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PAPER

On tools and toys: how children learn to act on and pretend with 'virgin objects'

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Abstract

*The focus of the present study was the role of cultural learning in infants' acquisition of pretense actions with objects. In three studies, 18- and 24-month-olds (*n = *64) were presented with novel objects, and either pretense or instrumental actions were demonstrated with these. When children were then allowed to act upon the objects themselves, qualitatively similar patterns of cultural (imitative) learning both of pretend and of instrumental actions were observed, suggesting that both types of actions can be acquired in similar ways through processes of cultural learning involving one or another form of collective intentionality. However, both absolute imitation rates and creativity were lower in pretense compared to instrumental actions, suggesting that the collective intentionality that constitutes pretense is especially difficult for children to comprehend. An additional analysis of children's gazes to the experimenter during their actions revealed that 24-month-olds looked more often to the experimenter during pretense actions than during instrumental actions – suggesting that pretense is culturally learned in a similar fashion as practical actions, but that young children understand pretense as a more inherently social, intersubjective activity.*

Piaget (1962) claimed that the onset of pretend play with objects in the second year is best seen as an expression of early egocentrism: the individual child by herself assimilates objects – the world – to non-appropriate action schemata – the ego. Some recent researchers, though more concerned with the contemporary question about the relation of pretense comprehension and production to theory of mind development, seem to follow Piaget in this focus on the individual mind as the cradle of pretend play. Most radically, Nichols and Stich (2000) claim that the ability and motivation to pretend is a universal human feature explained by a 'possible world box' in the individual's head. Consequently, the individual child acquires pretense actions on objects by herself before she can understand pretense in others.

Researchers inspired by Vygotsky (1966), in contrast, have stressed the social and cultural context, above all adult scaffolding, as crucial in the development of pretend play. For example, many studies have found that adult modeling of pretend actions enhances children's pretense behavior (Bretherton, O'Connell, Shore & Bates, 1984; Jackowitz & Watson, 1980; Ungerer, Zelazo, Kearsley & O'Leary, 1981; Watson & Fischer, 1977). Recently, fine-grained analyses of pretense modeling behavior by mothers and its potential role in pretense development have become a new area of research (Lillard & Witherington, 2001). It has also been claimed, more radically, not only that pretense development is strongly influenced by adult support, but that pretend play is both acquired and constituted in the same basic way as other cultural practices, including language. It is acquired by cultural (imitative) learning, and, as an inherently social activity, it is constituted by collective intentionality (Tomasello, 1999a, 1999b; Tomasello & Rakoczy, 2003). Support for this more radical claim comes from a study by Striano, Tomasello and Rochat (2001), who found that before 2 years of age, young children's pretense with objects derived almost exclusively from imitation of adults or from adult verbal instructions – or, in some cases, from their acting on toys with established pretense functions (i.e. they acted on objects as they had seen adults previously acting on similar objects, such as dolls). The claim is that if 2-year-old children were not exposed to other persons pretending, they would not invent pretense for themselves as a solitary activity at this young age (although perhaps they might some years later).

The present work follows up on these findings, looking at possible mechanisms of acquisition of pretense

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with objects from the background of a broadly Vygotskian Cultural Learning theory (Tomasello, Kruger & Ratner, 1993; Tomasello, 1999a, 1999b). The hypothesis is that there are fundamental commonalities in the acquisition of both pretense actions on toys and instrumental actions on tools. Most importantly, both types of actions can be acquired by cultural, imitative learning, based on children's intention reading. Accordingly, tools can became tools, and toys can become toys, ontogenetically, in similar ways. In contrast to the focus on the individual child's imagination in Piagetian and some recent pretense theories, the current approach stresses that both pretense and instrumental actions are acquired in a framework of collective intentionality: different persons are involved, typically the child and adults, and the child, by observing, understanding and imitating adults comes to acquire new actions herself. Although older children may become proficient solitary, creative pretenders, 2-year-olds do not individually invent pretense, but acquire it as a collective activity from adults.

However, despite this basic similarity in the ontogeny of both sorts of actions, there are also fundamental differences in the imitative acquisitions of pretense and instrumental actions. First, the intentions underlying the two types of actions – to be read by the child – are different in structure. Whereas instrumental actions have a means–ends structure and the underlying intentions specify a desired state of affairs in the world and the means to bring it about, pretense actions are of a more complex structure: the underlying intentions do not specify desired situations in the world as goals, but have as content a kind of counterfactual behavior, behavior as if some states of affairs were true (see, for example, Austin, 1979).

Second, the kinds of collective intentionality involved in actions on tools and toys and their acquisition are of a different quality. The collective intentionality in instrumental actions on tools is of a weaker kind; the learning of these actions is *socially mediated*. That is, these actions are often acquired in a social context from social models, but not necessarily so; the child can also discover and learn the actions individually. Early pretense actions on toys, however, involve a stronger form of collective intentionality; they are *socially constituted*. That is, these actions are inherently social; they are actually constituted by collective intentionality. These differences in collective intentionality reveal themselves in the different types of functions that children come to learn about in tools and toys. The functions that children culturally learn about tools are *physical functions* (Searle, 1995). Physical functions get expressed in the formula 'X can be used to do Y in context C'. They are out there in the world, in the objects, and accordingly, they can either be discovered individually or practical knowledge about them can be socially mediated. In contrast, the functions that children learn about toys are *status functions* (Searle, 1995). Status functions are expressed in the formula 'X counts as Y in context C'. General examples include 'this slip of paper counts as money in certain countries', 'this emission of sounds counts as making a statement in certain languages'. An example from pretense would be 'this orange wooden block counts as a make-believe carrot in certain pretense contexts'. Thus, status functions are not out there in the world, in the objects themselves, but come into being through collective intentionality; they are collectively assigned to objects. In other words, what makes an object have a status function is the fact that people treat it as having such a function. Young children, then, learn both about tools and about toys through social transmission and collective intentionality, yet the structures of imitation and collective intentionality differ in the two cases (for a related distinction between different functions of imitation, see Uzgiris, 1981).

In sum, the current approach claims that both pretense actions on toys and instrumental actions on tools can be acquired in similar ways, by imitative learning based on children's intention reading; but the types of intentions in both kinds of actions are different, and the collective intentionality involved in acquiring pretense actions is stronger. We sought to test these claims with a novel objects paradigm sometimes used in imitation and word-learning studies (e.g. Bellagamba & Tomasello, 1999; Meltzoff, 1995; Tomasello & Barton, 1994). We presented 'virgin objects' to the children – unfamiliar objects without any prior established function – and demonstrated different types of actions with these objects. In a model phase we showed the children the 'virgin objects' and demonstrated different pretense and instrumental actions on the objects. The number and quality of demonstrations was varied between the different objects both for pretense and for instrumental actions. In a test phase, the children could then act on each object themselves up to three times (called Trials 1–3). This set-up allowed us to take children's actions on the objects as a straightforward and simple measure of imitative learning and affordance creation. Comparing children's actions on objects as a function of different frequency of demonstrations (either pretense or instrumental), and comparing the course of actions over the three trials made it possible to look for commonalities in the learning of pretend and instrumental actions. To test for the hypothesized differences in the acquisition of pretense and instrumental actions we analyzed children's creative actions of both types, and their social gazes and smiles during both kinds of acts.

Several specific hypotheses were derived from the general theoretical background. Based on the hypothesized

commonalities in the acquisition of both types of actions, we expected qualitatively comparable patterns of imitative learning of pretense and instrumental actions, both as a function of number and quality of demonstrations, and across trials. Based on the hypothesized differences in acquiring both types of actions we expected that, since pretense intentions are more complex, pretense acts should be more difficult to understand and imitate than instrumental actions for children at around their second birthdays, when they start to become pretenders. Furthermore, as pretense is a matter of collective assignment of status functions, it is to be expected that early on this assignment is mainly supplied by adults, where children share an already established framework, in the style of a 'Zone of Proximal Development'. Consequently, in early pretense, individual creativity by the child is expected to be rare. Finally, as the collective intentionality involved in early pretense is of a qualitatively stronger sort, we expected some special interpersonal behavior by the child in pretending, specifically more social gazing[1] and perhaps more 'knowing smiles' than in instrumental actions.

