frontiers in Education

ORIGINAL RESEARCH
published: 28 February 2018
doi: 10.3389/feduc.2018.00012

Object Use in Children with Autism: Building with Blocks from a Piagetian Perspective

Antonio Iannaccone[1], Giulia Savarese[2] and Federico Manzi[1,3]*

[1] Institut de Psychologie et Éducation, Université de Neuchâtel, Neuchâtel, Switzerland, [2] Departimento di Medicina e Chirurgia, Università di Salerno, Baronissi, Italy, [3] Unità di Ricerca sulla Teoria della Mente, Dipartimento di Psicologia, Università Cattolica del Sacro Cuore, Milan, Italy

Aim: This study focused on the manipulation of objects by children with suspected autism spectrum disorder. The aim was to demonstrate how objects can be seen as active agents of interpersonal exchange in face-to-face interactions.

Participants: Three children with suspected autism spectrum disorder (aged 18, 20, and 24 months) were selected as representative of the sensorimotor stage of development.

Methods: Starting from Piaget's classical approach to the sensorimotor and symbolic developmental stages, the study moved toward a socio-material interpretation in which some patterns of interaction involving object manipulation seem to create a space that supports adult–child communication. In videotaped observations of verbal and non-verbal signs during an (organized) free play session, each child manipulated seven small blocks of colored plastic in the presence of an adult. The observations were informed by a checklist of 14 items, including eye contact and building a tower of toy blocks from section B of the CHAT (*CHecklist for Autism in Toddlers*) instrument.

Results: Based on a broad Piagetian perspective and recent work in the field of socio-materiality, key observations included the following: (1) sensorimotor and realistic play was observed in all three children; (2) there were some intriguing indications that objects serve as concrete mediators in the intersubjective space between adult and child; (3) some of the children's attention patterns were visibly mediated by the object.

Discussion and conclusion: All three children exhibited a particular sequence of actions. First, they manipulated the blocks through active experimentation; second, there was an apparent pause, during which, the children were in fact examining the blocks to determine how best to continue the interaction; and finally, the children monitored adult attention by means of eye contact or by restarting manipulation of the blocks. As this last step in the sequence indicated that the object became a mediator of reciprocal attention, this interpersonal process was labeled "attention mediated by object."

Keywords: children with autism, socio-materiality theory, object use, Piagetian perspective, toy construction blocks

OPEN ACCESS

Edited by:
Claudio Longobardi, Università degli Studi di Torino, Italy

Reviewed by:
Ana Moreno-Núñez, University of Valladolid, Spain
Flavia Lecciso, University of Salento, Italy

****Correspondence:***
Giulia Savarese
gsavarese@unisa.it

Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

Received: *12 October 2017*
Accepted: *09 February 2018*
Published: *28 February 2018*

Citation:
Iannaccone A, Savarese G and Manzi F (2018) Object Use in Children with Autism: Building with Blocks from a Piagetian Perspective. Front. Educ. 3:12. doi: 10.3389/feduc.2018.00012

INTRODUCTION

According to Piaget (1928, 1952, 1954), children with autism achieve object conceptualization skills by the fifth stage of sensorimotor development. As several studies advise caution in using the *stage* concept to describe typical and atypical psychological development, it seems useful to characterize these psychological processes in terms of specific activities that the child can plan and implement when acting on their physical and social environment. For example, as a predictive index, the number and type of different actions produced by children with autism during a recreational activity may not always follow the same stages as in typical development, and this can also be correlated with the severity of autistic functioning (McDuffie et al., 2015). In fact, while imitation difficulties may reflect a possible delay in psychological development, not all pre-scholars with autism have problems with imitation or symbolic play (Vanvuchelen et al., 2011). Within the broad line of research that raises questions concerning object canonicity, we identified some interesting elements related to the socio-material function of mediation during communication.

