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Letter to the Editor

Case report: Selective deficit in the production of intransitive gestures in an individual with autism

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Left-hemisphere brain damage may result in limb apraxia, a deficit in the processing of gestures (Rothi et al., 1991; Cubelli et al., 2000) which may be transitive (i.e., actual object use), intransitive (i.e., communicative), pantomime (i.e., a gestures that describe the object use), or meaningless gestures (i.e., arbitrary gestures that have no semantics). Previously identified patterns of impaired praxis processing include selective deficits in the production of transitive gestures (Motomura and Yamadori, 1994), object-related gestures (transitive gestures and pantomimes, Dumont et al., 1999), and pantomimes (Bartolo et al., 2003). Cubelli et al. (2000) reported an aphasic patient (Case 19) showing a deficit in intransitive but not transitive gesture production, but pantomimes were not tested. In summary, given the absence of any report distinguishing pantomimes and intransitive gestures, to date it is not possible to conclude that pantomimes and intransitive gestures are processed by different mechanisms (Carmo and Rumiati, 2009). Mozaz et al. (2002) and Carmo and Rumiati (2009) suggest that the difference between gestures depends on the complexity of the movements to be executed.

However, intransitive gestures differ from pantomimes as well as from transitive gestures in that they include socio-communicative content: ''waving hello'' puts two people in communication with each other, and a gesture like ''I'm cold'' communicates an internal state. It is well established that individuals with autism show impaired social communication skills (Dziuk et al., 2007), as well as a demonstrated visual preference for objects in social contexts (Klin et al., 2002). Thus, it is reasonable to expect that individuals with autism may be more affected in the production of intransitive gestures than in the production of object-related gestures. This pattern has not been observed in this population probably because most studies in autism often group intransitive gestures and pantomimes together (Dewey et al., 2007; Mostofsky et al., 2006).

In the course of a group study aimed at evaluating individuals with autism using different gestures, we came across the case of an individual (JK) who showed a clear pattern of sxelective deficit in the production of intransitive actions.

1. Case report

JK (11 year old male) was diagnosed with autism spectrum disorder (ASD) according to DSM-I V (American Psychiatric Association, 1994) criteria and was diagnosed with Asperger syndrome. He also achieved scores out of normal range in two tasks assessing social cognitive abilities, the Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 1999; pathologic score = above 10, JK score = 15) and the Social Communication Questionnaire (SCQ) (Rutter et al., 2003; pathologic score = 15 or above, JK score = 19). Twenty-three typically developing participants (TD, range age 7.3–15.8; mean age 12.0, standard deviation – SD 2.1) served as controls. All participants were administered a series of cognitive tests evaluating their general neuropsychological profile: the Beery Test of VMI (Visual Motor Integration) (Beery and Beery, 2004); the Beery Test of Visual Perception (VP) (Beery and Beery,

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2004); three working memory tasks (Pickering and Gathercole, 2001): Digit recall (DR); Word list matching (WLM); Listening recall (LR), and tests measuring Intelligence Quotient (IQ) (Wechsler, 1999): Verbal Intelligence Quotient (VIQ); Performance Intelligence Quotient (PIQ); and Full Scale Intelligence Quotient (FSIQ). To avoid false positive diagnoses, we determined the cutoffs as the worst score achieved by the TDs minus two further points (see Bartolo et al., 2003).

Gesture processing was evaluated by means of twelve tasks assessing gesture comprehension and production. The stimuli were designed for US children. Each task included 20 items (the transitive gestures task included 18). Gesture comprehension was assessed using three separate matching tasks. For transitive gesture comprehension the participants were instructed to point to a picture of the object that was the most strongly associated with the target photo in the presence of a semantic distractor (e.g., book matched to backpack instead of desk). In the intransitive gesture task the participants observed the examiner producing a gesture and then matched the gesture to one of four photos of social scenarios in the presence of three social scene distractors (e.g., 'stop' gesture matched to the social scenario of a student running in the hallway instead of a student walking in the cafeteria, a student playing basketball in the gym, and students sitting at a table in the library listening to the teacher). Similarly, participants viewed a target pantomime and matched the gesture to the correct photo in the presence of three object distractors (e.g., 'brushing teeth' gesture matched to toothbrush, instead of cup, scissors, or hamburger). Gesture production was assessed by means of five tasks assessing transitive gestures (object use on visuo-tactile modality) and the production of pantomimes and intransitive gestures in verbal and visual modality. In the pantomime production task, the participants were required to listen to the name of an object (verbal modality) or to view a real object and then to pantomime its use. Intransitive gestures were elicited after the participant listened to the description of (verbal modality) or watched a video of (visual modality) a social scenario. Imitation was assessed by means of four tasks testing the reproduction of transitive, intransitive, meaningless gestures and pantomimes. The tested gestures required unimanual movements.

For every item, each participant was given a score of 1 for correct, 0 for failure, for a maximum score in each task of 20 (18 for production of transitive gestures). Failures were determined according to the criteria set out in Bartolo et al., 2008.