Study 1

Method

Participants

The participants were 24 24-month-old children (13 males, 11 females; M = 23 months and 24 days, range = 21;25–25;28), all native speakers of German. Seventeen children were recruited by telephone from a list of parents and children who had volunteered for studies of child development, while seven were recruited in nurseries. Twenty-four additional children were excluded from the study either because of experimental error (n = 2), because they turned out not to be native German speakers (n = 2), or because they were unco-operative or their mother interfered (n = 20)[2].

[1] One recent study (Striano *et al.*, 2001) has found evidence for more social gazes during children's pretense than during their instrumental actions. However, in this study, children's gazing was only analyzed during three predetermined pretense actions and one instrumental action. Furthermore, objects well known to the children were used. These two aspects make it hard to interpret the findings as showing a general phenomenon. The present studies were thus a follow-up on the Striano *et al.* (2001) study with the aim of improving on the methodology and investigating social gazing in more varied contexts.

[2] This high drop-out rate was due to the fact that the sessions were relatively long and taxing for 2-year-old children. See the Discussion below. There was no significant age difference between children who had to be excluded (M = 24 months and 12 days) and the included subjects.

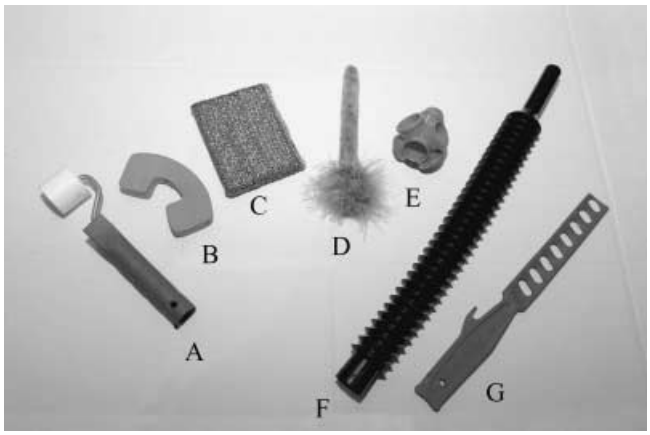

Figure 1 *Novel object set used in Study 1.*

Materials and design

An adult experimenter presented seven novel objects, one at a time, to each child: a paint roller (A); a pink soft door stop (B); a green sponge-like little piece of fabric (C); a purple furry pencil (not recognizable as such) (D); a tube-connector looking like a hydrant (E); a black installation tube (F); and a red color mixer (G) (see Figure 1). Each action that was demonstrated with one of these target objects involved a second 'substrate' object. For example, in one pretense model, the experimenter pretended the color mixer (target object) was his toothbrush, involving as the substrate a pack of toothpaste. In one instrumental condition, he used the black installation tube (target object) to hit against a glass (substrate), thereby producing a nice sound.

The first within-subjects variable was the kind of action model: three of the target objects were modeled with pretense actions, three with instrumental actions and one object functioned as a control object; it was only presented together with a substrate but not acted upon by the experimenter. The three pretense and three instrumental actions were each presented in a block, with the control object before, between or after these blocks (order of the blocks counterbalanced, position of the control object random). In demonstrating pretense actions, the experimenter made use of the usual markers for pretend, non-serious actions in order to highlight that he was not really performing or trying to perform the action: exaggerated and truncated movements, sound effects, laughing, etc. (see Lillard & Witherington, 2001). For example, he would pretend to brush his teeth with the color mixer by first holding the pack of toothpaste over the color mixer in an exaggerated fashion (as if putting toothpaste on it), then bringing the color mixer in front of his mouth, opening the mouth in exaggerated

fashion, making exaggerated movements with the color mixer in front of the mouth (as if brushing his teeth), accompanied by sound effects and laughter. In demonstrating instrumental actions, in contrast, the experimenter would highlight the effect of the action, while performing the action itself without special mannerisms. For example, in the model where the experimenter used the black tube to hit against a glass, he would take the tube, make a slow movement with the tube towards the glass and, when producing the sound, would comment on it in a positive but unspecific way ('Wow!' or 'There').

The three demonstrations within the two blocks were systematically varied and constituted the second within-subject variable: one object was acted upon only once (Once), the second four times in the same way (Repeated), and with the third object the experimenter demonstrated three different actions, showing each action twice (Mixed). Assignment of the seven objects to the modeling conditions was counterbalanced across subjects (see Appendix 1 for the actions, corresponding substrates and the logic of assignment).

The central dependent measure was the type of children's actions with the objects in the test phase when they were allowed to act on the previously demonstrated objects themselves. Our main interest was in comparing children's behavior with objects modeled Once and Repeated, both in the Instrumental and the Pretense model conditions. This created a 2 (model type: Pretense versus Instrumental) × 2 (model quality: Once versus Repeated) design as main focus of analysis. Children's actions with the other three objects (the control object and the two objects modeled in the Mixed conditions served as a baseline for more qualitative comparisons). The second type of dependent measures were children's looks to and smiles at the experimenter during their actions.

Procedure

Observations were done in a child psychology laboratory ($n = 18$) or in the nurseries ($n = 6$). Each child was tested individually. Children who came to the laboratory were accompanied by their parents throughout the session. The experimenter and the child sat at a table next to each other, with children sitting on their parents' laps (in the laboratory) or on a child's chair (in the nurseries). Parents were told not to influence the child during the study. Each session was videotaped. The study session consisted of a demonstration phase, where the experimenter presented the seven objects with their substrates to the child and acted upon six of the seven objects, in turn, and the test phase where the child was given the objects one at a time and allowed to act upon them himself/herself.

Demonstration phase

The experimenter told the child that he was now going to show him/her some interesting objects he had in a box and also show him/her what he could do with them, and that afterwards the child himself/herself would get the objects and be allowed to act on them. He then brought out the first object, saying 'Look at that! And look what I can do with it!', brought out the substrate and then performed the action with the object on the substrate. All objects and their substrates were presented to the child for 50–80 seconds. The duration of presentation was matched for the respective Pretense and Instrumental conditions (around 50 seconds for the Once condition, and around 70–80 seconds for the Repeated and Mixed conditions). In the Once condition, the experimenter performed the action (in a somewhat temporarily extended form), left the two objects for some seconds on the table and finally put them away again. In the Repeated condition, the experimenter modeled the action for the first time, left the objects for a short while on the table, said to the child 'Look! I am going to show you once again what I can do with this!' and performed the same action again, repeating this two more times so that there were four demonstrations. In the Mixed condition, after the first demonstration the experimenter left the first substrate on the table and said to the child 'Look what else I can do with this!' He then brought out the second substrate and performed the corresponding action. This procedure was repeated with the third substrate and action. Then the experimenter started a second cycle through the demonstrations, saying to the child, 'Look! I am going to show you once again what I can do with this!' and performed the three actions a second time in the same order. The control object was only shown to the children, with the experimenter saying something like 'Wow, look at this! It is long and red. Look at the hole here!'

