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Developmental Changes in Early Comprehension and Production of Drawings: Evidence From Two Socioeconomic Backgrounds

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ABSTRACT

Two studies examined young children's comprehension and production of representational drawings across and within 2 socioeconomic strata (SES). Participants were 130 middle-SES (MSES) and low-SES (LSES) Argentine children, from 30 to 60 months old, given a task with 2 phases, production and comprehension. The production phase assessed free drawing and drawings from simple 3-dimensional objects (model drawing); the comprehension phase assessed children's understanding of an adult's line drawings of the objects. MSES children solved the comprehension phase of the task within the studied age range; representational production emerged first in model drawing (42 months) and later in free drawing (48 months). The same developmental pathway was observed in LSES children but with a clear asynchrony in the age of onset of comprehension and production: Children understood the symbolic nature of drawings at 42 months old and the first representational drawings were found at 60 months old. These results provide empirical evidence that support the crucial influence of social experiences by organizing and constraining graphic development.

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Paintings and drawings on paper are two-dimensional representations with a strong presence in children's everyday lives. In Western culture, from early infancy parents shower their infants with baby books containing all sorts of pictures, from highly realistic and colorful drawings to cartoons that substantially distort what they depict. Once toddlers are able to hold a pencil, their homes begin to fill up with graphic productions. The present studies focus on age-related changes in young children's comprehension and production of representational drawings across and within two socioeconomic strata (SES): middle SES (MSES) and low SES (LSES).

The ability to comprehend and use pictures as symbols of the world is a complex and extended developmental process. Very young children show an understanding of the referential potential of pictures. When tested using language-based learning tasks, 15- to 24-month-old children extended a word learned for a depicted novel object to the real object (Ganea, Allen, Butler, Carey, & DeLoache, 2009; Ganea, Bloom Pickard, & DeLoache, 2008; Geraghty, Waxman, & Gelman, 2014; Preissler & Carey, 2004). However, this understanding remains tenuous for some time. Children younger than 30 months old have difficulties matching a real object with its picture (Harris, Kavanaugh, & Dowson, 1997) and using a picture to locate a toy hidden in a room (DeLoache & Burns, 1994; Peralta & Salsa, 2009). Moreover, in a study controlling for the bootstrapping of picture comprehension with language, Callaghan (2000) found that children do not fully understand pictures until they are 36 months old: Younger children rely on verbal labels to mediate the matching of drawings with referents. Even at 48 months old children can

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show confusion about the specific properties of pictures and depicted objects (Beilin & Pearlman, 1991) and the different consequences of actions in pictures versus objects (Robinson, Nye, & Thomas, 1994; Zaitchik, 1990).

As far as graphic production is concerned, children's first attempts to draw emerge sometime between 12 and 24 months old. These first drawings take the form of scribbles. Initially, these scribbles are composed primarily of horizontal zigzags, and later skein-like circles dominate as children gain more visual and motor control (Golomb, 2004; Kellogg, 1969). According to early views, scribbling is a nonrepresentational activity that children execute for kinesthetic pleasure rather than for an interest in the marks their motor activity leaves (Kellogg, 1969; Piaget & Inhelder, 1948/1956). But even in scribbles, the act of representation is sometimes carried out through symbolic action and language: Matthews (1984) referred to these kinds of representations as action representations, in contrast to later graphic representations where the final marks themselves reveal what they are intended to represent.

Along with action representations, 24- to 36-month-old children give their scribbles names. This romancing of form (S. Cox, 2005; Golomb, 2004) is not genuine symbolization; children typically divulge what they are intended to portray only after the fact and may change their earlier announced intention when their marks more closely resemble some other object. During the preschool period, between the ages of 36 and 48 months old, children move away from scribbling and begin to draw recognizable objects. One of the first spontaneous representational drawings children attempt is the human figure described as a tadpole; a circle with arms and legs (or just legs) emanating from it. Over time, children's drawings become much more realistic; they contain a wide variety of objects and details and children begin to consider the audience of their productions when they decide how to draw (Winner, 2006).

