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Effects of context and facial expression on imitation tasks in preschool children with autism

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The present study explored the effect of the context in which an imitation act occurs (elicited/spontaneous) and the experimenter's facial expression (neutral or smiling) during the imitation task with young children with autism and typically developing children. The participants were 10 typically developing children and 10 children with autism (mean chronological age: 72 months). They were tested in imitation of tasks and facial expressions posed by the researcher. The results showed that, compared with typically developing children, children with autism: (a) engaged less in imitation of action with objects, (b) had more difficulties with the imitation of facial expressions in the elicited condition, and (c) performed less accurately both at imitating the experimenter's facial expression and on tasks involving the simultaneous imitation of action with objects and facial expression, and (d) the type of the experimenter's facial expression did not influence the imitative performance of either group in either the elicited or the spontaneous condition. The present study attempts to advance investigation of imitative ability and impairment in autism.

Keywords: autism; imitation; imitative performance; elicited imitation; spontaneous imitation; action with objects; facial expression; preschool children

Although autism refers to a range of conditions, it involves core symptoms such as impairments in social interaction and communication, restricted interests and rigid, repetitive behaviour (American Psychiatric Association, 1994). Children with autism usually differ in their clinical picture, aetiology and response to intervention programmes (Ben-Itzhak & Zachor, 2007); however, impairments in the development of social relationships (Hobson, 2004, 2006, 2007), language, non-verbal communication (e.g. Vivanti, Nadig, Ozonoff, & Rogers, 2008), behaviour, learning (Trevvarthen, Aitken, Papoudi, & Robarts, 1998) and imitation (e.g. Williams, Whiten, Suddendorf, & Perrett, 2001) are common to children with autism. The absence of spontaneous imitation can indicate the existence of early autism (Mars, Mauk, & Dowrick, 1998) and imitative deficits are considered to be quite a reliable predictor for an autistic spectrum disorder in children 6–15 years old (Perra et al., 2008).

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Recent studies on imitative abilities of typically developing infant and preschool-aged children in their interactions with adults indicate the crucial role of imitation in the intersubjective communication from early life until early childhood for children's cognitive, social and emotional development (e.g. Kugiumutzakis, Kokkinaki, Markodimitraki, & Vitalaki, 2005; Nadel & Butterworth, 1999; Trevarthen, Kokkinaki, & Fiamenghi, 1999). Researchers who identified the contributory role of imitation in children's development focused their interest on the study of imitation in children with autism (for a review, see: Rogers & Pennington, 1991; Rogers & Williams, 2006; Smith & Bryson, 1994; Williams, Whiten, & Singh, 2004). A considerable number of recent studies showed contradictory findings. Most of them identified deficits in the imitation of actions with objects, the imitation of body and hand movements, deficits in pantomime contexts and tasks of vocal imitation (e.g. Hobson & Hobson, 2008; Hobson & Lee, 1999; Ingersoll, 2008a; McDuffie et al., 2007; Smith & Bryson, 2007; Stone, Ousley, & Littleford, 1997). On the other hand, there have been studies which found that children with autism do not necessarily exhibit imitation deficits (e.g. Carpenter, Pennington, & Rogers, 2001; Hamilton, Brindley, & Frith, 2007).

In order to understand the profile of imitative ability or impairment in autism, researchers have focused on different aspects of imitation, two of which became the focus of the present study: firstly, the context in which an imitation act occurs and secondly, facial expressions displayed during imitation tasks. Experimental studies have shown that in elicited conditions, individuals with autism did not perform imitation tasks differently from control groups of typically developing participants (Beadle-Brown & Whiten, 2004; Ingersoll, 2008a; McDuffie et al., 2007; Whiten & Brown, 1998). It seems to be more difficult for persons with autism to engage in spontaneous imitation acts which are intentional and have an explicit social function. Social interaction is considered to be the impetus for spontaneous imitation in typically developing individuals (Ingersoll, Schreibman, & Tran, 2003; Whiten & Brown, 1998). Moreover, the 'emotional matching' (Kugiumutzakis et al., 2005, p. 173) found in systematic observations of imitative interactions between typically developing infants and adults showed that even young children have an interest in information elicited from the human face. By contrast, research data focused on the perception of facial expression by children with autism show their weaknesses in this area (Gross, 2008). Infants with autism seem to take very little notice of facial expressions or the direction of gaze, if at all (Gepner, Deruelle, & Grynfeltt, 2001; for a review referring to the behavioural and electrophysiological studies, see Dawson, Webb, & McPartland, 2005). Such a deficit might be due to an abnormal amygdala function (Adolphs, Sears, & Piven, 2001) or a deficit in social interaction (Hobson, 2007). It could be explained by 'weak central coherence theory' as individuals with autism, according to Gross (2008, p. 298), tend to notice and concentrate on specific parts and features of stimuli rather than to perceive and process them as a coherent whole. According to Hobson (2007), a child with autism might perceive a smile rather as a misshapen face. Furthermore, Rutherford and McIntosh (2007, p. 188) suggested that 'individuals with autism may be using an atypical visuospatial strategy to process faces, possibly focusing on the different facial features in turn'.