Testing phase

The experimenter then explained to the child that he had shown all the things from the box and that it was now her turn to act with the objects. He then placed the 11 substrate objects – that served as cues – in a semicircle on the table (equidistant from the child and in random order) and told the child to take a careful look at all of them. The child was then given one target object at a time, in the order of demonstration. On giving the object to the child, the experimenter asked her 'Now, what can

you do with this (the target object) and one of these (pointed at the substrates)?' If the child did not react the question was repeated once or twice. In the case of no reaction after the third question the object was removed and the next one brought out. When the child performed an action, the experimenter watched passively until the child finished the action. the experimenter reacted to each action of the child with an equally positive emotional expression, using unspecific reinforcing comments like 'Aha! Good!'[3] and asked what the child had done, removed the substrate already acted upon and asked 'What else can you do with this and one of these?' When the child performed a second action, this procedure was repeated and the child got a third opportunity to act with the object. After the third action, the target object was removed, all 11 substrates were placed on the table again, the child was given the next target object, and so on.

Observational and coding procedure

All video-recordings were scored for the child's actions with the target objects and for their looks to and smiles at the experimenter by a single observer (O).

Actions

Children's actions were described in shorthand phrases of the type: 'pretends to brush teeth'. Each of the children's actions during testing was categorized into one of six classes. First, we distinguished between pretense and instrumental acts. An action was scored 'pretense' if it seemed clear on the basis of sound effects, language or co-ordinated sequencing of action that the child was deliberately acting 'as-if'. Actions were scored 'instrumental' when the child used an object purposefully to produce some observable effect on another object (e.g. used an object to roll play-dough, to wipe away dirt, to make a sound on a glass, etc.). Purely exploratory sensorimotor behavior with an object (e.g. banging, mouthing) was not scored at all. Second, within these two classes we further distinguished imitative actions (same action with same object as the experimenter) from old actions (same action using different object as the experimenter) and creative actions (actions that had not been modeled at all). Importantly, to count as imitative or old, an action did not need to be performed on the same substrate as in the demonstration. For example, a child could pretend a target object to be her toothbrush in all of the trials, each time pretending a different substrate to be the toothpaste, or even without including a substrate into the action. In such a case, all three actions were described as 'pretends to brush teeth' and scored as 'pretense, imitative' if pretend tooth brushing was modeled with this object. A second observer coded all videotapes for the children's actions. Interrater reliability was 91% (Cohen's *Kappa* = .85).

Looks and smiles

Children's looking and smiling behavior during their actions in the testing phase was coded from the tapes in real time,[4] or, if necessary, by using the slow-motion function of a VCR. The 'Interact' software package was used to determine the duration of gazes. Observers were trained in using the Interact software and the slow-motion function, and were trained to code gazes and smiles by experienced coders.

The first observer coded all of the children's action episodes for looks to the experimenter. A second observer coded 20% of the sessions for reliability. Interrater reliability, assessed by means of a Pearson correlation on the scored number of looks per action episode was .98. With regard to children's smiling behavior, only smiles at the experimenter during gazing were coded, that is, looking smiles. Smiling was operationally defined as retracting both lip corners upward and backward. A binary measure was chosen: for a given gaze to the experimenter, was it accompanied by a smile (yes/no)? A second observer coded 20% of the tapes for reliability. Per cent agreement was 97% (Cohen's *Kappa* = .95).[5] In addition, each social smile was coded in terms of whether the smile had its onset simultaneously with the gaze. A second observer coded 30% of the episodes of social smiles for reliability, Cohen's *Kappa* = .74.

The same looking and smiling behaviors were coded for the experimenter during his demonstrations in 19 of the 24 sessions. In the remaining five sessions, the camera angle prevented coding of the experimenter's facial behavior. A second observer coded a random sample of 25% of the sessions. Interrater reliability, assessed by means of a Pearson correlation was .94 for the experimenter's looks. Interrater agreement on the experimenter's smiles was 93% (Cohen's *Kappa* = .80).

[3] We coded 10% of the tapes to check whether the experimenter really had followed the instruction and did not reinforce some specific sort of action. No difference in the amount of the experimenter's smiling to the child during pretense compared to instrumental actions could be found.

[4] The slow motion function was used to determine the length of gazes in critical cases. It was not used in the first place to determine whether a gaze had occurred.

[5] For the reliability here, only those looks that both observers had scored were considered. A look was defined here as 'the same look coded by both' when both observers coded a looking episode and agreed on onset and offset times within a time frame of 1 second.

Table 1 *Mean number of modeled actions performed in test phase in the different conditions* (n = *24)*

		Frequency		
		Once	Repeated	Mixed
Type of model	Pretense	.50 (.78)	.83 (.70)	1.04 (.81)
	Instrumental	.96 (1.04)	1.42 (.83)	1.83 (1.13)

Note: Standard deviations are given in parentheses.

Results

Actions

The first point of interest was children's imitative behavior. Table 1 shows the mean number of imitative actions performed in the test phase (summed across Trials 1–3) in the six model conditions. In a first, more qualitative analysis of the number of imitative actions performed over the three trials we included the Mixed conditions. Interestingly, the results across the three Pretense model conditions show an analogous ordinal pattern as the results across the three Instrumental model conditions: children performed most imitative actions in the Mixed condition, next most in the Repeated condition, and least in the Once condition (see Table 1).

The main analysis regarding imitation was a 2 (type of model: Pretense–Instrumental) × 2 (frequency of model: Once–Repeated)[6] within-subjects factors ANOVA on the number of imitative actions performed in Trials 1 through 3. This analysis revealed a main effect for type of model, $F(1, 23) = 8.44$, $p < .008$, with children showing more imitative actions when these were instrumental ($M = 1.19$) than when they were pretense actions ($M = .67$). There was also a significant main effect for frequency of model, $F(1, 23) = 7.53$, $p < .012$, with children performing more imitative actions in the Repeated ($M = 1.13$) than in the Once condition ($M = .73$). There was no interaction between type and intensity of model.

Of special interest were children's actions over the course of the three trials, above all on Trial 1. Table 2 shows for each of the modeled actions ('Instrumental–Once action' in row 1 refers to the instrumental action that was modeled once with one object, etc.)[7] the number of children that performed them on Trial 1 with each of the seven objects (represented in the seven columns). Figure 2 shows the number of children that performed an imitative action in each of the three trials of the Once and Repeated Pretense model and Instrumental model conditions, respectively.

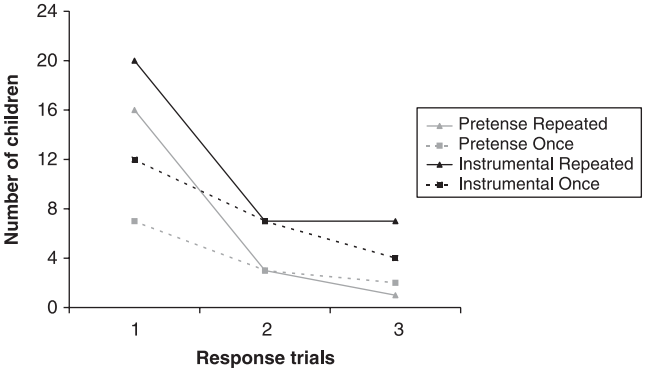

Figure 2 *Number of children performing an imitative action in the three trials of the two pretense model conditions and the two instrumental model conditions (Study 1,* n = *24).*

First, a control analysis was run to test whether children really imitated the modeled actions, that is, performed the target actions differentially as a function of model (comparing the frequencies of children performing a given action along each row in Table 2). This analysis revealed that for all target actions, children did produce them on Trial 1 differentially with the different objects as a function of the model that had been demonstrated with the object, Cochran's Q Tests, all ps < .0001. (A more specific follow-up analysis revealed that each target action was produced with significantly greater frequency with the object with which it was demonstrated than with the control object, McNemar tests, ps < .02.)

