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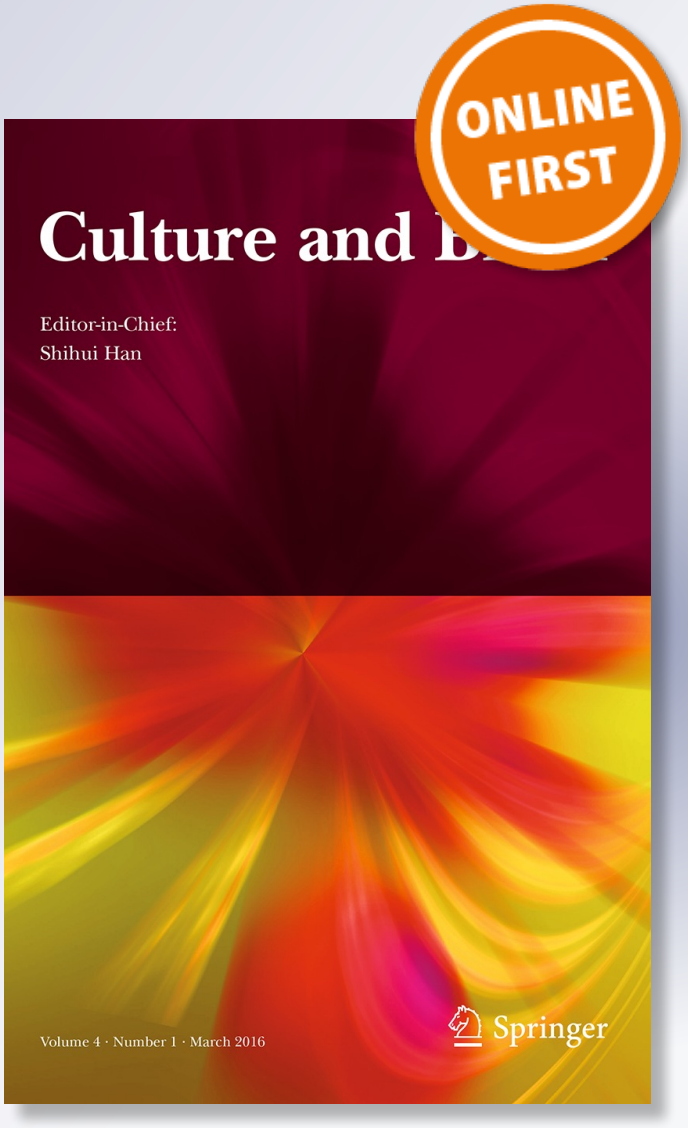

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ORIGINAL RESEARCH ARTICLE

Self- and other-descriptions by individuals with autism spectrum disorder in Los Angeles and New Delhi: Bridging cross-cultural psychology and neurodiversity

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Abstract Decades of cross-cultural research have shown that self-concepts vary across cultural contexts. However, it is unclear whether individuals with autism spectrum disorder (ASD), who have impairments in self- and other-understanding, will acquire the relevant cultural patterns regarding self- and other-concepts; or whether their social impairments will extend to broader cultural impairments. Here we present the first examination, to our knowledge, of self- and other-concepts in a cross-cultural sample of individuals with ASD in Los Angeles, USA, and New Delhi, India, compared with matched control groups in each culture. We used a modification of the well-known 20 statements description task, and coded participants' responses according to 28 sub-categories, along the axes of autonomous/social and abstract/specific. When describing themselves and their favorite fictional characters, participants in Los Angeles provided significantly more autonomous and abstract descriptions than participants in New Delhi, as expected from their different locations. Surprisingly, we found no effect of diagnostic group on the content of participants' responses, suggesting that individuals with ASD are indeed capable of acquiring the cultural scripts that surround them—at least on a cognitive, verbal level—despite their neurocognitive impairments. These results

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provide an important step towards bridging the study of cross-cultural psychology and global autism research; while simultaneously highlighting the ways in which individuals with ASD *can* become a part of their local cultures, serving as an important impetus of acceptance for caregivers and policy-makers worldwide.

Keywords Autism spectrum disorders · Cultural psychology · Self-concept · Fictional characters · India · United States

Abbreviations

ADOS	Autism diagnostic observation schedule
ASD	Autism spectrum disorder
LA	Los Angeles
mPFC	Medial prefrontal cortex
TPJ	Temporal-parietal juncture
TD	Typically developing

Introduction

One of the central concerns of cultural psychology since its inception has been to determine how individual beings, with particular neuro-psychological foundations, become embedded within particular cultures (Hallowell 1955; Sapir 2002). Decades of research have shown, for instance, that individuals from different cultures acquire a different sense of self: autonomous concepts are more prominent in the west, and social, contextualized descriptions are more prominent in the east (Markus and Kitayama 1991; Rhee et al. 1995; Shweder and Bourne 1984). These cultural differences have also been associated with different neural activations in brain regions such as the medial prefrontal cortex (mPFC) and the temporal-parietal juncture (TPJ; see Kitayama and Park 2010, for a review). For instance, Zhu et al. (2007) found that both Chinese and Caucasian participants activated the mPFC when thinking about themselves, but for Chinese participants this region was also activated when thinking about their mother, presumably due to a more social, interdependent representation of self. Importantly, however, the vast majority of cross-cultural research has examined healthy, neurotypical individuals, and very little is known about the ways in which individuals who are neurally *diverse* come to acquire cultural schemas.[1]

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that fundamentally disrupts the relation between self and other, or self and culture. As such, autism can serve as a unique case study for understanding the neural basis of cultural acquisition (Brezis 2012). ASD is defined by social and communicative difficulties and a tendency for routinized behaviors (APA 2013). Notably, recent research has shown that individuals with autism have difficulties not only in

[1] This approach draws from the neurodiversity movement (Silberman 2015), a term used by self-advocates with autism and their allies to call for recognition of individuals with a variety of neurological conditions.

understanding others, but perhaps more primarily in constructing their own sense of self. These difficulties are manifest in reduced self-awareness (Lind 2010), poorer autobiographical narratives (Brezis 2015), and difficulty with future decision-making (Lind et al. 2014). Interestingly, this reduced self-processing has been related to reduced activation in the mPFC, TPJ, and other regions involved in self- and social-processing, (Kana et al. 2013; Lombardo et al. 2010; Uddin 2011); the same regions found to be differentially activated by individuals in different cultures (e.g., Burrows et al. 2016). Given their basic difficulty with self-understanding, alongside their difficulty with social relations, would individuals with autism in different cultures acquire their relevant cultural self-schemas?