We mainly grounded this study on the classic definition of imitation, which is the reproduction of others' behaviour (Piaget, 1962/1945), but we moved a step forward investigating the emotional aspect of imitation as well and emphasising its importance for children's social development, in contrast to Piaget who was interested only for the cognitive aspect of imitation. We explored this phenomenon, following and extending a

process implemented by Ingersoll (2008a), within the context of two different conditions – elicited and spontaneous. In the elicited condition, we prompted imitation during the repetitions of a modelled action, using specific and simple verbal prompts. In the spontaneous condition, there were only general prompts at the beginning of each modelled action and it was left to the child's discretion whether to imitate the researcher's action and/or expression.

In this way, we moved beyond the exploration of the simple imitation of an action to the testing of imitation of a positive or neutral emotional expression posed by the researcher. We accepted that imitation of the facial expression had occurred in both elicited and spontaneous conditions, when the children displayed the same facial expression the researcher had posed during the task (neutral or smiling) regardless of whether they also imitated the action. Thus, in the present study, we examined both the simple reproduction of an action, and also the reproduction of an action paired with a facial expression in the context of an elicited and a spontaneous condition. Since imitation seems to be crucial for the development of social skills (Ingersoll & Gergans, 2007), it was important for us to examine whether the facial expression posed by the researcher had an effect on the results of mimicry. We believe that imitation in spontaneous or elicited conditions should receive particular attention so that we can achieve a better understanding of the phenomenon and develop more effective reinforcement strategies.

In this study, we repeated Ingersoll's (2008a) experiment with a Greek sample, exploring imitation in an elicited and a spontaneous condition. We used the same tasks and materials as Ingersoll and we added the variable of facial expression – neutral or smiling. A neutral expression was preferred to an overtly negative emotional expression, this being less unpleasant to preschool children and thus limiting the risk of withdrawal during the task. We chose a smiling facial expression because smiling is related to positively oriented feelings. According to recent findings, imitation mostly occurs in a pleasant context (Kugiumutzakis et al., 2005). Taking into account the results of previous studies (Beadle-Brown & Whiten, 2004; Ingersoll, 2008a; McDuffie et al., 2007; Stone et al., 1997; Whiten & Brown, 1998) according to which difficulties in spontaneous imitation might be linked to the difficulties children with autism have with social interactions, we formed our first hypothesis: that children with autism would have a lower overall performance on imitation tasks of action with objects than typically developing children, especially within the context of a spontaneous condition (Hypothesis 1). Our second hypothesis was that children with autism would have a lower performance than typically developing children with imitation of facial expressions during action in a structured condition (Hypothesis 2). The third hypothesis was that in comparison with typically developing children, children with autism would perform worse in the imitation of action with objects combined with facial expressions (Hypothesis 3). There was also a fourth hypothesis, namely that the experimenter's facial expression (neutral or smiling) would influence the imitative performance of both children with autism and typically developing children in both experimental conditions (elicited and spontaneous) (Hypothesis 4).

Method

Participants

Twenty-four preschool children participated in this study, four of whom (two with autism and two typically developing children) were not included in the final sample

as they did not complete the tasks. More specifically, the control group comprised 10 typically developing children (six boys and four girls) aged 58–82 months and the group of children with autism comprised 10 children (nine boys and one girl) aged 48–82 months who had been diagnosed with autism by the public diagnostic office (KEDDY – Kentro Diaforodiagnosis Diagnosis kai Ypostirixsis – Centre of Differential Diagnosis, Diagnosis and Support) which is the national organisation in Greece authorised to carry out diagnostic procedures and assessments on young people with special educational needs. The sample of children with autism included only one girl because we did not manage to get parental consent for another three girls who were attending the same school.

Instruments

Imitation tasks

The imitation tasks administered in the present study followed and extended a procedure described by Ingersoll (2008a). We were introduced to the children before the administration of tasks in order to become known to them. For each subject, we used two similar sets of toys (S1 and S2) (e.g. (S1) nesting cups, (S2) nesting eggs; (S1) teddy bear and food, (S2) infant and blanket; (S1) fish and net, (S2) blocks and container, etc.). The two sets were used alternately in the elicited and the spontaneous condition and alternately for each child. Thus, if S1 was administered to a child in the elicited condition, then S2 was administered to the same child in the spontaneous condition. During the task, the researcher displayed a facial expression (neutral or smiling) which remained the same in both conditions for each individual child. The expression used for the first child of the sample was randomly chosen and then it was alternated from one child to the next.