Second, the numbers of children performing the target actions on Trial 1 were compared in the four main conditions (Pretense and Instrumental, Repeated and Once). As can be seen from Figure 2 and Table 2, children more often imitated both pretense and instrumental actions on the first trial when the model was given Repeated than when given Once. Generally, children imitated instrumental actions more often than pretense actions. A non-parametric analysis of the frequencies of children performing as first action the modeled action in the four different conditions revealed significant differences between the conditions, Cochran's Q (3, 22) = .003. Pairwise comparisons yielded significant differences both for the two Pretense model conditions, such that more Repeated than Once imitative actions were performed (Binomial test: $n = 12$, $x = 2$, $p = .039$), and for the two Instrumental model conditions, also with more Repeated

[6] The Mixed conditions were not included in the main quantitative analysis, because they were not comparable to the other conditions due to asymmetries in baseline probabilities – children had been shown three different actions they could imitate in the test phase. A more qualitative analysis, however, revealed that the results across the three pretense model conditions show qualitatively the same pattern as the results across the three instrumental model conditions.

[7] As it was counterbalanced across subjects, with which object each action was done and in which condition it was, for different children the 'Instrumental–Repeated', 'Instrumental–Once', etc. actions were different.

Table 2 *Number of children who performed the target actions on Trial 1 with each of the seven objects*

	Object/model condition						
Number of children	Instrumental Repeated	Instrumental Once	Intrumental Mixed	Pretense Repeated	Pretense Once	Pretense Mixed	Control object
Instrumental–Repeated action	20[(i)]	0	1	0	0	1	5
Instrumental–Once action	0	12[(i)]	0	0	1	0	2
Instrumental–Mixed action	2	5	20[(i)]	1	1	3	3
Pretense–Repeated action	0	0	0	16[(i)]	0	0	0
Pretense–Once action	0	0	0	0	7[(i)]	1	0
Pretense–Mixed action	0	0	1	2	2	11[(i)]	1

Note: (1) The cells marked with [(i)] refer to imitative actions, i.e. actions done were modeled with the same object in the model phase. (2) The three actions in the pretense and instrumental Mixed conditions were treated disjunctively here, i.e. it was checked how many children produced *one of them*.

imitative actions performed than Once imitative ones (Binomial test: $n = 10$, $x = 1$, $p = .021$). There were neither significant differences between the two Repeated, nor between the two Once conditions.

Another point of special interest was children's creativity in performing pretense and instrumental actions. We therefore determined for each child whether he/she had performed at least one creative action of both types. Twenty-three of the 24 children performed at least one creative instrumental action (showing a total of 152 instances of a creative actions), whereas only nine children produced creative pretense acts (14 in total). Fourteen children performed creative instrumental actions but no creative pretense actions, and no single child showed the opposite pattern, this difference being highly significant (Binomial test: $n = 14$, $x = 0$, $p < .0001$).[8]

Looking and smiling behavior

A paired samples *t*-test revealed that children looked significantly more often, indeed twice as often, to the experimenter during their pretense ($M = 1.01$) than during their instrumental actions ($M = .49$), $t(23) = 3.84$, $p < .001$.[9]

Each episode of looking to the experimenter was scored if this look was accompanied by a smile. A proportion score was computed from these data: the proportion of looks to the experimenter during which the child also smiled at the experimenter. We analyzed the proportion measure as a function of action type. The proportion of looks that included a smile was higher for instrumental actions ($M = .29$) than for pretense actions ($M = .16$), though the difference between them was only marginally significant, $t(20) = 1.87$, $p = .08$.

This might seem like a surprising finding given the emphasis that is often given to children's 'knowing smiles' as a sign of their engaging in shared pretense (e.g. Wellman & Hickling, 1993) and given that we found more looks in the pretense conditions. However, research on the development of emotion expression suggests that smiling in social contexts is a more ambiguous behavior than looking to an adult. Smiling can occur to share affect and experience (e.g. Jones & Hong, 2001), but it can also arise as a sort of 'mastery smile' due to experiencing contingency or success (e.g. Lewis, Sullivan & Brooks-Gunn, 1985; Watson, 1972). The abovementioned proportion measure, however, cannot distinguish cases where children look and smile to the experimenter to share affect and experience from those where children experience mastery on acting with an object, start to smile because of this and then look to the experimenter, continuing their originally non-social smile. Therefore we ran a more qualitative analysis, taking into account the relative onset of looking and smiling. We reasoned that genuinely social smiles might tend to have their

[8] One concern with this finding is that the criterion for an action being 'creative' is too weak: when children perform an unmodeled action on Trial 1, this might just be due to the fact that they have forgotten what the experimenter did. Therefore a control analysis was run with a more stringent criterion: only those actions were scored as 'creative' that were performed after the child had done the modeled action. The results are qualitatively analogous: under this operational definition, three children showed creative acts of both kinds, eight children showed neither creative pretense nor instrumental acts. Only one child showed creative pretense, but no creative instrumental acts. Twelve children showed the opposite pattern (Binomial test: $n = 12$, $x = 1$, $p < .0001$).

[9] One possible concern with this result is that it might be a methodological artefact: all instrumental actions involved two objects all the time, whereas some pretense actions (eating, brushing teeth) can be largely done without a second object and mostly self-centered, so that children can look to the experimenter more during these pretense actions simply because they are performed close to the face and with less attention to the object needed. However, a more detailed analysis of the data can rule out this possibility: children's looking behavior during these more self-centered pretense actions was no different from their looking behavior during no self-centered pretense actions (pour, write, stir, drive a car, etc.), $t(23) = .58$, $p < .95$, and during non self-centered pretense actions children looked significantly more often to the experimenter than during instrumental actions, $t(23) = 3.98$, $p < .001$.

Table 3 *Contingency of relative onset of smiles/looks and type of action (pooled over 10 subjects)*

		Onset of smiling relative to look onset	
		Simultaneous	Before or after
Type of action	Pretense	13	6
	Instrumental	10	21

onset simultaneous with the onset of the look to the experimenter. There were 10 children who performed both pretense and instrumental actions while looking and smiling to the experimenter. In total these 10 children produced 50 episodes of an action with looking to the experimenter and smiling. For each episode it was determined whether the onset of the smile was simultaneous with the look onset or not. Table 3 presents the pooled contingency table over all these episodes. As can be seen from Table 3, pooled over all subjects, smiles to the experimenter during pretense actions tended to occur simultaneously with looks to the experimenter, whereas during instrumental actions smiles tended to have their onset before or after the onset of the look. To test the statistical significance of this pattern, we assigned to each of the 10 children a 'pretense score' that was +1 if during pretense actions the child showed more smiles with onset simultaneously with look onset, 0 when there were equal numbers of both types of smiles and –1 when there were more smiles with onset before or after look onset. Each child also got an 'instrumental score' that was assigned in an analogous way. We then compared the instrumental score and the pretense score. When a child had a pretense score bigger than his/her instrumental score this meant that she showed more simultaneous look and smile onset during pretense than during instrumental actions. Eight of the 10 showed exactly this pattern, one had equal pretense and instrumental scores and only one child had an instrumental score bigger than her pretense score (Sign test: $x = 1$, $n = 9$, $p = .039$).

Looking and smiling by the experimenter

The main reason for analyzing children's looks and smiles was to investigate whether children express nonverbally a special cognitive and interpersonal attitude in pretense, thereby showing that they have a grip of the special social character of pretense. There is, however, a concern with this rich interpretation of looking and smiling in pretense: adults are known to show more looking and smiling when they pretend for and with children (e.g. Lillard & Witherington, 2001). Children's looking and smiling behavior could then be explained more parsimoniously in terms of rather meaningless mimicking of the corresponding behavior of adults. To establish whether this more parsimonious approach can explain the current data, we analyzed the looks and smiles of the experimenter towards the child during his demonstrations.[10] The experimenter looked significantly more often to the child during pretense ($M = 2.64$) than during instrumental actions ($M = 1.34$), $t(18) = 7.79$, $p < .0001$. A higher proportion of his looks was accompanied by smiling during pretense ($M = .10$) than during instrumental demonstrations ($M = .48$), $t(18) = 2.05$, $p < .06$. For each child, the mean number of social gazes the experimenter showed during modeling pretense actions in the model phase was determined. Across children this value was correlated with each child's mean number of social gazes during her own pretense actions in the testing phase. An analogous correlation was computed between the mean proportion of gazes accompanied by smiles shown by the experimenter in the pretense actions in the model phase for a given child, and this child's smiling behavior in the testing phase. Neither of these two correlations was significant ($r = .13$ for looks and $r = .09$ for smiles). This makes a simple mimicking explanation of children's looking and smiling during pretense implausible.