In marked contrast with research focused on comprehension or production of drawings, research into the relationship between these two processes in young children is fairly scant. Callaghan (1999) asked 24-, 36-, and 48-month-old children to draw pictures of five simple objects, use them in a social communicative game, and respond to the experimenter's drawings. Verbal labels did not play a role because all objects were balls, and thus shared a basic-level verbal label. The balls differed in four distinctive features that were easy to capture in a drawing: small versus large, one versus many, plain versus spider ball with rubber legs, and ball versus stick. Moreover, the objects could be drawn with circles and lines, which are within children's mark-making ability at these ages. On the children's first attempt to draw the objects, before the social game, 24-month-olds made significantly fewer representational drawings (6%) than 36-month-olds did (42%), who in turn made fewer drawings than 48-month-olds did (70%). Regarding comprehension, when the experimenter held up a picture showing which object should be chosen, only 24-month-olds could not use the adult's drawings as symbols (47%). Callaghan argued that these findings provide evidence that children comprehend the symbolic nature of drawings before they are able to produce them, and that both abilities develop close to the third year of life.

The purpose of the present research was to get a closer view of the onset of comprehension and production of representational drawings by comparing pictorial performance both in children at six-month age increments and in two SES groups (MSES and LSES). As in Callaghan's research, we used a single procedure to measure production and comprehension. We asked 30-, 36-, 42-, and 48-month-olds to produce a free drawing and drawings of five different objects. Then, we assessed children's understanding of adult's drawings of the objects. Thus, this research served to evolutionarily complement the findings reported by Callaghan (1999), and was motivated by the longstanding evidence that showed a relatively rapid progress in children's mastering of pictures (Callaghan, 2000; DeLoache & Burns, 1994; Salsa & Peralta, 2007).

Most critically, each age group consisted of children from MSES and LSES to examine whether children growing up in different social contexts would show variations in the age of onset of symbolic functioning with pictures. To the best of our knowledge, there is virtually no research that has focused on children's pictorial performance comparatively in two SES samples, within a cultural setting; these skills have been studied mainly in children developing in MSES groups, in English-speaking countries. However, a sociocultural approach suggests that cultural practices like drawing always have a social component; seemingly solitary activities are not really solitary when one uses symbols or tools created or

adapted by others (Rogoff, 2003; Vygotsky, 1978). Within this framework, this study represents an effort to more fully understand how individual and social factors are interwoven and therefore influential in pictorial competence and its development.

In the last two decades, research on drawing development has begun to examine how children learn to understand and create pictures through interacting with others. Adults often provide verbal and nonverbal assistance to children during collaborative drawing activities. Mothers remark on children's pictures, offer suggestions, and provide directions on how to create depictions as they draw with older infants and young children (Braswell, 2001; Braswell & Callanan, 2003; Braswell & Rosenberg, 2005; Yamagata, 1997). Training studies have also demonstrated that when young children were engaged in social interactions where an adult highlighted the symbolic function of drawings to them, their comprehension and production of graphic representations improved (Callaghan & Rankin, 2002).

It is important to note, however, that social aspects of drawing development need not be limited to face-to-face social interactions. A strong empirical support for this claim comes from a study conducted by Callaghan et al. (2011) in three cultural settings, Canada, Peru, and India. In a drawing comprehension task, the Canadian children performed better than chance at 30 months old, more than 1.5 years earlier than the other two groups of children. In the production of representational drawings on their own, the Canadian children showed productive capacity at around 48 months old, about 1–1.5 years earlier than the remaining groups of children. According to maternal interviews, only the Canadian children had had extensive exposure to child-oriented pictures, picture books, and family photographs in their early environments.

Based on these sociocultural studies that show that drawing development is highly dependent on the contextual input the children received, we wondered whether the age trends documented for production and comprehension would vary across SES. An extensive line of research indicates that the frequency or complexity of oral language activities that parents engage in with their young children vary widely as a function of the SES backgrounds of families, variations that seem to impact early language development (Hoff, 2003; Hoff-Ginsberg, 1991; Ninio, 1980; Peralta & Salsa, 2001). Similar results were found with other cultural symbols, showing SES effects in children's acquisition of writing (Korat & Levin, 2001; Treiman et al., 2015) and numerical skills (Anders et al., 2012; Gunderson & Levine, 2011; Jordan & Levine, 2009).

Motivated by these empirical issues, our efforts, in Study 1, were to compare 30- to 48-month-old children's production and comprehension of representational drawings within and across SES, MSES, and LSES. We were intrigued as to whether differences would appear for the first steps of drawing development or not, given that drawing activities are presumably familiar to children growing up in Western societies. If symbolic production or comprehension were related with SES, we expected performance in the LSES groups to suffer. Therefore, in Study 2, we further explore the emergence of these abilities in older LSES children.