In the elicited condition, the researcher and the child sat at a table at a 90° angle to each other. The researcher encouraged the child to watch her carefully and copy what she did: ‘I have some toys to play with. Watch closely and do what I do’. When the task began, the researcher modelled an action for the child using a verbal marker (Table 1) and one of the toys of either Set 1 (S1) or Set 2 (S2). The toy was randomly chosen from the set and the demonstration lasted for 10 seconds, as Ingersoll (2008a) did in her experiment. There were three repetitions of the same action. Before each demonstration, the researcher repeated: ‘Watch me’. At the end of each demonstration, the researcher prompted the child: ‘You do it’. This process was repeated for all the toys in the same set, regardless of whether the child imitated the action and/or the expression of the researcher (adapted from Ingersoll, 2008a, p. 335).

In the spontaneous condition, the researcher sat on the floor with the child placing two identical sets of toys (one for the researcher and one for the child) in front of her. The researcher told the child ‘I have some toys to play with. We can play together’. The researcher then imitated the child for 2 minutes. Following this introductory period, the researcher simply said ‘Watch me!’ and started modelling actions with toys using verbal markers and displaying the same facial expression as this had been used in the elicited condition. The researcher presented each model three times and waited for 10 seconds to see the child’s reaction. At the end of all three repetitions, the researcher started imitating the child again, this time for 45 seconds before modelling a new action with a different toy, similarly to Ingersoll’s (2008a) experiment. This

Table 1. Imitation tasks and materials (Ingersoll, 2008a, p. 336).

Toy	Action	Verbal marker
<i>Set 1</i>		
Nesting cups	Hit bottom of two cups together	Bang, bang
Teddy bear and food	Feed bear	Teddy's hungry
Slinky	Put on nose	Look at my nose!
Tambourine and rattle	Hit tambourine with rattle	Ta da!
Garland	Put around neck	I have a scarf
Train	Roll off table	Oh no, it fell!
Recorder	Blow and move fingers	I'm playing music
Fish and net	Place fish in net	I caught a fish
Light tube	Spin around in air	Whoa!
Squishy ball	Roll back and forth on table	Roll, roll
<i>Set 2</i>		
Nesting eggs	Spin	Spin, spin
Infant and blanket	Cover infant	Infant's tired
Pom-pom	Put on head	Look at my hair!
Musical triangle	Strike stick in middle	Ding, ding!
Teething ring	Put around wrist	I have a bracelet
Car	Crash into wall	Uh oh, it crashed!
Party favour	Blow	Happy birthday!
Blocks and container	Place block in container	In it goes
Sound tube	Turn upside down	Whee!
Koosh ball	Hold by string and bounce	Bounce, bounce

process was carried out for each of the toys in the set in a random order (adapted from Ingersoll, 2008a, p. 335).

Every imitation session was videotaped and two independent researchers rated each trial. The scoring definitions for imitation of actions were also taken from Ingersoll (2008a), which were accordingly complemented with scoring definitions for the imitation of facial expression and the combined imitation of action and facial expression. Thus, the rating scale for imitation of action with objects was 2 for an exact imitation, 1 for an unsuccessful attempt and 0 if there was no imitative response. To rate the imitation of facial expression, the two researchers awarded 1 when the child succeeded in imitating the researcher's expression, and 0 if the child had not imitated the facial expression, regardless of whether the child also imitated the action. The imitation of both action and facial expression in each trial was rated as 2 when the child had fully or partly imitated both the action and the researcher's expression (neutral or smiling), 1 if the child had fully or partly imitated the researcher's action but had not imitated the facial expression and 0 if the child had made no effort to imitate either the action or the facial expression. As a result, scoring yielded three types of measures for each condition (elicited and spontaneous): a measure for the imitation of action with objects, a measure for the imitation of facial expression and a measure for the combined imitation of action with objects and facial expression. Only the most successful of the child's three attempts at each task was scored.

Non-verbal cognitive ability

The Matrices and Recognition subtests of the Wechsler Nonverbal Scale of Ability (WNV) (Wechsler & Naglieri, 2006) were administered to both children with autism and the control group. These subtests were chosen to provide a shortened version of assessment according to the test's manual (Wechsler & Naglieri, 2006). Three children with autism were assessed in the presence of their teacher since they had difficulties in communicating with the researcher.

We should stress that, in this study, children did not need advanced verbal skills in order to understand what the researcher asked them to do or to imitate the verbal markers that accompanied the researcher's action (Table 1). Moreover, scoring did not take into account any verbal imitations; it rather focused on the imitation of action and facial expression. For this reason, we did not consider a formal assessment of verbal skills to be necessary; we concluded that all children had adequate verbal skills following an informal exploratory interaction. We also took account of their parents' and teachers' remarks when they were asked to comment on the child's verbal abilities.