As with most psychological and psychiatric research, the vast majority of autism research has been conducted in North America and Europe (Henrich et al. 2010). International autism research has grown significantly in recent years (Elsabbagh et al. 2012; Grinker et al. 2011), yet this research has focused primarily on ways in which different cultures affect the diagnosis and prognosis of individuals with autism. One notable exception is a study by Koh and Milne (2012), which examined the ways in which children with ASD and matched control groups, in Singapore and England, perceived of embedded figures. They found that participants in Singapore were more focused on the ground than the figure, in line with the cross-cultural literature on the topic (e.g., Nisbett and Miyamoto 2005); and participants with ASD in England, compared with TD participants, were focused more on the figure than the ground, in line with multiple studies of embedded figures in ASD (e.g., Jarrold et al. 2005). Yet they found an interaction effect of culture and diagnosis, such that in Singapore, participants with ASD did not differ from their TD counterparts. These results suggest that culture interacts with neurocognitive processes to produce different presentations of autism in different cultures.

Despite the growth of research on autism and culture, very little is known about the ways in which individuals with autism themselves view culture—through their own eyes. Here we attempt to bridge the study of cross-cultural psychology and global autism by asking individuals with autism in the United States and India to describe themselves—and testing whether these descriptions vary across cultural contexts.

A further complication inherent in global autism research is that although autism is heritable, there is no single biological marker for autism. Thus, all diagnoses—including the ones performed in this study—currently rely on behavioral observation systems which were developed in Western contexts (Lord et al. 1999; Rutter et al. 2003b), and often translated to local languages with minimal cultural adaptation (e.g., Rudra et al. 2014). Given the fact that the same behavioral diagnosis is used across different cultural contexts, it is difficult to determine which symptoms of autism are universal, and which are culturally variable (Daley 2002; Wallace et al. 2012). By investigating a behavior (self-descriptions) that is not part of the core autism symptomatology, and is therefore not part of the pre-determined diagnostic observation, our study may contribute to the understanding of which autism symptoms are universal and which are culturally malleable.

New Delhi, India and Los Angeles, USA serve as two pertinent case studies for understanding the variability of self-descriptions by individuals with autism. While

both cities are large urban centers with 15–25 million inhabitants (Cox 2016), the two cities differ considerably in their cultural contexts, viz., in the ways their inhabitants describe themselves. In their seminal study, Shweder and Bourne (1984) showed that in describing themselves, Indians from Bhubaneshwar, Orissa, used more concrete, contextualized descriptions, compared to Americans in Chicago. More recently, in a large cross-cultural survey, Hofstede (2001) found that Americans are highly individualistic (average score of 91 on the Individualism-Collectivism scale), compared with the more collectivistic nature of Indians (who have an average score of 48). While collectivistic values are fast-changing in India, with the influx of more Western influences, English schooling, and the rise of the middle class (Seymour 1999; Gilbertson 2014), the two cultures remain markedly different.

Autism research in India has had a long and rich history, with over 170 studies, conducted by both Indian and international researchers, from various disciplinary perspectives between 1944 and 2010 (Daley et al. 2012). Multiple studies have described the challenges of individuals with autism and their families in receiving diagnoses and treatment, and countering stigma in everyday situations (Daley 2004; Desai et al. 2012; Brezis et al. 2015; Daley et al. 2013). Given the fact that individuals with autism in India, and adults in particular, remain marginalized in the society (Daley et al. 2014), we may hypothesize that they would not acquire the collectivistic themes dominant in their culture, and instead present more autonomous self-descriptions, as would be expected from their diagnosis (Tanweer et al. 2010). By contrast, individuals with autism in Los Angeles, who receive high amounts of services and inclusion (Autism Speaks 2011), may be more aligned with their cultural contexts due to both their higher degree of integration and the alignment between their diagnostic tendency for individualism and the cultural context (Tanweer et al. 2010).

To investigate the self- and other-descriptions of individuals with autism we adapted a well-established task from cross cultural research, the Twenty Statements Task (Kuhn and McPartland 1954), and employed the widely-used coding categories developed by Rhee et al. (1995). Rhee et al. asked participants in New York and Seoul to provide 20 statements starting with "I am", and coded those responses according to 33 categories which were further categorized on two binary scales: social-autonomous and abstract-specific. They found that American participants provided more abstract and autonomous responses than Asian participants.

To our knowledge, only one previous study has used this task in an ASD population. Tanweer et al. (2010) presented the Twenty Statements task to 11 individuals with Asperger's Syndrome (AS) and 15 TD controls in the UK. They found that participants with AS provided fewer, less varied responses, and that their responses were more autonomous and more abstract (i.e., less specific) than the control group. These results fit with known neurocognitive constraints in autism: a difficulty with social processing (APA 2013), and reduced specificity in self-related memory (Brezis 2015).

Here we extend this study to a larger sample of individuals with ASD in a Western context (Los Angeles, USA) and further provide a cross-cultural comparison of the self-descriptions of individuals with and without autism in

New Delhi, India. We further added a comparison condition, in which individuals described their favorite fictional characters. Prior ethnographic and experimental studies have shown that while individuals with autism may have difficulty constructing their sense of self, they often have a special interest in fictional narratives and spared ability to recall them (Solomon 2004), and may even use these and other cultural scripts as scaffolds for self-construction (Brezis 2012; Suskind 2014). We thus sought to compare the ability of individuals with ASD to acquire the cultural scripts that surround them—with regards to their own sense of self and their favorite fictional characters. As we were particularly interested in their relation with cultural scripts, we chose to compare their self-descriptions with those of a close fictional other—rather than a real-life close relative—for whom they would arguably have a no less complex internal representation to draw upon.