2. Results

JK performed above cutoff in both gesture comprehension and imitation (see Table 1). Pantomimes and transitive gestures production were also performed above cutoff. Although the TD group also showed higher scores in the production of pantomimes than intransitive gestures, JK scored well below cutoff in the production of intransitive gestures in both verbal and visual modalities, showing for the first time a dissociation between intransitive gestures (impaired) and pantomimes (well executed). This dissociation is confirmed by Crawford and Garthwaite's (2005) statistical method: JK's pantomime production statistically dissociated from that of intransitive gestures in both the verbal and visual modalities. For verbal modality, there were deficits in intransitive gestures [$t(22) = 6.18$, $p < .001$] and pantomimes [$t(22) = 1.78$, $p = .044$], with a strong dissociation [$r = .46$; $t(22) = 4.20$, $p < .001$]; for visual modality, there was a deficit in intransitive gestures [$t(22) = 6.96$, $p < .001$] but not in pantomimes [$t(22) = .00$, $p < 1$], with a classical dissociation [$r = .37$, $t(22) = 14.37$, $p < .001$]. From a qualitative viewpoint, JK's performance was characterized by "I don't know" answers or by providing the correct verbal response without generating a gesture.

3. Discussion

Whereas consistent findings show an advantage in the production of intransitive gestures over pantomimes (Bartolo et al., 2003; Dumont et al., 1999; Mozaz et al., 2002; Carmo and Rumiati, 2009), JK is the first report of a selective deficit in the production of intransitive gestures differing from previous studies reporting production deficits in both pantomimes and intransitive gestures (Smith and Bryson, 2007) and in earlier studies reporting deficits of pantomime to command and in tasks assessing intransitive gestures (Rogers et al., 1996). This deficit cannot be due to gesture complexity, since JK's performance was above cutoff in gesture imitation, thus improving when a model was provided. It also cannot be explained by arguing that intransitive gestures based on a story telling task may be too complex for an autistic participant. Indeed, JK had an intact cognitive profile, in particular his language comprehension skills were adequate for following verbal instructions, participating in functional conversation, and completing a test of LR above cutoff. Moreover, his verbal IQ score was well above cutoff. These finding weaken the plausibility of attributing the impairment of gestural performance to a pure language comprehension deficit. Finally, JK was also able to comprehend the visual social scenario, since he could match a gesture to the correct situation, suggesting that his impaired socio-cognitive abilities did not affect his capacity to understand gestures.

Overall, this finding contradicts the hypothesis that any deficit is complexity-driven (Mozaz et al., 2002; Carmo and Rumiati, 2009). To understand the nature of JK's pattern, it is worth noticing that during conversational speech, JK demonstrated a reduced capacity to integrate gestures into social communication, and although his "I don't know" responses in the production of intransitive gesture task predominated; at times he also expressed correct knowledge of the gesture to be executed, further confirming this difficulty in integrating the appropriate gesture in the specific social context. Recently, Dziuk et al. (2007) found a correlation between praxis and social impairments suggesting that dyspraxia may be a 'core feature of autism' (p. 734). JK performed out of the normal range in tasks assessing socio-cognitive abilities (ADOS and SCQ) as well as in tasks of intransitive gesture production. Therefore, given that the only tasks JK failed were those assessing social abilities and the production of intransitive gestures, we claim that a more convincing explanation is that the ability to produce intransitive gestures relies on socio-cognitive skills.

Table 1 – Range, means, standard deviations and cutoffs of the scores achieved by the 23 TD in the tasks assessing the general cognitive abilities and the comprehension, production and imitation of gestures. JK's scores are reported in the right column. Cut-off scores were determined as the worst score achieved by the TDs minus two further points.

General neuropsychological assessment		TD scores	JK
Cognitive measures	Tasks	Range mean (SD) cutoff	
IQ	VIQ	87–134 107.5 (12.9) 85	126
	PIQ	69–143 112.8 (18.8) 67	127
	FSIQ	79–139 111.4 (16.5) 77	129
Visual spatial abilities	Beery VP	19–30 27 (2.5) 17	27
	Beery VMI	78–136 102.4 (13.4) 76	105
Working memory	WLM	77–143 106.0 (16.2) 75	77
	LR	68–126 100.3 (16.7) 66	77
	DR	71–145 108 (21.6) 69	81
Assessment of gesture comprehension, production and imitation		TD scores	JK
Task	Type of gesture	Range mean (SD) cutoff	
Gestures comprehension	Transitive	18–20 19.3 (0.8) 16	18
	Intransitive	15–20 (1.6) 18 13	16
	Pantomimes	16–20 19 (1.0) 14	17
Gestures production	Transitive	17–18 18 (0.2) 15	16
	Intransitive	Verbal 15–20 17.2 (1.3) 13	9*
		Visual 14–20 17.8 (1.8) 12	5*
	Pantomimes	Verbal 16–20 19 (1.1) 14	17
		Visual 17–20 19 (0.8) 15	19
Gestures imitation	Transitive	17–20 19.3 (0.8) 15	18
	Intransitive	17–20 19 (0.8) 15	17
	Pantomimes	15–20 18.9 (1.7) 13	13
	Meaningless	15–20 18 (1.5) 13	17

* Indicates pathological scores in relation to the cutoff.

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