The Autism Screening Instrument for Educational Planning – 3rd edition

The children's teachers were asked to evaluate the behaviour of each child with autism using the Autism Behaviour Checklist Form from the Autism Screening Instrument for Educational Planning – 3rd edition (ASIEP-3) (Krug, Arick, & Almond, 2008), which was adapted and translated into Greek. The checklist was translated into Greek from English by the fourth author of this paper. In addition, a professional translator translated the checklist back into its original language. Original and back-translated documents were then compared and the Greek translation was improved accordingly. Before its formal use, the checklist was used by a group of four kindergarten teachers in Rethymno (Greece) who reported that there were no ambiguous words and the instructions for the completion of the checklist were clear. All of the teachers completed the checklists and returned them to the researchers within a week. We used these checklists as an instrument of external validity in order to verify the diagnosis of autism and assess symptom severity. According to the norms of the original scale, eight children presented an 'extremely high' and two children a 'moderate' probability of having autism. Consequently, all 10 children were included in the sample. Four children with autism were enrolled in the nursery class of a special needs school, two children were enrolled in a specialist nursery for children with autism and four children were enrolled in the inclusion class of a regular nursery school.

Procedure

All participants were tested individually in their establishment during school hours in April or May of the school year 2008–2009. The procedure was carried out in two sessions, each lasting for approximately 20–30 minutes. In the first session, the imitation tasks were undertaken and in the second, administration of the WNV subtests was carried out.

Data analysis

In the present study, we used six imitation measures (three types of measures in two conditions). The score for each measure is the total of marks attained in each of the

10 imitation tasks (Table 3). The score for the imitation of action and the combined imitation of action and facial expression ranged from 0 to 2 for each task. Since the score for each imitation of action or the combined imitation of action with facial expression could be 0, 1 or 2 for each task, the maximum score for each of these measures would be 20. The maximum score for the imitation of facial expression would be 10 (since imitation of facial expression in each of the 10 modelled actions was scored with 0 or 1).

To examine the comparison of participants' mean scores on matching variables by group, we used the non-parametric Mann–Whitney U test because of the deviance from the normal distribution on the subtests of the WNV and the small number of participants in each group. To examine whether the two groups differed on the six imitation scores and control the familywise Type I error, we used MANOVA (Tabachnick & Fidell, 2007). After this initial analysis, the Wilcoxon non-parametric test for paired samples was used to perform a within-group analysis to examine whether children's performance in imitation differed by the type of condition (elicited versus spontaneous). Finally, an ANOVA was performed by a 2×2 design in order to examine whether the experimenter's facial expression (neutral versus smiling) influenced imitation scores in each condition differently for each group (children with autism versus typically developing children).

Results

An initial comparison between the two groups of children (Table 2) revealed that children with autism did not differ from the typically developing children with regard to chronological age (Table 2, line 4) or the raw scores of the Matrices subtest on the WNV (Table 2, line 1). However, the group of children with autism performed less well than the typically developing group on the raw scores of the Recognition subtest of the WNV (Table 2, lines 2 and 3). This caused the total raw score of the WNV to drop (we used the raw scores and not the norms because the WNV test has not been standardised for the Greek population).

Table 3 displays the mean scores by group. In order to examine whether the achievement of typically developing children and children with autism differed, we

Table 2. Means (M) and standard deviations (SD), Mann–Whitney U tests (z) and effect sizes (d) of the participants' scores on matching variables by group.

Matching variables	Children with autism		Typically developing children		z	d
	M	SD	M	SD		
(1) WNV – Matrices	8.25	2.49	10.5	3.17	–1.21	0.75
(2) WNV – Recognition	6.25	1.98	10.5	2.95	–2.86*	1.61
(3) WNV – Full Scale	14.5	3.9	21.00	3.86	–2.83*	1.59
(4) Age (in months)	75.2	15.36	68.8	6.30	–0.87	0.52
(5) ASIEP-3	89.3	13.67				

Notes: WNV = Wechsler Nonverbal Scale of Ability; ASIEP-3 = Autism Screening Instrument for Educational Planning-3rd edition; d = Cohen's d (Hedge's adjustment).

* $p < 0.001$.

Table 3. Means (M) and standard deviations (SD), Mann–Whitney *U* tests (*z*) and effect sizes (*d*) of single imitation scores and a combination of action and facial expression imitation by group and condition.