Hypotheses

1. Participants in LA will provide more autonomous and more abstract responses than those in New Delhi.
2. Given their difficulties with self- and other-understanding, participants with ASD will have fewer, and less varied, responses than their typically developing (TD) peers.
3. If individuals with autism do not acquire the relevant self- and other-schemas of their cultural context, we expect their self- and other-description to differ significantly from TD participants, across both cultures. Based on their cognitive biases (Tanweer et al. 2010), we expect ASD participants' responses to be more autonomous and more abstract (i.e., less specific) than TD participants.
4. We expect an interaction effect of culture and diagnosis, such that individuals with ASD in Los Angeles will be more aligned with their cultural contexts, given their cognitive tendency for autonomous responses and the society's higher level of acceptance; whereas individuals with ASD in New Delhi will have significantly more autonomous responses than their TD peers, given the same cognitive tendency alongside a lower level of societal acceptance and integration.
5. We expect an interaction effect of diagnosis and condition, such that TD participants' descriptions of themselves will be richer than their descriptions of their favorite fictional character, while in the ASD group there will not be an internal difference between the two (given their reduced self-understanding, and difficulty inferring others' mental states; Lind 2010; Uddin 2011). Yet the representations of the fictional character by the ASD participants will be as rich as those of TD participants (i.e., their fictional processing will be spared; Suskind 2014).

Methods

Recruitment and participants

Participants were recruited across two locations, as part of two larger studies at two different times. Thus, the recruitment procedures and the demographic variables available for each location do not overlap. In Los Angeles (LA), a sample of 32 youth with ASD and 30 TD participants (ages 8–18) were recruited as part of a larger study on self-related processing in youth ASD (see Brezis et al. 2014 for a full description of recruitment and inclusion procedures). ASD and TD participants were well-matched on age, gender, Full-Scale IQ, Performance IQ and Verbal IQ (Wechsler 1999) (see Table 1). Participants differed significantly, as planned, in their degree of autism symptoms as measured by parent-report on the Social Communication Questionnaire (Rutter et al. 2003a) and the Social Responsiveness Scale (Constantino 2005). Diagnosis of participants with ASD was confirmed on the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 1999) and Autism Diagnostic Interview—Revised (Rutter et al. 2003b). All participants were US-born, and fluent in English; no other demographic variables were collected.

In New Delhi, adults with autism (ages 18–34) were recruited as part of a larger collaborative study between the University of California, Los Angles (UCLA) and Action for Autism, New Delhi, a non-governmental organization that serves as the National Center for Autism in India (see http://www.autism-india.org). The ASD sample represented here is a sub-sample of verbally fluent adults who participated in a larger survey on adults with autism in New Delhi (Daley et al. 2014). Diagnosis was confirmed using the ADOS. Given the varying emphasis on self-presentation across Indian social strata, and across English- or Hindi-based education systems (Seymour 1999), we chose to control for measures of language and monthly family income in matching the control group to the ASD participants (see Table 2). Participants came from families whose monthly income ranged from less than 10,000

Table 1 Demographic characteristics of LA sample

	TD ($n = 30$)	ASD ($n = 32$)	Statistic	p value
Age	8–18 (13.5 ± 2.9)	8–18 (12.4 ± 2.9)	$t(60) = 1.49$	.14
Gender	77 % male	88 % male	$\chi^2(1) = 2.70$	.10
Full Scale IQ (FSIQ)	81–137 (110.4 ± 12.2)	82–140 (110.4 ± 15.8)	$t(60) = .04$	.97
Performance IQ (PIQ)	61–128 (101.9 ± 13.6)	70–132 (107.1 ± 14.2)	$t(60) = -1.42$	.16
Verbal IQ (VIQ)	96–137 (116.8 ± 12.5)	84–151 (111.0 ± 18.0)	$t(60) = 1.49$	.14
Social Communication Questionnaire (SCQ)	1–13 (4.8 ± 3.0)	9–32 (22.5 ± 6.4)	$t(57) = 13.63$	<.001
Social Responsiveness Scale (SRS)	5–46 (21.8 ± 10.9)	27–142 (77.8 ± 26.4)	$t(59) = 10.70$	<.001
ADOS Social-communication Total	–	5–17 (10.2 ± 3.6)	–	–

Range (Mean ± SD)

Table 2 Demographic characteristics of New Delhi sample

	TD ($n = 12$)	ASD ($n = 12$)	Statistic	p value
Age	20–34 (23.5 ± 4.3)	18–31 (25.1 ± 5)	$t(22) = .82$	.42
Gender	67 % male	83 % male	$\chi^2(1) = .89$	.64
Preferred language	58 % English	75 % English	$\chi^2(1) = .75$	.65
Monthly family Income	25–50,000 INR	50–75,000 INR	$t(22) = .50$	.62
SRS	54.8 ± 7.1	63.5 ± 8.3	$t(20) = 2.67$	.02
ADOS Social-communication Total	–	8–19 (14.03 ± 6.0)	–	–

Rs (185 USD) to more than 75,000 Rs (1389 USD), which represents roughly the top 10 % of Indian population (Desai et al. 2010).

The control group of TD participants was further matched on age and gender. All participants further completed the adult self-report version of the SRS-II (Constantino 2012); and participants differed significantly in their autism symptoms, as planned.

Study procedures in both locations were approved by the UCLA Institutional Review Board. The procedures in New Delhi were further approved by the ethics board of Action for Autism.