It is known that canonical functions of objects are introduced by other people present in the child's world (Leontiev, 1981; Costall, 1997; Rodríguez and Moro, 2008; Barthélémy-Musso et al., 2013). Indeed, Sinha (2009) suggests that the canonical functions of the object are acquired as a normative phenomenon during social interactions, although cognitive understanding of that status is a prerequisite. Additionally, Sinha (2015) (p. 12) points out that "the materiality of meaning and meaningfulness of materiality is central to approaches in cognitive science emphasizing the importance of objects in extended cognitive embodiment." In particular, there is evidence that canonical functions are acquired during child–adult interactions (Rodríguez and Moro, 1998; Sinha and Rodríguez, 2008; Moro, 2011, 2014). Several studies have reported how, under certain conditions (for example, impaired interpersonal relations or attentional focus), objects become mediators of social interaction (Williams et al., 1999; Dimitrova, 2014; Moro, 2014). Cárdenas et al. (2014) highlighted the importance of the reciprocal nature of these interactions by showing how they emerge from communicative and triadic contexts (adult–child–object). The crucial role of the adult in the acquisition of object use is observable from early infancy (Moreno-Núñez et al., 2017). Moreover, during child–object–adult interaction, the child's visual attention is more focused when interacting with an experienced caregiver than with an unfamiliar adult (Miller et al., 2009; Miller and Gros-Louis, 2013). Miller and Gros-Louis (2017) also showed that the child's attention is influenced by partner social style. Tomasello et al. (1993) and Tomasello (2016) highlighted different kinds of learning, such as imitative, instructed, and collaborative. For instance, imitation is important for learning that involves others and objects, as it facilitates understanding of the normative expectations of a given cultural group (Tomasello, 2016). Sinha (2009) suggested that children apprehend canonical functions primarily by cognitive means, thereby accessing the normative identity of the cultural group. Bruckner and Yoder (2007) reported that, even among children with autism, object use can be linked to emergent functions in the preoperational stage, such as imitation and attention to the other person.

Most of the existing research suggests that imitation is impaired in children with autism (Charman and Baron-Cohen, 1994; Rogers, 1999; Rogers et al., 2003; Williams et al., 2004). Indeed, Smith and Bryson (2007) noted that children with autism exhibit difficulty in imitating any unconventional use of objects but are able to imitate canonical object use. By imitating this canonical use, children with autism access part of the cultural group's heritage. With respect to manipulative play activities, Kanner (1943) was among the first to note that, despite differences and limitations, children with autism exhibit a number of functions related to the use of canonical and non-canonical objects. Trevarthen and Hubley (1978) described the dynamics informing subject–subject–object triangulation (the theory of "secondary intersubjective tuning"). Typical children alternate their eye gaze between the object being viewed and the other person, so engendering joint attention. However, in atypical development, and especially for those on the autistic spectrum, an abnormality has been observed in the development of behaviors related to joint attention. Palacios and Rodríguez (2015) showed that in typical children aged 9–15 months, the symbolic use of an object develops within a triadic context. Ungerer and Sigman (1981) assessed the use of everyday objects in a group of children with autism ranging in age from 39 to 74 months in a structured and free play session and found that most were unable to use an object according to its designated function. Williams et al. (2005) interviewed parents of 10 children with autism (MA = 62.2 months; SD = 19.9) who reported problems relating to the use of an object, such as an interest in some unusual aspect of the object, an unusual way of using the object, or difficulty in generalizing object use. Custance et al. (2014) suggested that imitative deficits in children with autism can be reduced by means of object-related activities, especially if there are no time limits on use of the object. Object-related activities promote joint attention, motor imitation, and intentional communication with a social partner (Bruckner and Yoder, 2007), and there is evidence that interventions focused on play involving different objects can promote social and imitative behaviors (Brown and Murray, 2001; Stahmer et al., 2003; Lee et al., 2017). Swettenham et al. (1998) observed three types of attentional behavior: (1) between an object and another object, (2) between an object and a person, and (3) between one person and another. Children with autism showed relatively more attention to interactions between an object and another object. In our recent studies, we have observed the important role of the object in activating attention in the child with autism, and we describe the phenomenon as "attention mediated by the object," which may be a precursor of joint attention (Iannaccone et al., 2016; Manzi and Savarese, 2017; Savarese et al., 2017).

The observational study reported here incorporates a socio-material perspective, referring in particular to the mediating role that objects seem to assume in the interaction between children and adults, which has to date been neglected in the scientific literature. Using a selected set of objects, the study analyzed the child with autism's ability to manipulate those objects and to evaluate their symbolic use. Starting from presentation of

the object, a further objective was to identify the type of game engaged in by the child. During interaction with an adult, we observed first whether there was eye contact; second, whether this changed how the child used the object; and third, whether the canonical use of the object was an important element in the child–adult interaction.

MATERIALS AND METHODS

Participants

We used the tower building item from section B of the "CHecklist for Autism in Toddlers instrument" (*CHAT*; Baron-Cohen et al., 1992). It was developed to help identify children who are at risk of developing social-communication disorders (scoring "high risk of autism"). It was administered to filter participants and one child aged 22 months did not pass this item. Children aged 18 months are capable of tertiary circular reactions and can stop and restart a sequence of actions at any intermediate step, which is crucial in building a tower of blocks. Children older than 18 months can use symbolic mental representations. The selected age range, therefore, allowed us to observe the early development of symbolic functions.

The study's participants were three non-verbal male children with suspected autism spectrum disorder. The suspected diagnosis of autism was identified through the use of the CHAT instrument.

Their different ages encompassed the transition from sensorimotor to preoperational stage; participant 1 was aged 18 months, participant 2 was aged 20 months, and participant 3 was aged 24 months.