Study 1

Method

Participants and pictorial symbols environments

The participants were 112 children, 56 of MSES and 56 of LSES. Four age groups of 14 children were tested within each SES: 30, 36, 42, and 48 months old. Table 1 presents details of age ranges, mean age in months, and number of girls and boys in each one of the eight groups.

All children were recruited from daycare centers in Rosario, a large city in Argentina. MSES children attended two private daycares located in a middle to high socioeconomic neighborhood; LSES children attended two public daycare centers funded by the county and residing in a marginal suburban area of the city. The SES was corroborated through information available in the daycares' files regarding parental education and occupational status. Ninety three percent of MSES mothers and 96% of fathers had pursued university-level studies; most of them worked in professional or commercial positions. For LSES, 85% of the mothers and 65% of the fathers had not pursued education beyond the seven-year primary

Table 1. Participant characteristics.

	MSES group			LSES group		
Age (months)	*M* age (months)	Girls	Boys	*M* age (months)	Girls	Boys
30 (29–31 months)	30.34	7	7	30.05	7	7
36 (35–37 months)	36.22	8	6	36.61	7	7
42 (41–42 months)	42.17	6	8	42.32	8	6
48 (47–49 months)	48.19	7	7	48.64	6	8

school, and 10% of the mothers and 32% of the fathers had not completed secondary school. Most of the LSES families received some kind of government based financial assistance because their basic needs were unmet; if mothers or fathers were employed, they worked in unskilled positions. Finally, only data from children who had no reported special developmental issues were included in the study.

The experimental sessions took place in the daycares and some children were accompanied by their mothers. In those cases, a questionnaire regarding home environment with respect to pictorial symbols was administered to the mothers in a personal interview format (18 from MSES and 20 from LSES). The purpose of these interviews was exploratory. In both SES, all mothers reported that their children had substantial exposure to family photos and moving images (television or home video). Although all MSES mothers reported having children's books in their homes (in 64% of the cases more than 20 books), only the 57% of LSES mothers reported that their children had books (in most cases less than five). Having newspapers and magazines at home was similar in both groups (around 75%).

All MSES children participated in picture book interactions with adults at home, in contrast to the LSES group (36%); 93% of the MSES mothers reported reading picture books to their children at least three times per week. Finally, all children were used to drawing at home. However, more MSES mothers (85%) than LSES mothers (35%) reported sitting or talking with their children while they were drawing.

Materials

A soft child-size pencil and letter-sized sheets of paper were provided to the children to produce their drawings. Five simple objects similar to those used in previous picture-object tasks (Callaghan, 1999, 2000) were used: (1) a ball, (2) a ball with small wooden sticks attached, (3) a ball smaller than balls 1 and 2, (4) two balls joined together, and (5) a wooden stick. The objects were identical in color (orange).

A box (30 × 20 cm) and a brightly colorful tunnel (15 cm diameter, 90 cm length) were used to provide the children with an interesting activity to perform with the objects in the comprehension phase of the task. Five red boxes (20 × 14 cm) were also used; each box contained an experimenter's line drawing of each one of the objects (see Figure 1).

Procedure

Before the experimental session, the study was described to the parents and informed consent was obtained. Children were tested individually in a quiet room at the daycare center they attended. Two Argentine, female experimenters conducted the procedures. To establish rapport, the session began with a brief warm-up period in which the experimenters chatted with the children about what they had been doing that day. When the children appeared to be comfortable, they sat at a small table next to the primary experimenter (Analía M. Salsa) and the task began. The task was based on the procedure described in Callaghan (1999); it lasted approximately 25 min and had two phases, production and comprehension, beginning with production.

The production phase assessed children's ability to produce representational drawings from imagination (free drawing) and from a three-dimensional model (model drawing). First, the experimenter gave the children a pencil and a sheet of paper and asked them to draw a picture of anything they liked. After drawing, the experimenter interviewed the children about their productions and wrote down on the back of the sheet the names given to the images (free drawing).