Procedures

Participants were first asked, "How would you describe yourself to someone who doesn't know you?" To simplify the task for our population, participants responded to the prompt orally, and were encouraged to give as many responses as possible. Participants were then asked to identify their favorite movie or book (or one "they know a lot about"), and then identify their favorite character. They were then asked "how would you describe your favorite fictional character?" This was done to ensure that the participant knew the chosen fictional character well, and that the character would be embedded within a rich pre-existing narrative structure (rather than an isolated character, such as a stuffed animal).

In Los Angeles, all interviews were conducted by the first author. In New Delhi, the first author trained three local research assistants with bachelor's degrees in psychology, who had extensive experience with individuals with autism. Particular focus in the training was placed on ensuring that the degree of prompting would be equal across interviewers; i.e., encouraging participants to provide as many possible responses, without reaching a point of irreversible frustration.

Participants identified a range of favorite fictional characters. In LA these included cartoon-characters (Pink Panther, Spiderman) and semi-realistic characters (Harry Potter, Santino Corleone). In New Delhi these included characters from common fables (Crane, Monkey), mythological figures (Hanuman), or movie stars, which were sometimes used interchangeably with the characters they acted out (Amitabh Bachan in the movie Baghban).

Responses were transcribed and translated into English where applicable. The transcripts were parsed into 973 descriptive phrases (defined as a unit that contains no more than one subject-predicate-object). Irrelevant responses (e.g., "I don't know", or descriptions unrelated to the character at hand) were marked as such and not further coded.

Coding

Two coders, blind to participants' diagnosis and location, coded all relevant phrases according to 28 categories and sub-categories (see Appendix for examples of each category). All disagreements were resolved by discussion. Each phrase could be coded for more than one category. We used the coding scheme developed by (Rhee et al. 1995) as a basis, and made the following adaptations to fit our data and analysis goals: (a) the category of Origin was merged into Ethnicity/Race/nationality, (b) the categories of Role status (e.g., student) and Self-ascribed identities (e.g., musician, dancer) were merged into Occupation; (c) we did not sub-divide the categories of Qualified traits and Global descriptions into their further sub-categories; and (d) we considered the categories of Immediate situations, Present residence and Other's descriptions as Irrelevant. The categories of Factual and Existential descriptions defined by Rhee et al. did not appear in our data. We further added three categories which emerged from our data: (a) Knowing/Understanding: anything that someone thinks or perceives that they know, (b) Past information: descriptions of specific past events; and (c) Narration: longer, detailed accounts including two specific events or more.

Analysis

We computed the number of relevant responses per participant and the variety of categories they used (i.e., the number of different categories). Response categories were further classified on two scales (based on Rhee et al. 1995): autonomous/social and abstract/specific (see Appendix). The following categories were classified as Autonomous: Pure traits, Name, Physical description, Physical condition, Age, Possessions and the autonomous sub-categories of Preferences, Aspirations, Activities, Knowing, Evaluative descriptions, Knowing, and Emotional states. The following categories were classified as Social: Contextualized traits, Family, Ethnicity, Gender, Religion, Occupation, and the social sub-categories of Preferences, Aspirations, Activities, Evaluative descriptions, Knowing, and Emotional states.

The following categories were classified as Abstract: Pure traits, and Emotional-autonomous states; and the following descriptions were classified as Specific: Contextualized Traits, Family, Ethnicity, Gender, Religion, Occupation, Name, Preferences, Aspirations, Activities, Knowing, Evaluative, Physical descriptions, Age, Physical conditions, Emotional-social states, and Possessions. These were then used to compute the percent of Autonomous and Abstract responses (from each participant's amount of relevant responses), which served as the main dependent variables in our analyses.

The following categories were not categorized according to Social/Autonomous and Abstract/Specific scales, as they did not pertain directly to these poles, but to broader narrative styles: Negation, Global, Past information, and Narration. As there were relatively few utterances that pertained to these categories, and those generally received an overlapping code that placed them in one of the categories of interest, they were analyzed qualitatively but not included in the quantitative analyses presented here.

Preliminary analyses demonstrated that age correlated with the number of relevant categories, and with the percent of autonomous and abstract responses. Since participants in LA and New Delhi also differed significantly in age, we entered age as a co-variate in all analyses.

We computed Repeated-Measures ANCOVAs for Number of Relevant Responses, Variety of Categories, Percent Autonomous and Percent Abstract as dependent variables, with Group (ASD, TD), Location (LA, Delhi) as between-subjects factors, and Condition (Self, Fictional) as within-subjects factor. In order to compare our findings more specifically with those of Tanweer et al. (2010), which were conducted in a Western context, we compared the self-descriptions of ASD and TD participants in LA alone using ANOVA analyses with Percent Autonomous and Percent Abstract as dependent variables.

Results

Number of relevant responses

We found significant interaction effects of Group by Location ($F(1,64) = 6.41$ $p = .014$, $\eta^2 = .09$) and Condition by Age ($F(1,64) = 7.69$, $p = .007$, $\eta^2 = .11$), and a trend for Group by Condition ($F(1,64) = 3.70$, $p = .059$, $\eta^2 = .06$). These were mediated by a main effect of Group ($F(1,64) = 10.60$, $p = .002$, $\eta^2 = .14$); a main effect of age ($F(1,4) = 13.73$, $p < .001$, $\eta^2 = .18$); and a trend towards an effect of Condition (Self > Fictional, $F(1,64) = 3.90$, $p = .052$, $\eta^2 = .06$) (see Table 3). Post-hoc analyses revealed that while TD participants provided more responses than ASD overall, in LA this difference was marginally significant ($t(60) = 1.9$, $p = .051$), while in Delhi it was not significant ($t(22) = 1.75$,

Table 3 Total number of relevant responses across locations, groups, and conditions

	TD			ASD			Total
	Self	Fictional	Total	Self	Fictional	Total	
LA	4.10 (1.8)	3.78 (2.2)	4.12 (1.9)	3.30 (2.3)	3.11 (1.8)	3.19 (1.8)	3.64 (1.9)
New Delhi	14.42 (12.8)	8.33 (5.4)	11.38 (8.7)	8.25 (3.3)	5.50 (2.0)	6.87 (1.8)	9.13 (6.6)
Total	7.05 (8.3)	5.34 (4.1)	6.12 (5.8)	4.82 (3.5)	3.85 (2.1)	4.19 (2.4)	5.10 (4.5)

Mean (SD)

$p = .09$). Furthermore, while TD participants provided marginally more responses for themselves than their favorite Fictional character, ($t(34) = 1.98$, $p = .055$); among ASD participants the difference was insignificant ($t(36) = 1.67$, $p = .10$). Finally, the number of relevant responses increased strongly and significantly with age for self-descriptions ($B = .67$, SE $= .18$, $p < .001$), and more weakly for fictional descriptions ($B = .26$, $SE = .095$, $p < .01$).