Methods

The study employed videotaped observations (with one camera) of verbal and non-verbal signs during an organized free play session, in which each child played with seven small blocks of colored plastic in the presence of an adult (a different experimenter was used for each observation). The observations were conducted on the basis of a checklist consisting of 14 items (see Appendix A), including eye contact and the building of a tower of toy blocks from section B of the CHAT procedure.

The blocks were selected not only because of their use in the CHAT procedure but also in accordance with the empirical tradition of Piaget (1962) and Reifel (1984), who have shown the importance of toy blocks in the child's cognitive development. The interaction sequences from the video recordings were transcribed in full for microgenetic and semiotic analysis, primarily examining the children's non-verbal signs (gestures and posture) during interactions with the objects. Adult intervention was also analyzed in terms of non-verbal signs (gestures and posture), again focusing on sequences of microgenetic and semiotic actions. Sequences were selected using the following criteria: the presence of gestures, actions, or both, where (1) the adult intervened and the object became a mediator of the interaction, and (2) the object mediated the attention between child and adult. The observations of child and adult occurred simultaneously.

Ethical Issues

This study was carried out in accordance with the recommendations of AIP (Associazione Italiana di Psicologia), and all of the children's parents gave written informed consent in accordance with the Declaration of Helsinki. As there is as yet no psychological ethics committee at the University of Salerno, the protocol was approved by the external experts group from the University's "Centro di Counseling Psicologico" (Counseling Center). While the Center is not specifically responsible for ethical approval, the external experts group supervises research carried out by psychological researchers at the University. In Italy, few universities have a psychological ethics committee, and these generally offer degree courses in psychology or have a psychology department or institute. The University of Salerno has not activated degree courses in psychology and has no such department. We would like to thank the external experts, Dr Oreste Fasano (Psychologist), Dr Nadia Pecoraro (Psychologist), and Dr Monica Mollo (Lecturer in Psychology).

RESULTS

The interactions with the blocks helped to observe behaviors that related to the blocks' physical attributes and the child's competence to establish relations with them. This playful manipulation of objects probably helps planning and coordinated action, stimulating and strengthening the child's ability to interact with the outside world. At the same time, these activities allow children to imagine new construction scenarios (Harris, 2000). In the presence of potential partners or competitors (children or adults), the child's management of play activities and their implementation of communication strategies can also be observed. For example, the 18-month-old touched and handled all seven blocks, the 21-month-old touched and handled six blocks, and the 24-month-old touched and mechanically stacked all seven blocks.

Based on their independent observations, the two researchers agreed that the three children's symbolic use of objects (see **Table 1**) could be assigned to the first level of symbolic play as proposed by McCune-Nicolich (1981), based on Piaget's sequence (1972), because the children played using sensorimotor schemes. In addition, unlike the 24-month-old, the 18- and 20-month-old played a realistic game. Pretend and symbolic play was not observed in any of the three children's behaviors.

Based on observations of the "Can the child build a tower of blocks?" item in section B of the CHAT instrument (see **Table 2**), it was established that all three children used the objects in a manner similar to that described by Piaget as part of the manipulative activities of sensorimotor functioning. The children showed

TABLE 1 | Use of objects.

	Child 1: 18 months	Child 2: 20 months	Child 3: 24 months
Realistic play	Yes	Yes	No
Pretend play	No	No	No
Symbolic play	No	No	No

TABLE 2 | CHAT Section B: non-key items.

	Child 1: 18 months	Child 2: 20 months	Child 3: 24 months
Tower of blocks	Yes	Yes	Yes
Eye contact	Yes	Yes	No

active exploratory behaviors as the toy blocks were manipulated, sorted, and stacked.

In observations of the Eye Contact item of CHAT section B, the 18- and 20-month-old made visual contact with the adult, but the 24-month-old showed no eye contact. In the child–object–adult or simple child–object interactions excerpted below, a set of seven colored plastic blocks was placed in front of the child. Transcription commenced when the child began to manipulate the blocks.

Observational Results

In this section, we describe the observations we made of children with autism in relation to the types of object use (see **Table 1**). Crucial episodes were selected to illustrate the characteristics of the interactions between the children and the adults.

Generally, adults help children to interact with objects. In the observation of Child 1, the child was able to perform a complex series of actions on the object during the interaction. The child grabbed the object, manipulated it to orient it, dropped it, balanced it, and connected the different objects by stacking them. Here, the adult's help was crucial, as the elements of the child's interaction with the object were changed; at the same time, the object became a mediator in transforming the interactive arrangement between the child and the adult. The adult's hand in direct contact with the object became a source of interest to the child, who focused on this subject–object hybrid.