Imitation score of	Children with autism		Typically developing children		<i>z</i>	<i>d</i>
	<i>M</i>	SD	<i>M</i>	SD		
(a) Action with objects						
(a1) Elicited – C ^a	9.80	5.47	19.6	0.97	–3.41*	2.39
(a2) Spontaneous – C ^a	4.10	2.33	20.0	0.00	–4.05*	9.25
(b) Facial expression						
(b1) Elicited – C ^b	2.70	2.45	8.30	2.58	–3.33*	2.13
(b2) Spontaneous – C ^b	1.50	1.31	8.10	3.10	–3.43*	2.66
(c) Combined imitation score of Action and Facial expression						
(c1) Elicited – C ^a	8.40	3.74	18.2	2.62	–3.64*	2.91
(c2) Spontaneous – C ^a	4.77	2.27	17.9	3.22	–3.74*	4.51

Notes: C = Condition; *d* = Cohen's *d* (Hedge's adjustment).

^aMaximum score 20.

^bMaximum score 10.

**p* < 0.001.

initially performed an MANOVA of their performance in six imitation measures. The MANOVA with 'group' (typically developing versus children with autism) as a between-factor variable and the six imitation measures as dependent variables showed a significant main effect of 'group' – Pillai's trace = 0,99, $F(6, 11) = 153,89$, $p < 0.001$. For this reason, a post hoc analysis for each imitation measure was performed after Bonferroni adjustment. The modified alpha level was adjusted according to the comparisons across the six imitation measures (the alpha level had to be less than 0.008). In all cases, the analyses by the Mann–Whitney *U* test showed that children with autism performed significantly worse than the typically developing children (Table 3). In addition, the effect size of the differences between the two groups was always extremely high according to Cohen's (1988) criteria. It is interesting to note that according to the effect sizes, the gap between the two groups increased strongly from the elicited (Table 3, lines a1, b1 and c1) to the spontaneous condition (Table 3, lines a2, b2 and c2).

In order to examine whether the participants' performance in imitation was similar in the elicited and the spontaneous condition, the non-parametric Wilcoxon test for paired samples was used. These analyses showed that children with autism performed better in the elicited than in the spontaneous condition in all tasks: namely, when they imitated action with objects ($z = -2.53$, $p < 0.02$; Table 3, lines a1 versus a2), a facial expression ($z = -2.53$, $p < 0.02$; Table 3, lines b1 versus b2) or action with objects together with a facial expression ($z = -2.04$, $p < 0.05$; Table 3, lines c1 versus c2). However, the typically developing children's performance did not show a similar differentiation; they imitated action with objects and the facial expression in a similar way in both the elicited and the spontaneous condition.

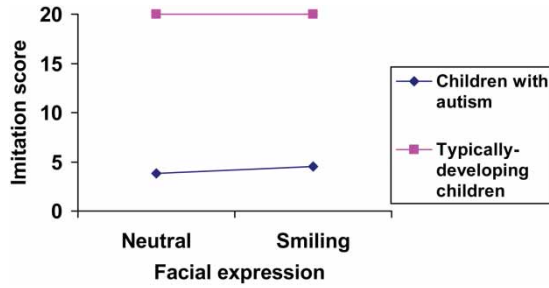


Figure 1. Imitation of action with objects in the elicited condition.

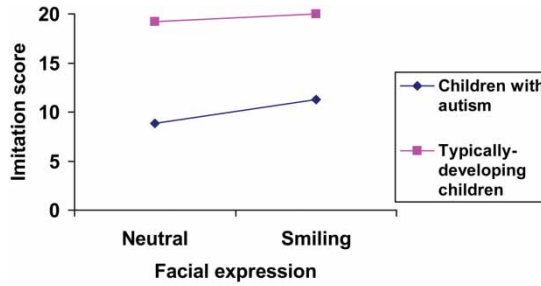


Figure 2. Imitation of action with objects in the spontaneous condition.

We also examined whether the experimenter’s facial expression (neutral or smiling) had influenced the imitative performance of either group in each experimental condition. For this reason, a series of 2×2 mixed-model ANOVAs was performed using ‘group’ (children with autism versus typically developing children) and ‘type of facial expression’ (neutral versus smiling) as between-factor variables and each imitation variable as a dependent variable. The results of these analyses are presented in Figures 1–6. There was a significant main effect of ‘group’ in the imitation of action with objects in the elicited condition, $F(1,16) = 27.29, p < 0.001$, partial $\eta^2 = 0.63$ (Figure 1), and the spontaneous condition $F(1,16) = 410.72, p < 0.001$, partial $\eta^2 = 0.96$ (Figure 2). There was also a significant main effect of ‘group’ in the imitation of facial expression in the elicited condition, $F(1,16) = 23.62, p < 0.001$, partial

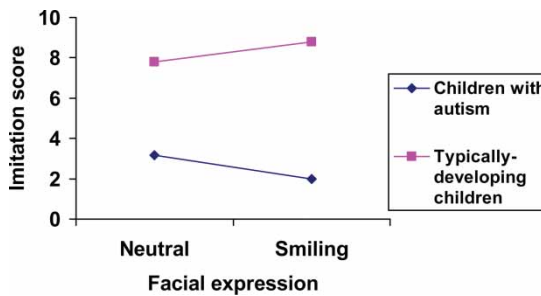


Figure 3. Imitation of facial expression in the elicited condition.