Descriptions

Examples of each category are included in the Appendix. The mean percent of each type of description provided by participants is summarized in Table 4. As can be seen by Table 4, the most common response was Pure Traits, followed by autonomous activities, autonomous evaluative descriptions, social activities, occupations, negation of descriptions, and autonomous preferences.

Variety of categories

We found a significant interaction effect of Condition x Group x Location ($F(1,64) = 4.18$, $p = .045$, $\eta^2 = .06$); which was mediated by a main effect of Group (TD > ASD, $F(1,64) = 13.66$, $p < .001$, $\eta^2 = .18$), and a main effect of Age ($F(1,64) = 11.91$, $p = .001$, $\eta^2 = .16$) (see Table 5). Post-hoc between-subjects analyses revealed that in LA, participants with ASD used fewer types of descriptive categories than TD participants: significantly so for fictional characters ($t(48) = 3.01$, $p = .004$), and marginally so for themselves ($t(55) = 1.86$, $p = .069$). In Delhi, participants with ASD used marginally fewer descriptive categories than TD participants in describing themselves ($t(22) = 1.84$, $p = .079$), but no fewer categories in describing their favorite fictional character ($t(22) = .43$, $p = .671$). Within-subjects analyses revealed that TD participants in LA employed marginally more categories in describing their favorite fictional character than themselves ($t(22) = -1.85$, $p = .07$), while in Delhi they employed more categories when describing themselves than their favorite fictional character ($t(11) = 2.47$, $p = .03$). By contrast, in both locations, ASD participants employed statistically similar numbers of categories when describing themselves and their favorite fictional characters (LA: $t(21) = .00$, $p = 1.0$; Delhi: $t(11) = .82$, $p = .43$).

Percent autonomous responses

In the main ANCOVA analysis, we found a main effect of Location (LA > Delhi; $F(1,64) = 4.60$, $p = .036$, $\eta^2 = .07$; Fig. 1) and all other effects were non-significant (Group × Location, $F(1,64) = .459$, $p = .501$, $\eta^2 = .01$; Group, $F(1,64) = .336$, $p = .564$, $\eta^2 = .01$; Condition, $F(1,64) = .19$, $p = .664$, $\eta^2 < .01$). When repeating the analysis for the Self condition in the LA sample only, we further found no effect of Group ($F(1,55) = .094$, $p = .76$).

Table 4 Mean percent of descriptions from each category, across locations, groups and conditions

	LA				New Delhi			
	TD		ASD		TD		ASD	
	Self	Fictional	Self	Fictional	Self	Fictional	Self	Fictional
Traits—pure	43.7 (0.3)	49.4 (0.3)	36.1 (0.3)	37.0 (0.4)	11.1 (0.2)	10.7 (0.2)	4.3 (0.1)	18.1 (0.2)
Traits—Contextualized	11.6 (0.2)	4.8 (0.1)	4.6 (0.1)	2.8 (0.1)	3.4 (0.1)	0	0.8 (0.0)	0
Family	0	7.5 (0.1)	0.4 (0.0)	3.0 (0.1)	7.4 (0.1)	12.2 (0.3)	2.9 (0.1)	10.8 (0.2)
Ethnicity	0	0.7 (0.0)	0	0	2.1 (0.0)	1.5 (0.0)	2.5 (0.1)	0
Gender	0.4 (0.0)	0	0	0	0	2.4 (0.1)	1.0 (0.0)	0
Religion	0	0	0	0	1.8 (0.0)	1.4 (0.0)	0	0
Occupation	1.9 (0.1)	4.8 (0.1)	1.1 (0.1)	8.8 (0.2)	18.8 (0.1)	5.0 (0.1)	12.9 (0.2)	20.5 (0.3)
Name	0	0.3 (0.0)	0	0.6 (0.0)	5.1 (0.1)	1.2 (0.0)	13.1 (0.1)	3.3 (0.1)
Negation	13.0 (0.2)	9.6 (0.2)	9.8 (0.2)	1.2 (0.0)	8.2 (0.1)	7.5 (0.1)	9.8 (0.2)	6.1 (0.1)
Preferences—autonomous	10.4 (0.2)	6.3 (0.2)	10.1 (0.2)	1.2 (0.1)	13.9 (0.1)	5.8 (0.1)	8.9 (0.2)	6.2 (0.1)
Preferences—Social	1.9 (0.1)	5.3 (0.2)	4.1 (0.2)	0	3.9 (0.1)	1.4 (0.0)	6.5 (0.1)	3.0 (0.1)
Aspirations—autonomous	1.9 (0.1)	6.4 (0.1)	0	1.2 (0.1)	8.0 (0.1)	5.1 (0.1)	3.7 (0.1)	1.2 (0.0)
Aspirations—social	4.6 (0.1)	2.3 (0.1)	2.8 (0.1)	1.2 (0.1)	1.6 (0.0)	3.7 (0.1)	1.9 (0.0)	2.1 (0.0)
Activities—autonomous	12.6 (0.2)	9.3 (0.2)	13.9 (0.3)	15.0 (0.3)	15.1 (0.1)	10.4 (0.1)	14.6 (0.1)	19.1 (0.2)
Activities—social	8.0 (0.2)	12.1 (0.2)	8.6 (0.2)	12.5 (0.2)	6.8 (0.1)	6.3 (0.1)	14.6 (0.2)	6.5 (0.1)
Knowing—autonomous	2.3 (0.1)	2.5 (0.1)	2.1 (0.1)	1.8 (0.1)	13.5 (0.1)	6.2 (0.1)	7.2 (0.1)	2.6 (0.1)
Knowing—social	3.5 (0.1)	5.8 (0.2)	2.5 (0.1)	1.2 (0.1)	4.4 (0.1)	0.4 (0.0)	2.3 (0.1)	2.7 (0.1)
Evaluative—autonomous	15.6 (0.2)	17.5 (0.2)	21.3 (0.3)	13.9 (0.2)	8.5 (0.1)	10.5 (0.1)	2.9 (0.1)	13.7 (0.2)
Evaluative—social	4.8 (0.1)	4.1 (0.1)	8.9 (0.2)	3.4 (0.1)	4.3 (0.1)	8.3 (0.1)	2.8 (0.1)	2.6 (0.1)
Physical description	0	1.0 (0.1)	3.3 (0.1)	6.0 (0.2)	1.8 (0.0)	5.7 (0.1)	2.1 (0.1)	11.0 (0.2)
Age	0	0	0	0	0.9 (0.0)	1.2 (0.0)	6.7 (0.1)	1.7 (0.1)