> *Observation 1. Child 1.* Difficulties in the use of the material features of the object induced the intervention of the adult.
>
> *The child cries because the blocks he had begun to stack fall; while he cries, he holds two blocks in his hands and tries to put them on a block on the table. The adult comes over and gets behind the child. The child tries to lay block 1 but fails because he is shaken by tears. The adult places the existing block in a better way. The child looks attentively at the adult's hand and places block 1. The adult takes block 1 with the child and helps to place it in the right position in balancing it.*
>
> *(…) With his hand, the adult moves block 4 (stacked by the child) to achieve better balance. The child observes the adult's hand. The child leaves block in his left hand alone and, continuing to watch the stacked blocks, extends his right arm to grab block 6. He places block 5 onto block 4 and, without looking, tries to grab block 6.*

The child's initial frustration on being unable to stack the blocks led to an intervention by the adult, who was seated on the ground behind the child. The adult intervened when the child played with the blocks, and the object became a mediator of interactions and interpersonal activity.

> *Observation 2. Child 1.* The previous help of the adult activated the attention of the child.
>
> *Once block 4 is in his left hand, he stretches his right arm and grabs block 5 before positioning block 4. While watching block 5, the child places block 4 and leaves it on block 3a; in the meantime, he brings block 5 closer to his body. After leaving block 4, the child takes a step back to turn to the adult, and they look at each other.*
>
> *(…) He places block 6 onto block 5 and leaves it. Having left block 6, he turns to the adult, and they look at each other.*

The child continued to play with the blocks, which became a mediator of attention between the child and the adult. After his intervention, the adult facilitated the stronger relational attractiveness of the object, as it became a transformative element in the initial environmental arrangement.

> *Observation 3. Child 1.* The child used the material features of the object correctly after the intervention of the adult.
>
> *The child stretches his right hand and grabs block 4. The child then passes block 4 to his left hand, no longer looking at block 4 and directing his gaze to block 5. Meanwhile, the child keeps block 5 in his right hand. Holding the new block, the child turns to the stacked blocks and simultaneously raises his right hand (with block 5). He raises both arms above his head and grabs block 5 with both hands.*

The child combined the object's socio-material properties by combining the material properties of the object with the social structures inherent in the object itself.

Furthermore, a series of interesting gestures was observed in the child–object interaction. When the child took the block and raised it over his head, even though the blocks on which the held block was to be placed were much lower in height, the child may have been planning to build a much higher structure with different characteristics to the existing one. One may take these behaviors as possible evidence of an imaginative process. This can also be seen as an explanation of the socio-material link, as imagining a structure beyond what is immediately present may indicate the child's ability to combine the material properties of objects. As the adult intervened, he became an example for the activity of the child. In the child–adult interaction, the object became a mediator of attention.

In the observation of Child 2, the child's manipulative skill was organized in a complex series of actions. He eyed the objects, planned to grab and stack them, rotated the objects in both hands, left, and again grabbed the objects. The material characteristics of the objects were explored. The adult intervened when the child played with the blocks, and the clock (the object) became the mediator for the joint attention of the child and the adult.

> *Observation 4. Child 2.* The child began to actively explore the objects.

The child moves the blocks in front of him (almost shuffling them), watching them carefully. Still looking at the five blocks in front of him, he moves his right hand and touches block 1, which is not present in his visual field.

The child explored the material features of the blocks, and through these actions, which blended complex activities, the child seemed to experience the object adapting and being adapted by its constituent elements. In building a tower of blocks, the child's aims and imaginative action planning appeared to converge. Thus, even though a symbolic game could not be identified, it seems that sensorimotor play and realistic play were present.

Observation 5. Child 2. The child used the material features of the object.

He raises block 1, keeping his eyes on it while grabbing block 2 with his left hand. He turns block 2 around, changing the side that rests on the ground; in the meantime, his right hand brings block 1, moves it in the air, and passes it over block 2. He is about to place block 1 but brings it back close to himself, touching it with his left hand and resting it on block 2.

Here, the child experienced the features of the object. The adult intervened several times during these child–object interactions. The subject–object hybrid identified during the observation of Child 1 is also present here. During the first stage, the child's attention was focused on the transformative mediation of the subject–object hybrid, highlighting how this inextricable relationship drives the modification of the initial environmental arrangement. The child's actions can be seen to occur in a synchronic and harmonic circle of the imitation of the adult's actions.

Observation 6. Child 2. The socio-material features emerged during the child–adult interaction.

The adult places his hand in the child's visual field by moving a block over to him; putting it onto the floor, the adult begins to stack the block. Throughout the sequence, the child is attracted by the adult's hand manipulating the block. He directs his gaze to block 1 and grabs it; continuing to watch it, he takes it with both hands. The adult begins to stack the blocks. The child manipulates block 1, which he holds in his two hands. He rests block 1 and leaves it. Directing his gaze to the blocks in front of him, he watches the adult, who stacks blocks.