Discussion

The current study allowed us to investigate commonalities and differences between 2-year-olds' learning of pretense and instrumental actions with unfamiliar objects. The major findings in this study are consistent with the theoretical claims based on Cultural Learning theory. First, we had hypothesized that both pretense and instrumental actions can be imitatively learned in similar ways, in frameworks of collective intentionality. Children's imitations of both pretense and instrumental actions indeed showed qualitatively similar patterns both across different frequency conditions and across the three trials. These results support our hypothesis of common cultural origins of pretense actions on toys and instrumental actions on tools.

With regard to the hypothesized differences between the two types of actions and their acquisition, the current findings also supply evidence in favor of our claims. As predicted, both absolute imitation rates and creativity were lower in pretense than in instrumental actions.

[10] Due to sub-optimal camera angles on the experimenter's face only the number of looks per action could be coded and the binary measure whether a given look was accompanied by smiling. The quality of the videotapes did not permit analysis of the exact onset of the experimenter's smiles.

We take these data to show that for young children, pretense is more difficult to understand and imitate than instrumental actions, and that early pretense frames are mainly supplied by adults, with creativity in pretending being a later derived phenomenon.

Findings on children's more frequent social gazes during pretense actions suggest that the collective intentionality involved in early pretense is indeed of a qualitatively stronger sort than in instrumental actions. Prima facie, somewhat surprisingly, we could not find any evidence for more social smiling during pretend play acts. More qualitative analyses with a small sub-sample of children yielded some preliminary hints that there may instead be a qualitatively specific pattern of social smiling – perhaps the famous 'knowing smile' – in pretense acts, such that children simultaneously start to gaze and smile at the adult during pretense, but not during instrumental actions.

There is, however, a major methodological concern with this study: the design with its long demonstration phase, in which the child was only watching the adult and was not allowed to act herself, was very demanding for 2-year-old children. Consequently, the drop-out rate was extremely high, with only half of the tested children included in the final sample.

In a second and third study, therefore, we tried both to overcome the methodological shortcomings of the first study and to validate and extend its findings. With Study 2, in which we tested 18-month-old children with a simplified design, we pursued two goals: first, we wanted to validate the findings on children's imitative learning of both pretend play and instrumental actions, and second, we sought to investigate and compare developmental trajectories in children's understanding and performing both types of actions. In Study 3 we tested another sample of young 2-year-olds, in a significantly simplified design, with the goal of eliciting as many actions of both types as possible. We tried to validate the findings on children's actions and social gazes from Study 1, and sought to obtain more clarifying data on children's social smiles.

Study 2

Study 1 revealed that 24-month-old children are capable of imitatively learning pretense actions with unfamiliar objects. They do this in a way analogous to their learning of instrumental actions, but reveal by their gazing and smiling behavior that they have a grasp of the specific interpersonal nature of pretense.

In this follow-up study we sought to determine the proficiency of 18-month-old children in this sort of task. In the light of other research showing significant development of pretense understanding during the second half of the second year (e.g. Harris & Kavanaugh, 1993; Walker-Andrews & Kahana-Kalman, 1999), we expected 18-month-olds to show the qualitatively same pattern of imitative and creative actions of both sorts, but with less proficiency in pretense than the 24-month-olds.

Method

Participants

The participants were sixteen 18-month-old children (seven girls, nine boys; mean age = 18 months and 10 days; range = 17;18–18;10), all native speakers of German. All children were recruited by telephone from a list of parents and children who had volunteered for studies of child development. Four additional children were excluded because they were unco-operative or their mother interfered.

Materials and design

As the demonstration phase in Study 1 was quite long and many children refused to participate further, and as the Mixed model conditions were not entered into the main analyses of Study 1, we chose a simplified design without the Mixed condition for the 18-month-olds: the first within-subjects variable had the same kind of action model, but now only two objects were modeled with pretense actions and two with instrumental actions. The two pretense and two instrumental actions were each presented in a block (order controlled), with a control object, not acted upon, always between the two blocks. The second within-subjects variable was frequency of modeling: within the two blocks, one object was acted upon only once (Once), the other one four times in the same way (Repeated). Thus an adult experimenter (the experimenter) presented five objects to each child. Objects C and D from Study 1 figured as control objects for each half of the participants. The objects A, B, E and G were assigned in a counterbalanced way to the four model conditions. We used as the two pretense actions 'pretending to brush one's teeth' and 'pretending to eat', and as the two instrumental actions 'hammering (a nail into a pegboard)' and 'rolling (play-dough)' (see Appendix 2). As in Study 1, children were given each object in the test phase and could act with it up to three times (Trials 1–3).

Procedure and coding

Observations were done in a child psychology laboratory. The general procedure was the same as in Study 1,

Table 4 *Mean numbers (and standard deviations) of modeled actions performed in test phase in the different conditions (*n = *16)*

		Frequency	
		Once	Repeated
Type of model	Pretense	.19 (.40)	.25 (.45)
	Instrumental	.69 (1.01)	1.06 (.93)

only without the Mixed conditions. The coding procedure for the children's actions was also the same as in Study 1.[11] All video-recordings were scored for children's actions by a single observer (O), while a second observer coded 30% of all tapes. Interrater reliability was 94% (Cohen's *Kappa* = .89).

Results

As in Study 1, one main point of interest was children's imitation of pretense and instrumental acts. Table 4 shows the mean numbers of imitative actions over the three trials in the four conditions. As in Study 1, the main analysis was a 2 (type of model: Pretense–Instrumental) × 2 (frequency of model: Once–Repeated) within-subjects factors ANOVA on the number of imitative actions performed in Trials 1 through 3. This ANOVA revealed a significant main effect of model type, $F(1, 15) = 13.15$, $p < .002$, with children showing more imitative actions when these were instrumental ($M = .88$) than when they were pretense actions ($M = .22$). There was neither a significant main effect for frequency ($p < .25$) nor a significant interaction effect ($p < .48$).

Again, the course of imitative actions of the three trials, above all on Trial 1, was a point of special interest. Table 5 shows how many children performed each of the four target actions on Trial 1 with the five different objects. Figure 3 shows the number of children that performed an imitative action in each of the three trials of the Once and Repeated pretense model and instrumental model conditions, respectively.

First, the same kind of control analysis as in Study 1 was run to test whether children imitated, that is, responded to the target actions differentially as a function of the model condition of the respective object. As can be seen from Table 5, all four target actions were performed by more children with the corresponding object (the object they had seen this action with in the model phase) than with the other objects. This difference in the number of

[11] Children's looks and smiles were not coded as the 18-month-olds did not perform enough pretense acts to allow interesting comparisons between their performance of pretense and instrumental actions.