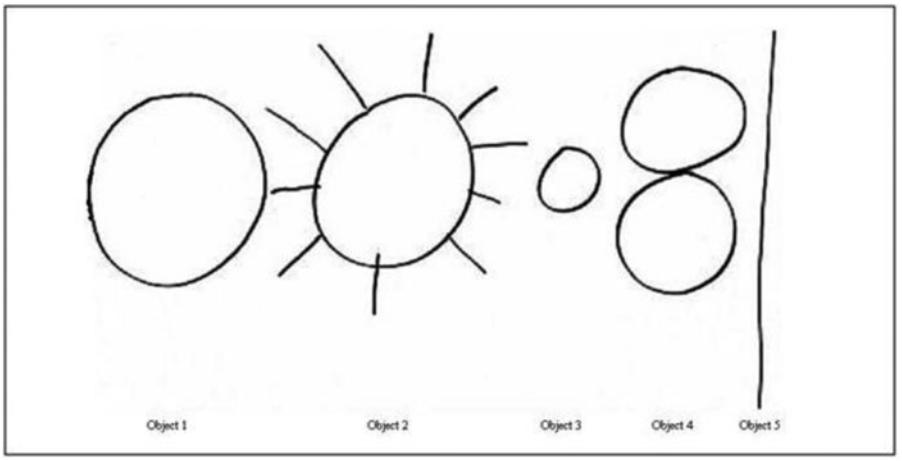

Figure 1. Experimenter's line drawings of the objects used in the comprehension phase of the task.

Afterwards, the experimenter told children that they were "going to make drawings of some toys" (model drawing). All the objects were presented as "toys" to control the effects of verbal labels as symbols to guide pictorial performance. The experimenter gave the objects to the children for a brief period of tactile exploration because this has been found to improve drawing ability (Cox, 1986). She then placed the objects in front of the children forming a horizontal line easy to see but out of their reach, and picked up one object at a time for the children to draw. After the children made a drawing of an object, the experimenter coded which object was drawn on the back of the sheet. Each of the five objects was individually drawn on a separate piece of paper. The order of presentation of the objects was counterbalanced so that half the children of each group drew the objects in one order and the other half in another. Children were always asked to first make a drawing of object 1 or object 5 (see Figure 1); these objects were required first because they can be drawn using either of the two simplest form elements, circle and line.

The comprehension phase tested children's comprehension of the drawings made by the experimenter. The children had to identify the graphic representation by establishing a correspondence between the drawing and its referent, and to use the drawings as symbols of the objects.

Once all children's drawings were completed, the experimenter put the objects in a box and presented the tunnel. Children were first told that they were going to play a game with the tunnel, some boxes and pictures. The experimenter said, "I will throw down the tunnel the objects. You will have to keep each toy in its corresponding box. You will know where to keep the toys because each box has a drawing inside." She showed one by one the five boxes, saying, "This is the box of this toy (pointing to the experimenter's drawing inside)." All the boxes were lined up near the lower end of the tunnel. The experimenter presented five trials, one for each object: She put down the tunnel an object and said, "Where are you going to put this toy?" If necessary, a more explicit prompt was given ("Where is the drawing of this toy?"). Once the children placed a toy inside a box, the experimenter removed it so that the children had to choose each drawing among the five drawings of the set. The order of presentation of the objects was counterbalanced. This procedure provides a stringent test of comprehension; children have to use the drawing as a symbol of a particular item and the name that may be generated when they see the picture cannot help them match (Callaghan, 2000).

Coding and analyses

The second experimenter (Romina Vivaldi) was present for the testing of all children in these studies. She used a score sheet to record comprehension choices and collected all drawings for later coding. The data for the production phase were the number of representational drawings made by the children in free and model drawing tasks. Free drawings were presented to two independent judges (naive to the hypothesis of the studies) along with the label provided by the children. They were classified as representational if

the judge could discern what was being portrayed in the picture and as prerepresentational if the judge was unable to tell the subject of the drawing. In all prerepresentational cases the drawing was a scribble that did not resemble at all its label; in representational ones, the subject of the drawing was evident even without the label. Interobserver reliability was 100%.

In line with Callaghan's (1999) study, children's object drawings were coded as representational according to whether they exhibited the four possible distinctions between the objects:

1. Added feature (object 1 vs. object 2). Object 1 could be depicted with a circle but object 2 must had lines emanating from the circle to distinguish it from object 1.
2. Size (object 1 vs. object 3). Object 3 needed to be smaller than object 1 to be distinguished from it.
3. Number (object 1 vs. object 4). Object 4 needed to show two circles.
4. Figure (object 1 vs. object 5). Object 5 could be distinguished from object 1 by the use of a line instead of a circle.