(…) The adult takes the blocks that the child had put in rows and stacks them on top of each other. The child again takes block 4 with both hands. The child carefully observes the adult's movements while stacking. Still with block 4 in his right hand, crawling and with momentum, the child approaches the blocks stacked by the adult. The child grabs block with both hands, looks at it, and manipulates it. He turns block 4 in the direction that seems to enable stacking. He watches the blocks being stacked by the adult and, with his right hand, places block 4 onto the stack of blocks.

The subject/adult–object hybrid appeared to represent the transformation of the subject/adult–object–subject/child relationship, leading to revised planning of the action and thereby structuring of general aims. As well as becoming a mediator of the child's exploration of the surrounding environment, the object also rewrote the relational terms. This last step seems to follow the socio-material perspective, as the social structure of the object was intertwined with its material characteristics.

In observation of Child 3's sequence of actions, the attractiveness of the object overrode the ability to create a contact area with the adult who remained peripheral, or as a mere spectator of the child's construction. Actions have a regularity of performance: blocks are looked at, the hand gets ready to grab, the arm is stretched out to get to the object, the object is grabbed, the child identifies where to put the object, and eventually rests it in balance for stacking.

Observation 7. Child 3. The child used only the material features of the objects.

The child grasps block 1 with his right hand and rests it on a raised board, which has a width equal to the side of the block. He looks closely at block 1 and grabs it with both hands as if to be sure it is in balance. He pulls his right hand away from block 1 and, holding himself with his left hand, leans over the board to see what is there. He directs his eyes to where the blocks are located. He lowers himself, leaning with his left hand on the board and gripping block 2 with his right hand. He gets up and, watching block 1, rests block 2 onto block 1. He removes his right hand from block 2, lowers his body to take block 3, and grabs it with his right hand. He gets up and places it onto block 2, leaving block 3.

Following this regularity of actions, which converged in a purposeful activity, we can assume that the child has completed the main stages of sensory–motor skill development and understood the object's material characteristics. Additionally, the social function inherent to the object appears to be linked to its use.

In fact, the building of the tower was achieved through structured planning and with a constant imaginative tendency. What is lacking seems to be an understanding of the possibility to use the object as a social agent, because the adult was present only as a spectator.

Based on the regularity of actions that converged in purposeful activity, we can assume that Child 3 had completed the main stages of sensorimotor skill development and was able to understand the object's material characteristics. Further, the objects' inherent social functions appeared to be linked to their use. In fact, the building of the tower was achieved through structured planning and with a constant imaginative tendency. The adult did not intervene when the child played. In the child–adult interaction, what seemed to be lacking is an understanding of the possibility of using objects as social agents, as the adult was present only as a spectator.

Searching for constants in analyzing the filmed sequences of the three children, their successive actions were identified; initially, each actively manipulated all the blocks. This activity preceded an apparent break, but during that phase, the child observed the objects to determine how to continue. Immediately thereafter, the child either sought the adult's attention through eye contact or resumed the interrupted object manipulation.

At the beginning of the game, the children moved, shook, and turned the items several times, and this correlated with activation of their hand movements. Here, we probably witnessed the typical secondary circular reactions of the sensorimotor stage. After the break and the search for mutual attention and/or eye contact with the adult, the children then proceeded (by trial and error) to build the tower of blocks, modifying their existing schemes in so doing. This was indicative of tertiary circular reactions.

DISCUSSION AND CONCLUSION

Consistent with a theoretical perspective emphasizing the role of social and material dimensions in psychological development and activities (Iannaccone, 2015), our analysis highlights two important implications in our observations of object manipulation. First, consistent with the Piagetian perspective, the observations highlighted object manipulation and action planning identifying the presence of secondary and tertiary circular reactions (Piaget, 1972). In relation to the game, invoking the McCune-Nicolich model (1981), all the children exhibited sensorimotor play, in which the object was manipulated and understood in terms of its material characteristics.

The second implication relates to how, in some action sequences, the material and social characteristics of the objects contributed to shaping partner interactions between child and adult. This aligns with several empirical studies of the social uses of objects (conventional, canonical, and symbolic) (John-Steiner and Mahn, 1996; Moro, 2011). In such interpersonal situations, the activities of participants (child and adult) are clearly affected by the setting's physical and social affordances. In particular, during child–parent interactions (Moro, 2014), triadic child–object–adult interactions (Moro, 2011) seem to create relevant socio-material scenarios that frame communicational activities. In our observations, two of the three children in fact exhibited a kind of object management mode that seemed to replace eye contact with the adult. In some sequences of actions, child and adult managed to coordinate action planning through object manipulation, child exploratory activity, and adult scaffolding. For example, the child observed and touched the objects to encourage play activities; the adult touched the object with his hand, and this action frequently became a source of interest for the child. The child looked for the adult's attention through eye contact, and the child began to manipulate the object. In activities of these kinds, it seems evident that the objects can serve as mediators in communicative interactions with the adult. As well as taking into account the social function of objects, the observed children were already considering the socio-material characteristics of the play situation, as adults and children engaged in managing a kind of "socio-material space" as proposed by Rodríguez et al. (2015). In fact, from the first year of life, adults produce a shared space with objects that serve as effective tools of communication with children. Our findings in relation to the object as a tool for adult–child interaction align with Moreno-Núñez et al. (2017), confirming that the first shared understandings between adult and child take place around the object and its uses. Finally, in considering these first results, we can imagine relevant challenges for a new developmental psychology based on further related research.