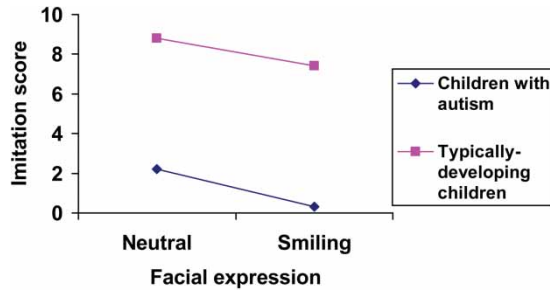


Figure 4. Imitation of facial expression in the spontaneous condition.

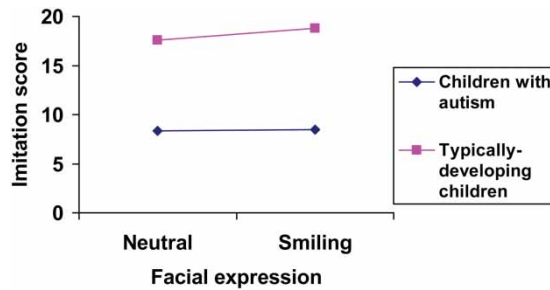


Figure 5. Simultaneous imitation of action with objects and facial expression in the elicited condition.

$\eta^2 = 0.60$ (Figure 3), and the spontaneous condition $F(1,16) = 32.03, p < 0.001$, partial $\eta^2 = 0.70$ (Figure 4). Similarly, a significant main effect of ‘group’ was found in the combined imitation of action with objects and facial expression within the elicited condition, $F(1,16) = 40.69, p < 0.001$, partial $\eta^2 = 0.72$ (Figure 5), and the spontaneous condition $F(1,16) = 101.24, p < 0.001$, partial $\eta^2 = 0.87$ (Figure 6). These main effects suggest that the imitative performance of children with autism was in all cases lower than that of their typically developing peers regardless of the facial expression they were exposed to (neutral or smiling). The effect sizes were always high, although they tended to be higher in the spontaneous than in the elicited condition.

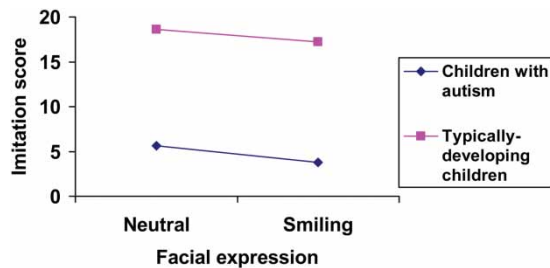


Figure 6. Simultaneous imitation of action with objects and facial expression in the spontaneous condition.

However, there was no main effect of facial expression and no group interaction by facial expression in any of the six ANOVAs for the imitation measures. This means that the facial expression had no influence on the performance of imitation tasks either for the children with autism or the typically developing children.

Discussion

The aim of the present study was to explore the imitative ability or impairment in autism. More specifically, we focused on the exploration of children's ability to imitate action with objects in an elicited and a spontaneous condition as well as their ability to imitate the facial expression (neutral or smiling) of the person modelling the actions in both conditions. We also examined the degree of influence the facial expression had on the imitative performance of the two groups in the aforementioned conditions (elicited and spontaneous).

Initial comparisons on the matching variables revealed a significant difference between the two groups on two non-verbal subscales. The poor performance of children with autism in the Recognition subtest might have been due to the increasing visual complexity of the geometric designs that the children were called to recognise. Williams, Goldstein, and Minshew (2006) have found that children with autism may not differ from typically developing children when recalling geometric designs, simple picture scenes and sequences but they do, however, prove to have a particularly poor memory when it comes to more complex visual stimuli.

The results showed that, compared with typically developing children, children with autism: (a) engaged less in imitation of action with objects, (b) had more difficulties with the imitation of facial expression in the elicited condition, and (c) performed less accurately both at imitating the experimenter's facial expression and the simultaneous imitation of action with objects and facial expression, and (d) the type of the experimenter's facial expression did not influence the imitative performance of either group in either the elicited or the spontaneous condition.

