitive effects of exposure to this variability, and that are able directly or indirectly to quantify the underlying biological factors separately from the outcome variables which are an interaction of biology and culture. Although such explorations would have been difficult even a few years ago, they are becoming more and more possible. Subjects can be assayed for systemising and empathising skills using several measures that have been applied in our and others' studies of normal and pathological cognitive variation, including the Autism Spectrum Quotient (Baron-Cohen et al., 2001b), a self-report measure of positive-systemising and negative-empathising autistic traits (Hoekstra et al., 2008) which has been validated across British and Japanese cultures (Wakabayashi et al., 2007b); the Social Responsiveness Scale, a peer-report measure of autistic social traits (Constantino et al., 2003) which has been validated in American and German populations (Bölte et al., 2008) though not yet in Asia; a computerised, forced-choice version of the Embedded Figures Test, a nonlinguistic measure of perceptual disembedding (Witkin, 1950); the Reading the Mind in the Eyes Test, a measure of facial emotion recognition (Baron-Cohen et al., 2001a); and a suite of computer games developed in our laboratory (Yoder & Belmonte, 2010) in which are embedded motivating, ecologically valid tests of motion coherence perception, behavioural inhibition, behavioural sequencing and planing, spreading and shifting of visual spatial attention, perceptual disembedding, facial emotion recognition, and social perspective-taking. This game format has been successfully applied both in studies of autism spectrum conditions and in studies of cognitive variation in normal young adults (Valla et al.,

2010). Some of these tools need still to be adapted for the environment of South Asia, and validated against the original versions – for instance, tests of facial emotion need to incorporate facial images representative of South Asian ethnicities, facial emotional manifestations, and verbal emotional labels – but such adaptations are only a matter of time. Clinical diagnoses on the autism spectrum now can be verified in an experimental subject's mother tongue using Western Psychological Services' pre-publication editions of the Social Communication Questionnaire (Rutter et al., 2003), a validated diagnostic instrument which has been translated (linguistically and culturally) into Hindi and Bengali, and which has been applied not only within the autism spectrum but also as a coarse, screening-level quantification of sub-diagnostic autistic traits in other populations (Kochhar et al., 2011). Although work remains to be done, cross-cultural comparisons within and beyond the autism spectrum have come within reach of practical experimental methods.

Assaying the biologically based liability separately from the culturally influenced outcome is a thornier question, but not an impossible one. Although absolute measure of a biological variable is difficult with only behavioural methods, much information may be implicit in contrasts between experimental groups within and between cultures. Absent undiscovered population-genetic interactions, it seems fairly safe to infer that wholly biologically determined behavioural outcomes would be invariant across cultures, whereas shifts in behavioural variables and in the the relationships between them could be attributed to interactions between cultural and biological biases. Even the issue of population genetics could be controlled by using a contrast group consisting of second-generation immigrant families acculturated within Western communities. When addressing the question of autism spectrum conditions and the broader autism phenotype, typically developing individuals with no autism in the family can be used as a within-culture control sample, with differences in the autism-spectrum population expressed in terms of statistical deviations from population norms for that culture (Wakabayashi 2007a, 2007b). Some theoretically fractionable effects of culture may be difficult to separate, practically, from know effects of population variations – for instance, the potentiation of executive functions (Bialystok, 2010) and theory-of-mind (Kovács, 2009; Rubio-Fernández & Glucksberg, in press) that comes with early bilingualism, a condition common in India, especially in the middle-class urban populations that are most accessible to researchers, but rare in Britain and the United States.

Again, the major hypothesis is that lifelong exposure to a South Asian culture, focused on attention to context and on social interdependence, may constitute an implicit behavioural intervention that would shift cognitive traits throughout the entire population distribution away from the autism spectrum. This effect might be most evident and most potent in the social competence of individuals at the boundary of that spectrum, with Asperger syndrome and the broader autism phenotype. So one would predict (1) an overall increase of empathising and perceptual construal level in South Asians in comparison to North Americans, and perhaps (2) an uncoupling of empathising from systemising in South Asians relative to North Americans, especially in the case of individuals with Asperger syndrome or mild autism-spectrum traits. Furthermore, the more prescribed, even algorithmic nature of family and social relations in South Asia could support and scaffold social interaction in low empathisers: because both they and their social partners would have relatively well defined roles and scripts, the social system - and their social partners acting within that system - would be able to meet them more than halfway, as it were. This phenomenon would predict (3) a heightening of the tendency in males with low empathising to "systemise empathy," that is, within the sample of males who score low on overall measures of empathising traits and level of construal, the correlation between scores on overall measures of systemising traits and scores on specific measures of empathising would be increased. Lastly, one could predict that (4) when the results are separated by sex, male and female population distribution curves would differ across cultures, with the male empathising curve being shifted rightwards in South Asians as an effect of social scaffolding, and the female curve being flattened with more individuals occupying its tails because of differential access to social scaffolding in the context of prescribed gender roles. It remains an open question how the closeness of correlation between dependent measures of perceptual level of construal on the one hand and social cognitive perspective-taking and other forms of psychological distance on the other may change across cultures, across genders, and across the interaction of these two independent variables.

Western biomedical research – and Western biomedical researchers – could benefit from an Indian sensibility, one that complements an analytical view of autism as a clinical disorder *separate* from the rest of humanity with a more synthetic view of autism as essentially *connected* to human diversity. Autistic cognitive traits, in moderation, are an essential ingredient in human cognitive variation, just as genes associated with autism susceptibility are strewn throughout normal population genetics (Dutta et al., 2007; Guhathakurta et al., 2008). These autistic traits interact with culturally transmitted cognitive emphases to determine cognitive outcomes. Anecdotally, many parents who have migrated report that the family structures available in India are much more efficient at supporting their autistic children than are those available in the West. By examining and documenting the effect of South Asian culture on cognition, both in autism-spectrum and non-autistic persons, the proposed research agenda would make a step towards codifying culturally transmitted wisdom, informing not only behavioural therapies for children with autism spectrum conditions but also best practices for developing every child's cognitive potential. By understanding how each culture succeeds for some individuals on and off the autism spectrum, and also how each culture fails some individuals, social practices and therapeutic methods

in all cultures can take a step forward towards better serving all members of the community.

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