Table 4 continued

	LA				New Delhi			
	TD		ASD		TD		ASD	
	Self	Fictional	Self	Fictional	Self	Fictional	Self	Fictional
Physical condition	0.3 (0.0)	2.8 (0.1)	1.7 (0.1)	2.1 (0.1)	0.3 (0.0)	3.0 (0.1)	1.0 (0.0)	3.1 (0.1)
Emotional—autonomous	8.0 (0.1)	5.9 (0.1)	2.7 (0.1)	6.4 (0.2)	3.7 (0.1)	2.4 (0.1)	0.8 (0.0)	1.0 (0.0)
Emotional—social	3.0 (0.1)	0	0.5 (0.0)	0	0.6 (0.0)	1.7 (0.0)	0.5 (0.0)	0
Possession	0	0.7 (0.0)	1.1 (0.1)	0.6 (0.0)	0	1.9 (0.1)	0.5 (0.0)	0
Global	0	2.0 (0.1)	0	4.5 (0.1)	0.2 (0.0)	0.4 (0.0)	0	0
Past information	0.3 (0.0)	0	0	0	5.6 (0.1)	0	2.9 (0.1)	0
Narration	0	5.5 (0.1)	0	5.7 (0.2)	1.8 (0.0)	10.5 (0.2)	2.2 (0.1)	14.7 (0.2)

Mean (SD)

Table 5 Mean number of different categories used by each participant, across locations, groups and conditions

	TD			ASD			Total
	Self	Fictional	Total	Self	Fictional	Total	
LA	3.52 (1.7)	4.32 (2.2)	4.07 (1.9)	2.96 (1.7)	2.83 (2.1)	2.79 (1.9)	3.44 (2.0)
New Delhi	8.83 (4.1)	5.50 (2.5)	7.17 (3.7)	6.08 (3.2)	5.08 (2.8)	5.58 (2.7)	6.38 (3.3)
Total	5.24 (3.7)	4.70 (2.3)	4.95 (2.9)	4.03 (2.7)	3.60 (2.4)	3.61 (2.5)	4.29 (2.8)

Mean (SD)

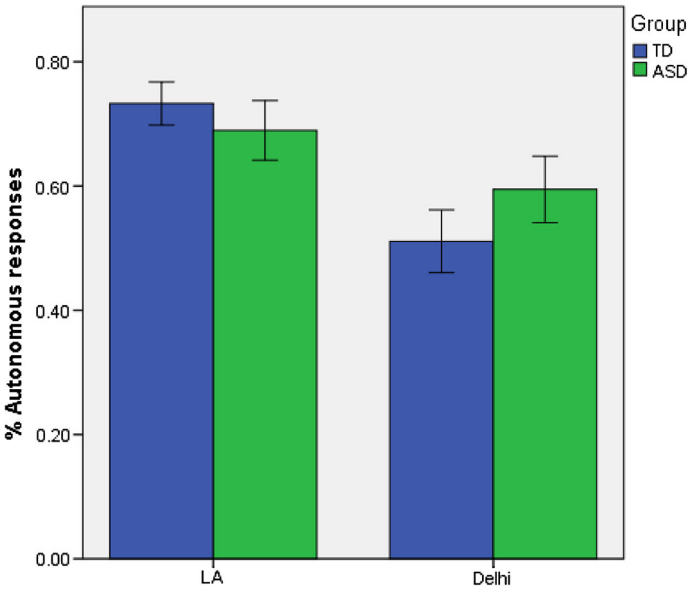

Fig. 1 Percent of autonomous responses; *Error bars* ± 1 SE

Percent abstract responses

In the main ANCOVA analysis, we found a main effect of Location (LA > Delhi; $F(1,64) = 17.36$, $p < .001$, $\eta^2 = .21$; Fig. 2) and all other effects were non-significant Group x Location, $F(1,64) = .255$, $p = .615$, $\eta^2 < .01$; Group, $F(1,64) = 1.05$, $p = .309$, $\eta^2 = .02$; Condition, $F(1,64) = 1.87$, $p = .176$, $\eta^2 = .03$). When repeating the analysis for the Self condition in the LA sample only, we further found no effect of Group ($F(1,55) = 1.55$, $p = .22$).

Discussion

In describing themselves and their favorite fictional characters, participants with ASD provided fewer, less varied, responses than their typical peers, in line with their difficulties with self- and other-processing (Tanweer et al. 2010; Uddin 2011).