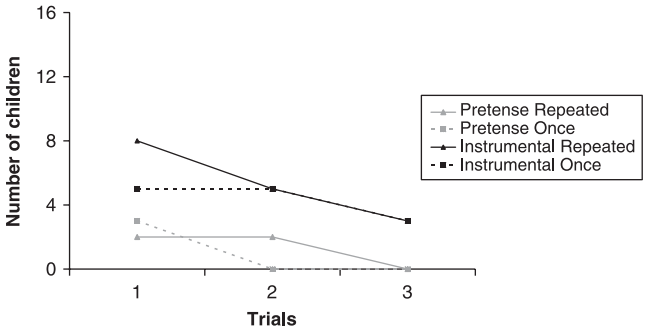

Figure 3 *Number of children performing an imitative action in the three trials of the two pretense model and the two instrumental model conditions (Study 2,* n = *16).*

children performing the target act between the objects was significant for the Instrumental–Repeated and the Pretense–Once actions, Cochran's Q Test, ps < .02. (The more specific follow-up analyses comparing the number of children performing each action with the object with which it was modeled with the number of children performing it with the control object, revealed a significant effect for the Instrumental–Repeated action, McNemar's test, $p < .02$, but due to floor effects failed to reveal a significant effect for the Pretense–Once action, $p < .25$.) Although the patterns were in the right direction (more children performed the target action with the object with which it was demonstrated than with any other object), the differences failed to reach significance for the Instrumental–Once (Cochran's Q Test, $p < .19$) and the Pretense–Repeated (Cochran's Q Test, $p < .26$). As can be seen from Table 5, the difference failed to reach significance for the Pretense–Repeated action because children were at floor in imitating this action. That the difference for the Instrumental-Once action failed to reach significance might mean that children did not imitate this action with the corresponding object, but performed it spontaneously without any influence of the model. More likely, however, given that all the objects were novel and did not afford any specific actions, is the possibility that children did indeed imitate the action with the object with which they saw it modeled (in fact, they performed it more often with this than with the other objects), but then also transferred it to the other objects.

Second, as in Study 1, the numbers of children performing the target actions on Trial 1 were compared in the four main conditions (Pretense and Instrumental Repeated and Once). Therefore, the same non-parametric tests as in Study 1 were run on the number of children showing imitative actions on Trial 1 of the different conditions. The difference between the numbers of children performing imitative actions in the four conditions approached significance, Cochran's $Q = .053$. Pairwise

Table 5 *Number of children who performed the four target actions on Trial 1 with the five objects*

Number of children	Object/model condition				
	Instrumental Repeated	Instrumental Once	Pretense Repeated	Pretense Once	Control object
Instrumental–Repeated action	8[(i)]	4	4	1	1
Instrumental–Once action	2	5[(i)]	2	1	3
Pretense–Repeated action	0	0	2[(i)]	1	0
Pretense–Once action	0	0	0	3[(i)]	0

Note: The cells marked with [(i)] refer to imitative actions, i.e. actions done were modeled with the same object in the model phase.

comparisons did not yield significant differences between the two Pretense, the two Instrumental, the two Once and the two Repeated conditions, respectively.

In a re-analysis of the current data and the data from Study 1, we also compared the imitation rates of the 18- and the 24-month-olds in the four conditions across Trials 1 through 3. The only condition where the 24-month-olds performed significantly more imitations was the Pretense Repeated condition, $t(38) = 2.94$, $p < .003$, one-tailed. The difference in the Pretense Once condition approached significance, $t(38) = 1.47$, $p < .06$, one-tailed. There were no significant differences between 18- and 24-month-olds' imitations of instrumental actions.

Another major interest was the degree of creativity children showed in performing pretense and instrumental actions. We therefore analyzed for all children whether they had performed at least one creative pretense and/or instrumental action (an action not seen in the model phase), and if so, how many. Only two children performed one creative pretense action each, making a total of two creative pretense acts. In contrast, 15 out of 16 children performed at least one creative instrumental action, and together they performed a total of 90 such creative acts. Thirteen children performed creative instrumental actions but no creative pretense actions, whereas no single child showed the opposite pattern, this difference being highly significant (Binomial test: $n = 13$, $x = 0$, $p < .0001$).

Not only did the 18-month-olds hardly perform any creative pretense, but they also showed very little pretense actions in general. Seven of the 16 children performed at least one pretense action, producing a total of 14 pretense acts, of which seven were done by one single child. Of the 14 actions, two were creative (not modeled at all), seven were imitative (same action with same object as the experimenter) and five were old (modeled action using a different object as the experimenter). Interestingly, all the 12 imitative and old actions performed by the children were 'pretending to eat', that is, not a single child picked up the 'pretending to brush one's teeth' action. This is in sharp contrast to children's performance of instrumental actions modeled in the demonstration phase: of the 30 imitative and old instrumental actions shown by the children, 20 were 'hammering' and 10 were 'rolling'. In sum, the 18-month-olds in this study hardly did any creative pretense and little imitative pretense. If they did imitative pretense, this was confined to one action type, 'pretending to eat'.

In contrast to Study 1, children's gazes and smiles were not analyzed, because too few participants produced too few instances of pretense actions to allow statistical comparisons between children's gazing and smiling behaviors during pretense and instrumental actions.

Discussion

In this study we tested 18-month-olds with a design similar to that in Study 1, but simplified, thereby overcoming the methodological shortcomings of Study 1. The qualitative patterns of the 18-month-olds' imitative and creative actions of both sorts replicated some important findings from Study 1: children performed more imitative and creative instrumental than pretense acts. They also performed more imitative acts after Repeated than after Once models, but due to floor effects in the pretense conditions (there was very little imitation of pretense acts in both conditions) this difference was not significant. There were, however, also interesting differences between the two age groups: the 18-month-olds were less proficient in imitating pretense actions than the 24-month-olds, and performed almost no creative pretense acts. These findings are consistent with much other research showing emerging pretense understanding and performance towards the end of the second year.

Study 3

The main goal of this study was to see whether the findings from Study 1 on children's gazes and smiles during both types of actions could be validated. For this reason, we simplified the design significantly: in order to elicit as many actions of both types as possible from the children,

we left out the delay between model phase and test phase, and also had no variation in frequency of model.

Method

Participants

The participants were 24 2-year-olds (15 males, nine females: mean age = 26 months and 9 days, range = 22;22–28;08), all native speakers of German. All children were recruited by telephone from a list of parents and children who had volunteered for studies of child development. Six additional children were excluded because they were unco-operative or their mother interfered.

Materials and design

An adult experimenter (the experimenter) presented eight novel objects (six from Study 1 and two additional ones), one at a time, to each child. Again, the experimenter demonstrated with each object an action that involved a second 'substrate' object. For each child, four of the objects were used to demonstrate a pretense action, and the remaining four an instrumental action. Each object was presented to the child for approximately 50 seconds. Assignment of the objects to the conditions was counterbalanced across children (see Appendix 3 for the actions and corresponding substrates). All eight actions had occurred in Study 1. The four pretense actions and the four instrumental actions were demonstrated in blocks, with the order of blocks and the within-block order counterbalanced across subjects. As in the previous two studies, children could act with each object up to three times (Trials 1–3).

Each action was shown twice to the child, without any further variation in frequency of model. That is, the main within-subject variable was type of model only: Pretense versus Instrumental. Dependent measures were first children's actions and second children's gazes and smiles during their actions.