Our observations of these interactions do not focus on direct joint attention but identify a kind of psychological process that we call "activity mediated by the object." Unlike Tomasello (1995), we consider the object itself as mediator, not only of the mutual attention between adult and child but of the dynamic relational exchange between partners.

In conclusion, our study reported the preliminary results of a larger analysis. In considering these first results, we can imagine relevant challenges for the developmental psychology of children with autism. Consistent with the results of studies on children with typical development, our study on children with autism shows that the socio-material features of objects represent factors that mediate the construction of child–adult interactions. Starting from the first intervention of an adult, an object becomes a mediator and promoter of interpersonal activities and space.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of AIP (Associazione Italiana di Psicologia), and all of the children's parents gave written informed consent in accordance with the Declaration of Helsinki. As there is as yet no psychological ethics committee at the University of Salerno, the protocol was approved by the external experts group from the University's "Centro di Counseling Psicologico" (Counselling Centre). While the Centre is not specifically responsible for ethics approval, the external experts group supervise research carried out by psychological researchers at the University. In Italy, few universities have a psychological ethics committee, and these generally offer degree courses in psychology or have a psychology department or institute. The University of Salerno has not activated degree courses in psychology and has no such department. We would like to thank the external experts, Dr Oreste Fasano (Psychologist), Dr Nadia Pecoraro (Psychologist), and Dr Monica Mollo (Lecturer in Psychology).

AUTHOR CONTRIBUTIONS

The introduction was written by AI. The observational analysis was written by FM. The discussion of the results and the conclusions were written by GS.

FUNDING

The research in this paper has been funded thanks to Fondi SOS 2015—Savarese—Department of Medicine and Surgery, University of Salerno.

REFERENCES

Baron-Cohen, S., Allen, J., and Gillberg, C. (1992). Can autism be detected at 18 months? The needle, the haystack, and the CHAT. *Br. J. Psychiatry* 161, 839–843. doi:10.1192/bjp.161.6.839

Barthélémy-Musso, A., Tartas, V., and Guidetti, M. (2013). Prendre les objets et leurs usages au sérieux: approche développementale de la co-construction de conventions sémiotiques entre enfants. *Psychologie française* 58, 67–88. doi:10.1016/j.psfr.2012.10.001

Brown, J., and Murray, D. (2001). Strategies for enhancing play skills for children with autism spectrum disorder. *Educ. Train. Ment. Retard. Dev. Disabil.* 36, 312–317.

Bruckner, C. T., and Yoder, P. (2007). Restricted object use in young children with autism: definition and construct validity. *Autism* 11, 161–171. doi:10.1177/1362361307075709

Cárdenas, K., Rodríguez, C., and Palacios, P. (2014). First symbols in a girl with Down syndrome: a longitudinal study from 12 to 18 months. *Infant Behav. Dev.* 37, 416–427. doi:10.1016/j.infbeh.2014.06.003

Charman, T., and Baron-Cohen, S. (1994). Another look at imitation in autism. *Dev. Psychopathol.* 6, 403–413. doi:10.1017/S0954579400006015

Costall, A. P. (1997). The meaning of things. *Soc. Anal.* 41, 76–86.

Custance, D. M., Mayer, J. L., Kumar, E., Hill, E., and Heaton, P. F. (2014). Do children with autism re-enact object movements rather than imitate demonstrator actions? *Autism Res.* 7, 28–39. doi:10.1002/aur.1328

Dimitrova, N. (2014). "L'usage de l'objet, un lieu privilégié d'émergence de la communication intentionnelle chez l'infant," in *Sémiotique, culture et développement psychologique*, eds C. Moro and N. Muller Mirza (Lille, FR: Presses Universitaires du Septentrion), 79–98.

Harris, P. L. (2000). *The Work of Imagination*. New York, NY: Wiley-Blackwell.

Iannaccone, A. (2015). "Materiality and educational psychology," in *Paper Presented at the Symposium Materiality and Human Development, 16th Meeting of the International Society for Theoretical Psychology* (Coventry).