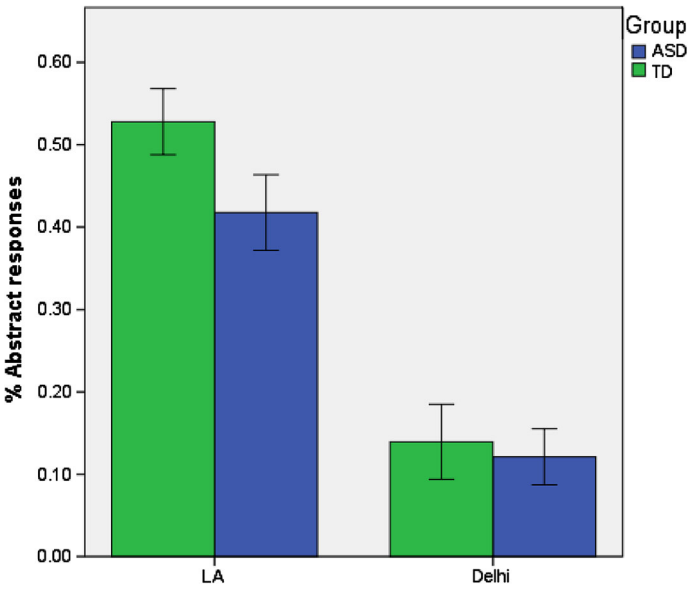

Fig. 2 Percent of abstract responses; *Error bars* ± 1 SE

Yet contrary to our hypotheses, cultural differences overwhelmingly prevailed in predicting the *content* of their responses. Participants in Los Angeles provided more autonomous and more abstract responses than participants in New Delhi, regardless of their diagnostic status; and despite their difficulties with self- and other-processing, participants with ASD did not differ from the TD participants of their respective cultures (see Figs. 1, 2). Furthermore, we did not find any significant interaction effects of culture and diagnosis. These results suggest that individuals with ASD *are* capable of acquiring the cultural schemas that surround them, regardless of their cultural surroundings, even when these schemas relate to a psychological construct—the self—with which individuals with autism struggle (Lind 2010; Uddin 2011).

These surprising results confound our hypothesis that neurocognitive constraints in ASD would shape their self- and other-descriptions to be more autonomous and less abstract than their TD peers. Indeed, we were unable to replicate the one previous study, to our knowledge, that found such results in a small group of adults with and without Asperger's Syndrome in the UK (Tanweer et al. 2010). While our sample was much larger, and hence our results perhaps more robust, notably our participants provided much fewer responses on average (5.1) than those in Tanweer et al.'s study (18). This may be due to the difference in ages between our samples, as we've seen that the number of relevant responses increased with age in our sample; or perhaps due to the fact that our participants responded verbally, rather than in writing. It is therefore possible that though we both computed percentages of autonomous and abstract responses (divided by the number of responses), the differences in content between ASD and TD participants that Tanweer et al. observed could not be observed in our sample given the smaller absolute number of

responses per participant. Nevertheless, it is striking that we found significant effects of location on the percent of autonomous and abstract responses, despite the smaller number of responses provided by each participant. These results suggest that location was much stronger than neurocognitive biases in shaping our participants' self- and other-descriptions.

Our findings did align with our hypothesis that participants with ASD would have fewer and less varied responses compared to TD participants. Interestingly, however, these main effects were mediated by interacting effects of location and condition. While ASD participants provided fewer relevant responses than TD participants, this was more pronounced in LA than in New Delhi—perhaps due to the fact that participants in LA were younger, or that the sample size in New Delhi was smaller. Further, while TD participants provided marginally more responses for themselves than for their favorite fictional character, in ASD participants this difference was not significant. These results lend further support to the hypothesis that fictional processing in autism is a relative strength (Brezis 2012; Suskind 2014).

The variety of categories used by participants, a measure of the richness and complexity of their self- and other-concepts, was also more reduced in ASD compared with TD participants (in line with Tanweer et al. 2010), but this was mediated by a three-way Location by Group by Condition interaction. Among ASD participants there was no difference between the variety of Self and Fictional descriptions; again, in line with the hypothesis that fictional processing is relatively spared in ASD. Yet among TD participants, there was a difference between Self and Fictional descriptions, mediated by location: while in New Delhi TD participants provided more varied responses for themselves than for their favorite fictional characters, in LA this pattern was reversed. Once again, it is possible that these differences in TD participants' description patterns are due to the fact that participants in LA were younger than those in New Delhi, and thus perhaps their favorite fictional characters are more salient for them. But it is also possible that there are cultural differences in the role of fictional characters vis-à-vis an individual's identity development: that in the US there is a greater tendency to encourage attachment to fictional characters (Gaskins et al. 2007), and that therefore their descriptions are more varied. Further developmental and cross-cultural research is needed to elucidate these hypotheses.

Our study has several important limitations. First, due to the fact that our samples were drawn from two different, larger studies, participants in each location differed in age: we recruited youth in LA and adults in New Delhi. Though we co-varied for age in all of our analyses, it is nonetheless impossible to determine whether the effects of location were primarily driven by cultural differences or by age differences between the groups. Notably, though we would have predicted that abstraction grows with age (Gelman and Baillargeon 1983), we did find that abstraction was greater in the Los Angeles than in the New Delhi sample; thus, it is likely that our results are culturally-driven, and not just driven by age. A further, related limitation is that we do not have socio-economic and ethnic data on participants in the US, and we were not able to collect IQ data on participants in New Delhi. While participants with ASD are matched to their control groups in each culture, the fact that we do not have the same demographic data available for the

entire sample limits our comparisons. Future cross-cultural research in ASD should take care to recruit groups matched on basic demographic parameters.

A second important limitation is that the descriptions task we used (Kuhn and McPartland 1954) probes only a thin layer of individuals' self- and other-concepts, leaving out other non-verbal layers, such as the directly perceived "me" (James 1890/2013). Thus, it is likely that participants repeated rote scripts which they have heard in describing themselves or their fictional characters (this would be especially true for participants with ASD; Lord et al., 2012). Indeed, it is perhaps *because* this task probed a more superficial layer of identity that ASD participants were so similar in their descriptions to their cultural peers. Recent research has shown that while individuals with ASD can use explicit verbal information to form an impression of others, they fail to use concurrent non-verbal cues (e.g., Kuzmanovic et al. 2011). Thus, it is possible that while individuals with ASD acquire the explicit, verbal layers of their cultural surroundings, they would have more difficulty perceiving of, and performing, non-verbal cultural behaviors. It is thus important to explore the ways in which individuals with autism in different cultures differ in their *non-verbal* understandings and representations of self and others, e.g., through cross-cultural studies of interoception (Ma-Kellams 2014).