Procedure

Observations were done in a child psychology laboratory. The general procedure was the same as in Study 1, with one important exception: there was no delay between model and test phase – immediately after the experimenter had demonstrated the action, the child was given the chance to act with the object. After the experimenter had demonstrated the action with the first object, she placed four additional substrates not involved in the model actions (a replica street, a replica apple, a replica bed and a replica bowl) on the table, plus the substrate of the first target object. She then asked the same question as in Study 1: 'What can you do with this (target object) and one of these (substrates)?' Again, each child could act up to three times per object. After the second model, the substrate of the second target object was added to these five substrates, that is, one substrate was added incrementally to the set of substrates the child could choose from after the demonstration with each object. The experimenter reacted to all kinds of actions by the child in an equally positive way.[12]

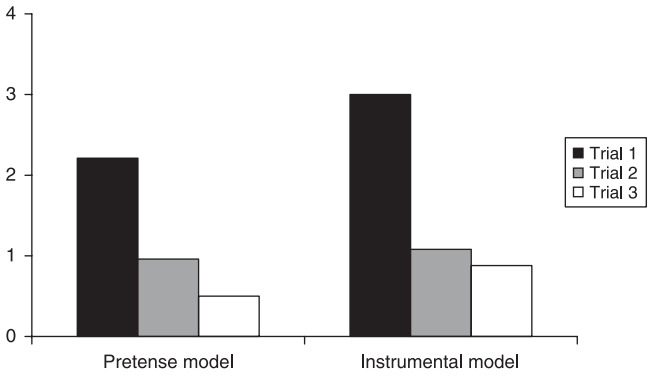

Figure 4 *Mean sum of imitations in the trials of the two model conditions (Study 3, n = 24).*

Observational and coding procedure

The same coding schemes as in Study 1 were used for children's actions, gazes and smiles. All video-recordings were scored for the child's actions by a single observer, while a second independent observer coded a random sample of 25% of all the tapes. Interrater reliability was 91% (Cohen's *Kappa* = .87). Two independent observers coded each half of the tapes for children's gazes and smiles, and some additional tapes for reliability, resulting in an overlap sample of 25% of the children coded by both. Interrater reliability for the number of gazes, assessed by means of a Pearson correlation, was .92. With regard to children's smiles, the same binary measures as in Study 1 were chosen: during a gaze episode, did the child also smile (Cohen's *Kappa* = .92), and was the onset of the smile simultaneous with the gaze onset (Cohen's *Kappa* = .75)?

Results

Actions

Figure 4 shows the mean number of imitative actions that the children performed on the three trials, summed

[12] Again, a random sample of 10% of the tapes was coded for the experimenter's behavior during the child's actions. No difference in the amount of the experimenter's smiles to the child during different types of actions of the child could be found.

up across the four objects in each condition, yielding values between 0 and 4. A 2 (model type) × 3 (trials) within-subjects ANOVA on the number of imitations yielded a significant main effect for model type, $F(1, 23) = 4.98$, $p < .04$, with children showing more imitations of instrumental ($M = 1.65$) than pretense actions ($M = 1.22$). There was also a significant effect of trial, $F(2, 22) = 103.59$, $p < .0001$, but no interaction effect.[13]

Gazes and smiles

As in Study 1, we computed for each child the mean number of social gazes to the experimenter during both types of actions. A paired samples *t*-test revealed that children looked significantly more often to the experimenter during pretense ($M = 1.03$) than during instrumental actions ($M = .61$), $t(21) = 3.28$, $p < .004$.[14]

With regard to children's smiles, for each child, the proportion of gazes accompanied by smiles during both types of actions was taken as a measure of social smiling. A paired samples *t*-test revealed that there was a significantly greater proportion of looks that were accompanied by smiles during pretense ($M = .69$) than during instrumental action ($M = .39$), $t(20) = 2.43$, $p < .025$.

The same more qualitative analysis of the onset of smiles as in Study 1 was done. There were 18 children who performed both pretense and instrumental actions accompanied by social gazes and smiles. These 18 children performed a total of 112 episodes of an action with gazing and smiling to the experimenter. Table 6 shows the pooled contingencies over all these episodes. The pattern from Study 1, such that smiles during pretense actions tended to begin significantly more often with simultaneous gazes, did not show up here. (Sign test: $x = 4$, $n = 8$, $p = .39$).

Table 6 *Contingency of relative onset of smiles/looks and type of action (pooled over 18 subjects)*

		Onset of smiling relative to look onset	
		Simultaneous	Before or after
Type of action	Pretense	9	37
	Instrumental	26	40

Discussion

Methodologically, the present study was successful in remedying the shortcomings of Study 1: without the demanding delay between model and test phase, the drop-out rate was lowered significantly, and more model objects could be used, thus eliciting more actions of both kinds. The findings of Study 3 replicated to a large degree those of Study 1. With regard to children's actions, the same patterns of imitative learning and creativity could be observed as in Study 1. The same pattern of social gazes was found as in Study 1, such that children looked significantly more often to the adult experimenter during pretense than during instrumental actions. The only deviations from Study 1 were found in children's social smiles: in contrast to Study 1, children in Study 3 showed significantly more social smiles during pretense than during instrumental actions, but no specific qualitative pattern of smile onsets. Thus, no unambiguous evidence for 'knowing smiles' in pretense could be found, and the role of children's social smiles in different action contexts remains in need of further empirical clarification.

General discussion

From the background of Cultural Learning theory we sought to investigate the ontogeny of young children's pretense actions on toys and instrumental actions on tools. The basic claim was that the acquisition of both sorts of actions shows important commonalities – imitative learning in a framework of collective intentionality – and fundamental differences in the structure of intention reading and collective intentionality as well. In three studies we presented 18-, 24- and 26-month-old children with novel objects and demonstrated pretense and instrumental actions with these objects.

One major finding was the similarity in patterns of imitation of instrumental and pretense actions as a function of the amount of modeling in Studies 1 and 2. Varying the number of models by an adult experimenter affected children's tendency to imitate the observed action in the same way for pretense and for instrumental actions. The patterning of imitative actions over the three response trials was analogous for pretense and for instrumental actions in all three studies.

[13] To test whether children did indeed imitate, that is, perform, the modeled actions differentially with the different objects as a function of model condition, the same kind of control analysis as in Studies 1 and 2 was run: for each of the eight target actions, the number of children who performed them on Trial 1 with each of the eight objects was analyzed. The differences were highly significant (Cochran's *Q* Test, all *p*s < .0001) for all eight actions.

[14] Again, this difference holds also when only children's non self-centered pretense actions are compared to their instrumental actions ($t(20) = p < .047$, one-tailed). This rules out the possibility that the difference was due to the fact that some pretense actions allowed the child to look to the experimenter more often because they required less attention to the objects involved.

These findings can be taken to show (1) that both types of actions can be culturally learned in a similar way in a framework of collective intentionality, and (2) that novel objects can become invested with both pretense and instrumental affordances by adults' model actions on them. It remains unclear, however, how comparable these two sorts of affordances are in early object use and play. One characteristic of mature pretense is its independence of fixed affordances of specific objects – objects can be flexibly substituted and assigned fictional identities. One could then speak of 'temporary affordances' in the specific play episode that are 'flagged' to the object (see the flagging model of Harris & Kavanaugh, 1993). Most everyday pretense of young children, however, arguably does not yet reveal this great amount of flexibility: it centers around replica objects always used in one specific way, toy cups and pots for pretend tea-parties, dolls for pretend feeding and bathing, etc. The exact nature of these different types and temporal extensions of affordances poses an important question for future studies.

The distinction between physical functions and status functions and the corresponding formulae 'X can be used to do Y in context C' and 'X counts as Z in context C', respectively, might be helpful in formulating speculations here. Whereas for tools, context C remains virtually the same over time (because it is determined by the physical make-up of the object), and also for many objects with status functions (pieces of money remain pieces of money normally until a currency reform), in mature pretense, context C is mostly very short-lived: now this object is assigned the status function of a make-believe sword in a drama, the next moment it becomes a pretend ploughshare. Put in these terms, one possibility is that, for young children, there is not yet much difference in the temporal character of the contexts C in physical and different status functions. That is, objects have rather permanent pretense status functions for young children: replica teapots are for pretend tea, dolls are for make-believe feeding, etc. Only gradually do they acquire the understanding of the temporally flexible nature of pretense status functions and their contexts as opposed to stable physical functions and more long-term status functions of things such as, for example, money.