Iannaccone, A., Savarese, G., and Manzi, F. (2016). "The use of objects for autistic children: a study in Piagetian perspective and the use of construction blocks," in *Poster Presented at XXIX Congresso Nazionale AIP- Sezione di Psicologia dello Sviluppo e dell'Educazione* (Vicenza).

John-Steiner, V., and Mahn, H. (1996). Sociocultural approaches to learning and development: a Vygotskian framework. *Educ. Psychol.* 31, 191–206. doi:10.1080/00461520.1996.9653266

Kanner, L. (1943). Autistic disturbances of affective contact. *Nerv. Child* 2, 217–250.

Lee, G. T., Feng, H., Xu, S., and Jin, S. J. (2017). Increasing "object-substitution" symbolic play in young children with autism spectrum disorders. *Behav. Modif.* doi:10.1177/0145445517739276

Leontiev, A. N. (1981). *Problems of the Development of Mind*. Moscow: Progress Publishers.

Manzi, F., and Savarese, G. (2017). "Interaction with/through object and social functions in ASD children," in *Abstract Book of the International Congress: EducA 2017 "Inequalities: What Contributions of the" Educations for ... "?* (Hammamet, Tunisia), 73.

McCune-Nicolich, L. (1981). Toward symbolic functioning: structure of early pretend games and potential parallels with language. *Child Dev.* 52, 785–797. doi:10.1111/j.1467-8624.1981.tb03115.x

McDuffie, A., Oakes, A., Machalicek, W., Thurman, A., Summers, S., Stewart, A., et al. (2015). Play with objects in young males with fragile X syndrome: a preliminary study. *J. Commun. Disord.* 53, 17–29. doi:10.1016/j.jcomdis.2014.10.002

Miller, J. L., Ables, E. M., King, A. P., and West, M. J. (2009). Different patterns of contingent stimulation differentially affect attention span in prelinguistic infants. *Infant Behav. Dev.* 32, 254–261. doi:10.1016/j.infbeh.2009.02.003

Miller, J. L., and Gros-Louis, J. (2013). Socially guided attention influences infants' communicative behavior. *Infant Behav. Dev.* 36, 627–634. doi:10.1016/j.infbeh.2013.06.010

Miller, J. L., and Gros-Louis, J. (2017). The effect of social responsiveness on infants' object-directed imitation. *Infancy* 22, 344–361. doi:10.1111/infa.12156

Moreno-Núñez, A., Rodríguez, C., and Del Olmo, M. J. (2017). Rhythmic ostensive gestures: how adults facilitate infants' entrance into early triadic interactions. *Infant Behav. Dev.* 49, 168–181. doi:10.1016/j.infbeh.2017.09.003

Moro, C. (2011). "Material culture, semiotics and early childhood development," in *Children, Development and Education: Cultural, Historical, Anthropological Perspectives*, eds M. Kontopodis, C. Wulf, and B. Fichtner (London, New York: Springer Verlag), 57–70.

Moro, C. (2014). "Le rôle de l'objet dans la construction de l'attention con jointe et dans l'accès aux intentions d'autrui," in *Sémiotique, culture et développement psychologique*, eds C. Moro and N. Muller Mirza (Lille, FR: Presses Universitaires du Septentrion), 55–77.

Palacios, P., and Rodríguez, C. (2015). The development of symbolic uses of objects in infants in a triadic context: a pragmatic and semiotic perspective. *Infant Child Dev.* 24, 23–43. doi:10.1002/icd.1873

Piaget, J. (1928). *The Child's Conception of the World*. London, UK: Routledge and Kegan Paul.

Piaget, J. (1952). *The Origins of Intelligence in Children*. New York, NY: Norton.

Piaget, J. (1954). *The Construction of Reality in the Child*. New York, NY: Basic Books.

Piaget, J. (1962). *Play, Dreams and Imitation in Childhood*. New York, NY: Norton.

Piaget, J. (1972). *The Psychology of the Child*. New York, NY: Basic Books.

Reifel, S. (1984). Block construction: children's developmental landmarks in representation of space. *Young Child*. 40, 61–67.

Rodríguez, C., Moreno-Núñez, A., Basilio, M., and Sosa, N. (2015). Ostensive gestures come first: their role in the beginning of shared reference. *Cogn. Dev.* 36, 142–149. doi:10.1016/j.cogdev.2015.09.005

Rodríguez, C., and Moro, C. (1998). El uso convencional tambiénhace permanentes a los objetos. *Infancia y Aprendizaje* 21, 67–83. doi:10.1174/021037098760378793

Rodríguez, C., and Moro, C. (2008). "Chapter 5: coming to agreement: object use by infants and adults," in *The Shared Mind: Perspectives on Intersubjectivity*, eds J. Zlatev, T. P. Racine, C. Sinha, and E. Itkonen, 89–114.