Our first assumption was that group differences would be noticed when children imitated actions in a spontaneous condition. Our results showed that in all action imitations, children with autism performed significantly worse than the typically developing children. Similar studies (e.g. Rogers & Pennington, 1991; Williams et al., 2001, 2004) have shown a variety of reasons that could relate to the above result, such as the difficulty children with autism have in forming social representations of themselves and others, the poor theory of mind skills or impaired social cognition and difficulties in internalising movements, or carrying out multi-tasking. As mentioned above, the levels of imitative performance in children with autism were significantly lower in all cases than those of the typically developing group and the difference between the two groups increased strongly from the elicited to the spontaneous condition. Children with autism performed better in the elicited than in the spontaneous condition, while the results of the typically developing children did not show a similar variation. This difference could be due to a number of reasons. Firstly, limited performance in the spontaneous condition could be ascribed to the inability of children with autism to develop interpersonal relations (Ingersoll, 2008a; McDuffie et al., 2007). It could also be explained by their inability to grasp people's intentions when it comes to communication (Hobson & Hobson, 2008). Secondly, the improved performance children with autism had in the elicited condition could be explained as a result of the researcher's modelling and instructions from which children could get ideas about how to use

the objects before they tried to reproduce the action. This is supported by some earlier studies which showed that children with autism can imitate goal-directed actions on objects when encouraged to do so (Charman & Baron-Cohen, 1994; Hobson & Lee, 1999) or when the task instructions are given and then repeated during the task in order to support accurate imitation for learning and training purposes (Ingersoll, 2008a, 2008b). Thirdly, we should not overlook the fact that there was an interval of 45 seconds before the presentation of each model in the spontaneous condition during which the researcher imitated the child. We noticed that this was confusing and perplexing for the children with autism and this could have affected, inhibited or suspended their imitative performance in the next task. Fourthly, according to Ingersoll's (2008a) remarks, children with autism find it difficult to decide when to reproduce an action in a spontaneous condition since no instructions are given by the researcher. This is considered to happen because they lack the impetus for communication, an assumption which is also supported by the findings of the present study.

To verify our second hypothesis that children with autism would have more difficulties than typically developing children with the imitation of facial expression in the elicited condition, we examined the children's and the researcher's facial expression during the elicited condition, leaving out children's ability to (partly or fully) imitate the actions. This hypothesis was not confirmed since results showed that children with autism performed better in the elicited than in the spontaneous condition in all tasks. Analogous studies that assess the imitation of facial expression in children with autism and typically developing children cannot be traced in the literature. A similar study by Hobson and Lee (1999) compared the imitative ability of children with autism and children with developmental delay. Although the nature of their sample does not allow any direct comparison with the results of our study, their findings also show that children with autism exhibit particular difficulty in imitating elements of body expression. They found that children with autism imitate the style of the researcher who shows them an action with objects less than children with developmental delay. A variety of reasons could explain this deficit in children with autism, such as the inability to differentiate themselves from the researcher, or their limited social interest. The way children with autism perceive social stimuli could also be of critical importance as well as their general difficulty in shifting their attention between different simultaneous stimuli (e.g. Vivanti et al., 2008).

Our third hypothesis was that children with autism would perform worse than their typically developing peers on imitative tasks which combined action with objects with some kind of facial expression. Our findings allow us to confirm this hypothesis. A potential explanation for this could be that children with autism were unable to be moved by the researcher's facial expression. Hobson and Hobson (2008) suggest that 'children with autism are less prone to being "moved by" another person's bodily expressed attitudes in such a way as to assume a new orientation to the environment' (p. 183). They explain children's inability to imitate the researcher's style as a failure to add aspects of expressive behaviour to their own style (Hobson & Hobson, 2008). Some similar studies have also shown that typically developing children display social behaviour during imitation to identify or communicate with the researcher. By contrast, children with autism, who lack the impetus to identify with the others, display considerably limited social behaviour and imitate action with objects to a lesser extent (Ingersoll et al., 2003). At this point, we should highlight the lack of studies that focus on structured tasks that combine imitation of facial expression and action with objects.

Moreover, according to our fourth hypothesis, we expected that the facial expression of the researcher (neutral or smiling) would affect the imitative performance of children in both groups and in both conditions (elicited and spontaneous). The fourth hypothesis was not confirmed because there was no main effect of facial expression on the imitative performance of either group in either condition. Research shows that even children with autism of low functionality can become sensitive when others imitate them and react in a more social way. Nadel et al. (2000) used the 'still face' paradigm to test this in a pilot study. The results showed that children with autism of low functionality do not expect a stranger to socially interact with them when he/she displays a still face. Our findings come to support this conclusion since a motionless face actually displays a neutral expression as we called it in our experiment. Neither the participants of our research nor Nadel's participants reacted differently to the neutral face. However, this occurred during the first phase in Nadel's experiment, in which the researcher was still an unfamiliar person for the children with autism. However, during a third phase, which occurred after the researcher imitated the children, children with autism developed anxiety towards the motionless face of the researcher – in contrast to our findings in which there was no reaction towards the neutral face by children with autism. This difference could be explained by the greater familiarity Nadel's researcher managed to develop during the three phases of the experiment. It is also possible that the difference between the results was simply due to the difference of the research design between the two studies. It is possible that children's performance in both groups was affected by the relevance of facial expression to the goal of the action. Hobson and Hobson (2008) distinguish three types of relations between the goal and the style of action in their own research. Namely, they define a 'style incidental to the goal' (Hobson & Hobson, 2008, p. 175) when this goal could be achieved regardless of the style a performer adopts. The 'style necessary for the goal' is needed 'as a means to achieve the goal', and the 'style intrinsic to the goal' is the style which is a goal in itself (Hobson & Hobson, 2008, p. 176). The importance of this distinction is shown by the results of their experiment in which children with autism imitated the facial expression less well than typically developing children when the expression was incidental or necessary to the goal but they were not significantly different from their typically developing peers when the expression was a goal in itself.