Despite the similarities we found in the learning of both types of actions, however, the analysis of children's looks to the adult experimenter in Studies 1 and 3 revealed important differences between the intersubjective characteristics of children's pretense and their instrumental actions. Looks to the adult occurred more often during pretense than during the practical actions. The present study thus replicated and extended the findings by Striano *et al.* (2001) that showed this pattern for a fixed small class of pretense and instrumental actions. These findings can be interpreted in the following way: while 2-year-olds seemed to learn pretend acts in the present studies in the same way as instrumental acts, pretense is not just another form of instrumental action for them. Their social gazes indicate that they are in some form aware of the strong collective intentionality in pretend play, of the fact that 'we' create some fictional reality. These gazes can be understood as a complex form of social referencing and sharing attention: the child checks for fit in the common pretense perspective, sharing in the pretense proposal made by the adult.

Whereas the exact same pattern of children's social gazes to the experimenter during pretense could be found in two studies, thereby tapping an obviously robust phenomenon, the data on children's social smiles from Studies 1 and 3 remain contradictory. One explanation for this might be that the simplified design in Study 3 without the delay between the experimenter's and the child's actions provided a better framework for direct turn-taking and so encouraged children more to engage in collective intentionality, of which their smiling was then a sign. Future studies will have to clarify these issues and search in a more fine-grained way for evidence of the famous 'knowing smile'.

Apart from the looking, there were further important differences between children's pretend actions and their practical actions in the present studies. First, though the pattern of imitation was analogous for both action types, instrumental actions were imitated significantly more often than pretense actions. We take these findings to suggest that the structure of pretense actions and the underlying intentions are more difficult to understand. Second, fitting with this interpretation, the 18-month-olds were less proficient than the 24-month-olds only in imitating pretense actions, but not in imitating instrumental actions. These results are consistent with other research showing that, on the one hand, children from 1 year of age onwards are proficient imitative learners of actions on tools (Meltzoff, 1988; Carpenter, Nagell & Tomasello, 1998), and on the other hand, children become proficient in understanding and performing pretense towards the end of the second year (e.g. Harris & Kavanaugh, 1993). Third, children showed very few creative pretense productions, but many creative instrumental actions. We interpret these findings as suggesting that in early pretense, the assignment of status function, the creation of a frame, is mainly supplied by adults, with children sharing it, and that creativity in pretense is a later derived phenomeneon.

Taken together, the results of the present study can be interpreted in a broadly Vygotskian theoretical framework: early pretend play is an inherently social activity, socially constituted and heavily scaffolded by adults

through the use of verbal descriptions, action models and special objects, above all replica toys. Pretend play is later acquired by children in the same way as other cultural activities, by means of cultural learning (Tomasello *et al.*, 1993). This interpretation puts the current approach in sharp contrast to some purely cognitively oriented theories of early pretense, such as that of Nichols and Stich (2000), who regard pretense as a primarily solitary activity which is done because of a primitive underlying motive to act according to a counterfactual proposition. We do not deny the remarkable cognitive abilities – above all keeping apart fact and fiction – that children must have in order to understand and learn pretense in the first place, and agree that children have to be 'cognitively ready' to learn pretense, as they have to be in any other domain of learning, such as imitative learning of novel actions (e.g. Meltzoff, 1988, 1995) or even language learning (e.g. Tomasello, 2000). But we consider early pretense an inherently social activity and see the current findings as evidence for the hypothesis that pretense is culturally learned in a similar way as are other activities, albeit with a specific interpersonal function: creating a 'funny' violation of reality-appropriateness and sharing experience. Solitary and deeply creative pretense is a phenomenon of the later preschool years that arises through the internalization of early interpersonal activities in much the same way as solitary self-regulatory speech arises through the internalization of social speech.

Of course this broader issue awaits more empirical clarification by cross-cultural studies. Cultures where adults do not often and systematically pretend with children and where there are no artifacts with specific pretend play functions like the replica toys in Western societies would provide the crucial testing case. Such cross-cultural studies could help decide between broadly Vygotskian approaches that stress the fundamentally social nature of early pretense on the one hand, and theories that infer from the seemingly universal presence of pretense in the preschool years that it emerges spontaneously, 'suggesting a biological basis' of its onset (Lillard, 2002, p. 188). Although no one could reasonably deny some biological basis for the cognitive and other abilities required to pretend – even human-raised chimpanzees do not pretend (Tomasello & Call, 1997) – we doubt that solitary pretense could be shown to arise spontaneously in children living in cultures in which adults or older children do not support this activity, and certainly not at 2 years of age.

It remains an interesting question for further research how exactly adult support and infants' cognitive 'readiness' interact dialectically in the emergence of pretend play. In the case of serious goal-directed actions, recent research has shown that infants are sensitive to temporal and other structural aspects of everyday actions by the first birthday (Baldwin & Baird, 1999, 2001) – a possible precursor to understanding intentional action from 1 year of age onwards. Furthermore, parents intuitively scaffold children in segmenting and understanding actions by exaggerating certain movement characteristics of their actions when they act in front of and for the infants (so-called 'Motionese': Brand, Baldwin & Ashburn, 2002). It has been speculated whether infants' early sensitivity to structural aspects of actions and parents' use of Motionese might dialectically supply a bootstrap for infants to enter into simple forms of the intentional stance. In the case of pretense, Lillard and Witherington (2001) have shown that parents make use of certain specific behaviors (exaggerated and truncated movements, sound effects, etc.) to mark the non-seriousness of their actions when they pretend for the infant. By extension, an exciting question for future research might be how infants – equipped with at least sensitivity for the structural aspects of pretending – come to make use of these markers in gaining an appreciation of the non-serious nature of pretense acts, consequently imitatively learn pretense actions themselves and thereby come to enter what could be called a simple form of 'fictional stance'.

Appendix 1 *Objects pairs, actions and corresponding substrates in Study 1*

Objects	Pretense action and substrate		Instrumental action and substrate	
A, B	Brushing teeth*	Toothpaste	Rolling play-dough*	Play-dough
	Eating a carrot	Plate	Kicking a ball	Ball
	Stirring soup	Cardboard box	Cleaning	Piece of glass
C, D	Driving a car*	Toy street	Wiping away dirt*	Pile of dirt
	Eating a carrot	Plate	Kicking a ball	Ball
	Stirring soup	Cardboard box	Cleaning	Piece of glass
E, F, G	Writing*	Paper	Making a sound by hitting a glass*	Glass
	Eating a carrot	Plate	Kicking a ball	Ball
	Pouring from a bottle	Cup	Hammering	Pegboard

Explanation:

- Each object had assigned to it three pretense and three instrumental actions that were demonstrated with it when it was in the corresponding Mixed condition. One of these actions (the one marked with *) was demonstrated when the object was in the corresponding Once or Repeated condition.
- Each object was systematically varied across children whether it was (a) in one of the Pretense or Instrumental conditions and (b) in the Once, Repeated or Mixed conditions.
- Half of the children received object F and the other half object G as control objects. The control object was only presented with a yellow wooden block as its accompanying substrate.
- For each child, 11 substrate objects were involved: three each were assigned to the two objects in the Mixed conditions, one was assigned to each of the four objects in the Once and Repeated conditions, and one (the yellow wooden block) went with the control object.

Appendix 2 *Objects pairs, actions and corresponding substrates in Study 2*

Objects	Pretense action and substrate		Instrumental action and substrate	
A, B	Eating a carrot	Plate	Rolling play-dough	Play-dough
E, G	Brushing teeth	Toothpaste	Hammering a nail into a pegboard	Pegboard

Appendix 3 *Object pairs, actions and corresponding substrates in Study 3*

Pretense action	Substrate	Instrumental action	Substrate
Writing	Paper	Hitting a glass	Glass
Pouring	Cup	Kicking a ball	Ball
Eating	Plate	Cleaning	Dirt
Brushing teeth	Toothpaste	Rolling a piece of play-dough	Play-dough

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