Further qualitative and ethnographic research should continue to investigate the ways in which individuals with ASD in different cultures *make meaning* of their identity: to what extent are different facets of their identity (such as ethnic, gender, family roles) actually played out in their personal narratives (Ochs and Capps 1996) and daily routines? And how do various aspects of the self in autism vary cross-culturally (LeVine 2010)?

Despite these limitations, our study presents an important step in bridging the study of cultural acquisition across both culturally and neurally diverse populations (see also, Koh and Milne 2012), suggesting multiple avenues of future research. First, it is important to continue surveying the development of self-concepts in individuals with autism of different ages across different cultures, to determine whether their self-concept is indeed malleable to cultural influence, and if so, at what age. Second, researchers should continue mapping different cultural abilities in autism (including non-verbal norms and practices), to determine which abilities are culturally acquired in autism, and which are more impeded by their neurocognitive constraints. This line of research may further illuminate the distinction between local and universal symptoms of ASD, helping us develop diagnostic measures that can be used globally, yet are sensitive to local cultural variations (Grinker et al. 2011; Wallace et al. 2012). Finally, it is important to supplement this behavioral cross-cultural research with neuroimaging research to determine whether individuals with autism employ different neurocognitive mechanisms when acquiring cultural schemas.

Conclusions

We found that in describing themselves and their favorite fictional characters, individuals with autism strongly ascribed to their culturally-relevant schemas, despite their difficulties in self- and other-processing. These results have several

important implications. First, while these results may not be surprising to cultural psychologists (Skinner and Weisner 2007), they are an important contribution to our knowledge of the way the ASD phenotype may vary from culture to culture. Indeed, not all ASD traits are biologically-determined, and some, such as self- and other-constructs, may vary depending on the cultural climate in which the individual is raised. Second, these results send an important message to caregivers of individuals with autism, demonstrating that an individual's cultural surrounding can influence even core beliefs such as their sense of self, and hence behavioral, interpersonal interventions are well-merited. Finally, these results send a message of inclusion to societies worldwide—reminding us that the individuals with autism in our midst are in fact not so different in some respects from their typically developing peers, especially when compared to people from another culture.

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Appendix

See Table 6.

Table 6 Examples of descriptive phrases given in each category

Category	Abstract/ Specific	Autonomous/ Social	Examples
Traits—Pure	Abstract	Autonomous	"Genius and bright", "loving", "a friendly guy"
Traits—Contextualized	Specific	Social	"Caring, when it comes to certain persons"; "at times, he's like laid back but then he can be really hardcore and kind of insane"
Family	Specific	Social	"having such a happy life with two daughters", "his tutor was his grandma"
Ethnicity	Specific	Social	"I'm Bengali"
Gender	Specific	Social	"I'm a good boy"
Religion	Specific	Social	"I'm a spiritualist"
Occupation	Specific	Social	"I am studying psychology second year", "he's a superhero"
Name	Specific	Autonomous	"My name is Imran"

Table 6 continued

Category	Abstract/ Specific	Autonomous/ Social	Examples
Negation	–	–	"I don't like school", "he's not really nervous to do a lot of crazy things"
Preferences—autonomous	Specific	Au	"I like to play video games", "I have this thing for art"
Preferences—Social	Specific	Social	"I love to talk to people and I love to be in the phone [sic]"; "I like to make new friends"
Aspirations—autonomous	Specific	Autonomous	"I'm trying to be a psychologist"; "He's this character that tries to live life to the fullest, takes chances"
Aspirations—social	Specific	Social	"he follows into groups and he basically tries to fit in"; "[Ranbir Kapoor] wanted the girl to marry him"
Activities—autonomous	Specific	Autonomous	"I study a lot at the library", "The gardener takes care of the plants"
Activities—social	Specific	Social	"I play football", "I would chat and hang out with friends all the time"
Knowing—autonomous	Specific	Autonomous	"I'm a scientific person and I would like to eliminate all these superstitions and false behavior that we are into"; "Gradually he understands everything"
Knowing—social	Specific	Social	"I take someone else's point of view in consideration" "He sees himself different from the world and everyone around him"
Evaluative—autonomous	Specific	Autonomous	"good at math"; "I can sometimes…[make] mistakes…like, I might say: love, dove."
Evaluative—social	Specific	Social	"I am different from others"; "I'm a good listener"; "I am someone you can talk to whenever they [sic] want to"
Physical description	Specific	Autonomous	"a short girl wearing spectacles"
Age	Specific	Autonomous	"I am 25 years old and I will turn 26 in April"; "I am the oldest"
Physical condition	Specific	Autonomous	"people who are physically challenged have many complications in life"
Emotional—autonomous	Abstract	Autonomous	"I kind of get these mood swings at times"
Emotional—social	Specific	Social	"But he has the basic understanding of loving other people"
Possession	Specific	Autonomous	"and all the special kids are my friends"; "he has webs"
Global	–	–	"Sam is a human"; "He was basically an alien in that movie, he has come from another planet"
Past information	–	–	"I went on a really high [roller coaster] on Knotts Berry Farm called Ghost Rider"

Table 6 continued

Category	Abstract/ Specific	Autonomous/ Social	Examples
Narration	–	–	"Then I wake up and I start dreaming that I'm flying a German jeep"
			"When Hanuman ji went to Lanka to search for Sita… then on his journey a mountain spoke to him asking him to take rest for some time and then continue his journey. But he said no and that he has to do his God's work and until and unless he won't finish his work he won't take any rest."

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