Rogers, S. (1999). "An examination of the imitation deficit in autism," in *Imitation in Infancy*, eds J. Nadel and G. Butterworth (Cambridge: Cambridge University Press), 254–279.

Rogers, S. J., Hepburn, S., Stackhouse, T., and Wehner, E. (2003). Imitation performance in toddlers with autism and those with other developmental disorders. *J. Child Psychol. Psychiatry* 44, 763–781. doi:10.1111/1469-7610.00162

Savarese, G., Manzi, F., and Iannaccone, A. (2017). Social functions in ASD children and interaction with/through object: a brief report. *Psychology* 8, 1129–1133. doi:10.4236/psych.2017.88073

Sinha, C. (2009). Objects in a storied world: materiality, normativity, narrativity. *J. Conscious Stud* 16, 167–190.

Sinha, C. (2015). Language and other artifacts: socio-cultural dynamics of niche construction. *Front. Psychol.* 6:1601. doi:10.3389/fpsyg.2015.01601

Sinha, C., and Rodríguez, C. (2008). "Language and the signifying object: from convention to imagination," in *The Shared Mind: Perspectives on Intersubjectivity*, eds J. Zlatev, T. Racine, C. Sinha, and E. Itkonen (Amsterdam, Netherlands: John Benjamins), 357–378.

Smith, I. M., and Bryson, S. E. (2007). Gesture imitation in autism: II. Symbolic gestures and pantomimed object use. *Cogn. Neuropsychol.* 24, 679–700. doi:10.1080/02643290701669703

Stahmer, A. C., Ingersoll, B., and Carter, C. (2003). Behavioral approaches to promoting play. *Autism* 7, 401–413. doi:10.1177/1362361303007004006

Swettenham, J., Baron-Cohen, S., Charman, T., Cox, A., Baird, G., Drew, A., et al. (1998). The frequency and distribution of spontaneous attention shifts between social and non social stimuli in autistic, typically developing, and non autistic developmentally delayed infants. *J. Child Psychol. Psychiatry* 39, 747–753. doi:10.1111/1469-7610.00373

Tomasello, M. (1995). "Joint attention as social cognition," in *Joint Attention: Its Origins and Role in Development*, eds C. Moore and P. J. Dunham (Hillsdale, NJ: Lawrence Erlbaum Associates Inc), 103–130.

Tomasello, M. (2016). Cultural learning redux. *Child Dev.* 87, 643–653. doi:10.1111/cdev.12499

Tomasello, M., Kruger, A. C., and Ratner, H. H. (1993). Cultural learning. *Behav. Brain Sci.* 16, 495–552. doi:10.1017/S0140525X0003123X

Trevarthen, C., and Hubley, P. (1978). "Secondary intersubjectivity: confidence, confiding, and acts of meaning in the first year," in *Action, Gesture, and Symbol*, ed. J. Lock (London: Academic Press), 183–229.

Ungerer, J. A., and Sigman, M. (1981). Symbolic play and language comprehension in autistic children. *J. Am. Acad. Child Psychiatry* 20, 318–337. doi:10.1016/S0002-7138(09)60992-4

Vanvuchelen, M., Roeyers, H., and De Weerdt, W. (2011). Do imitation problems reflect a core characteristic in autism? Evidence from a literature review. *Res. Autism Spectr. Disord.* 5, 89–95. doi:10.1016/j.rasd.2010.07.010

Williams, E., Costall, A., and Reddy, V. (1999). Children with autism experience problems with both objects and people. *J. Autism Dev. Disord.* 29, 367–378. doi :10.1023/A:1023026810619

Williams, E., Kendell-Scott, L., and Costall, A. (2005). Parents' experiences of introducing everyday object use to their children with autism. *Autism* 9, 495–514. doi:10.1177/1362361305057869

Williams, J. H. G., Whiten, A., and Singh, T. (2004). A systematic review of action imitation in autistic spectrum disorder. *J. Autism Dev. Disord.* 34, 285–299. doi:10.1023/B:JADD.0000029551.56735.3a

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX A

Checklist for Observations

1. Is the child paying attention to the whole object, or to parts of it?
2. Is the child pointing at the object?
3. Has the child shared joint attention with the adult?
4. Does the child understand the use of the object?
5. For how many seconds does the child observe, indicate or touch the object?
6. Does the child imitate what the adult does with the object?
7. Is the child picking up the object as requested?
8. Does the child speak the name of the object?
9. Does the child share the object with the adult?
10. Does the child use the object for its conventional purpose?
11. Does the child combine objects according to their conventional characteristics?
12. Does the child use the object to represent something else?
13. Does the child pretend to use an object that is present?
14. Does the child pretend to use an object that is not present?