The implication for our research is that the limited imitation of facial expression of children with autism could possibly be explained by the relevance of facial expression to the goal of actions. There were actions in which the facial expression displayed by the researcher could be defined as incidental to the goal, e.g. when a party favour was to be blown accompanied by the verbal marker 'Happy Birthday!' while the researcher had a neutral face. It is possible that some children in the study of Hobson & Hobson (2008) ignored the facial expression as irrelevant to the goal of action. However, our results do not allow us to arrive safely at this conclusion since the researcher's facial expression did not influence the performance of either group. Moreover, the exploration of children's ability to imitate facial expressions can contribute to the enhancement of their education and training (Brown, Brown, & Poulson, 2007; Nadel & Pezè, 1993; Vivanti et al., 2008), so the present study attempts to advance investigation of imitative ability and impairment in autism. Children with autism can relate their self-actions to others' actions, when they imitate others or when others imitate them, while their awareness and understanding of being copied by others can be developed through repeated practice and exercise. Finally, there are some important educational implications we can draw from the current discussion regarding the role of

imitation in intervention programmes: Answering questions about the elements of imitation tasks (such as expressions and body movements) would enable us to help children with autism develop their ability to select meaningful rather than meaningless actions for imitation and, consequently, imitate interesting and/or goal-directed actions. Our findings suggest that, at a basic level, the best imitation occurred in elicited conditions where children were guided through actions and tasks. At an advanced level, recognising additional elements such as expressions, feelings, movements, verbal comments etc. can help children with autism to become aware of the relationship between movement and language and develop more effective communication with the world around them.

The present study is an attempt to advance the investigation of imitative ability and impairment in autism. There are a limited number of studies which have explored the influence of context by setting imitation tasks with objects in elicited conditions (where participants were instructed and/or guided through tasks) and spontaneous conditions (Beadle-Brown & Whiten, 2004; McDuffie et al., 2007; Whiten & Brown, 1998). Weaknesses in imitation were reported; however, in these studies, the performance of children with autism was not compared with that of mental-age-matched typical or developmentally delayed participants. Moreover, there is a lack of studies which focus solely on the imitation of facial expression when typically developing and children with autism are called to imitate action with objects in an elicited condition. Most of the above studies were carried out with static materials such as photos (e.g. Gepner et al., 2001) and only a limited number of them used video materials (e.g. Celani, Battacchi, & Arcidiacono, 1999; Loveland et al., 1995). In the present study, we paid particular attention to the fact that the inability of children with autism to recognise facial and/or emotional expressions had played a particular role in the process of identification and imitation of action, especially when it came to an elicited situation in which the subject had to 'look and listen' carefully in order to perform the task successfully. Hobson (2007) claimed that the imitation of facial expression presupposes understanding of others' intentions and demands having an intersubjective perspective, an area of development in which children with autism seem to have considerable deficits. So the specific focus of the present study was on whether a child with autism could actually imitate an action together with the facial expression that accompanies it.

Several limitations need to be acknowledged in the present study. Firstly, the number of participants was small and came from typically developing children and children with autism from middle-class families who are enrolled in state nurseries in the island of Crete. Secondly, we need to acknowledge that the proportion of boys and girls was different in the two groups (children with autism and typically developing children), so there cannot be an accurate comparison between them. Thirdly, we need to take into account the fact that each child in our study was exposed to one facial expression only (neutral or smiling) and finally, the relationship between the facial expression and the goal of action was not explored in detail. Thus, we cannot draw safe conclusions regarding the effect of facial expression on the imitative performance.

Future studies need to further explore imitation within spontaneous conditions so that we can arrive at a better understanding of the phenomenon and find strategies which could effectively support the development of imitation skills. Moreover, issues that should be further investigated are the role of facial expression and action style in the imitation process, the effect of both facial expressions (neutral and smiling) on each child, the imitation of action with objects in a family context and the sole imitation of facial expressions so that a more detailed picture of mimicry in

autism is gained. Further investigation of imitation, especially in spontaneous conditions, would enable us to better understand the communicative and educative function of imitation and design more effective support and intervention programmes for the benefit of children with autism.

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