Children could obtain a score of 0–4 representational drawings. Pairs of drawings relevant to each distinction (e.g., added feature) were compared by two judges for 25% of the children to obtain interrater reliability, which was high (percent agreement = 93, Cohen's $\kappa = .86$).

The data for the comprehension phase were the total number of correct choices made by the children (of a total of five trials). Production (model drawing) and comprehension data were analyzed using a 4 Age × 2 SES analysis of variance (ANOVA). To assess the number of children in each age group or SES fitting in particular patterns of performance, nonparametric analyses were conducted. Preliminary analysis revealed no effects of gender or order of presentation of the objects (model drawing and comprehension) in any of the groups observed, so these variables will not be discussed further.

Results

There were two main questions addressed in the analyses for Study 1. First, we assessed developmental trends within each SES (MSES and LSES); second, we examined developmental differences across SES. These analyses were carried out first on production of representational drawings and later on comprehension.

Production of representational drawings

In the free drawing task, frequency data indicated a clear developmental progression in the MSES group. None of the 30- and 36-month-olds, four of the 42-month-olds (28%), and 10 of the 48-month-olds (71%) made representational drawings; a chi-square analysis showed a significant difference between the three younger groups and the older group, $\chi^2(3, N = 96) = 22.12$, $p = .001$. In contrast, for the number of LSES children producing free representational drawings, there was no effect of age, $\chi^2(3, N = 96) = 2.07$, $p = .557$: only one 48-month-old child was classified as a representational drawer. Even more, half of the prerepresentational drawings made by 48-month-old LSES children were scribbles that they labeled as human figures. With respect to SES differences, separate analyses of each age group confirmed significant differences only between 48-month-old children, $\chi^2(1, N = 28) = 12.12$, $p = .001$.

Regarding to the model drawing task, an ANOVA was performed with the number of representational drawings made by children as the dependent variable, and with age (4) and SES (2) as factors (see Figure 2). Results showed a significant main effect of age, $F(3, 108) = 32.57$, $p = .001$. Post hoc tests (Bonferroni) carried out in the MSES sample revealed that 30- and 36-month-olds made fewer representational drawings ($M = 0.50$ and 1.21, respectively) than did 42- and 48-month-olds ($M = 3.14$ and 3.50, respectively; all ps = .001). Of most importance, no significant differences were found between 30- and 36-month-olds and between 42- and 48-month-olds.

In the LSES group, Bonferroni's test only showed significant differences between the number of representational drawings of 30-month-old children ($M = 0.21$) and 48-month-old children ($M = 1.64$; $p = .01$). However, even in the older group, children made very few representational drawings, despite their use of circles or lines in their free drawings.

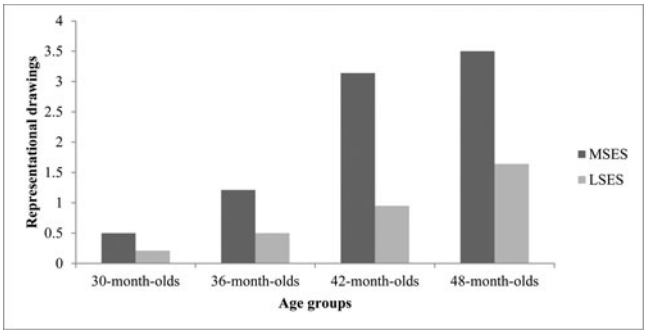

Figure 2. Mean number of representational drawings (out a total of 4) produced by children in model drawing as a function of age group and SES (Study 1).

The ANOVA also showed that SES had a significant effect on model drawing, $F(1, 110) = 51.00$, $p = .001$, and interacted with age, $F(3, 108) = 6.75$, $p = .001$. Pairwise comparisons (independent t tests) confirmed that MSES children performed better than LSES children in the 42-month-old group, $t(26) = 5.58$, $p = .001$, and the 48-month-old group, $t(26) = 5.53$, $p = .001$. There were no differences between the younger groups as a function of SES.

As seen in Table 2, we further examined the number of children who drew at least one representational drawing and the number who produced representational drawings to the maximum possible extent (all four). According to Callaghan (1999), achieving a score of "at least 1" could happen if a child draws a circle to represent all of the objects, a common strategy used by children in between scribbling and true representational drawing stages. To achieve a score of 4, a child could render the simplest distinction between the ball and stick (circle and line) but would also have to depict the objects that require the combination of circles and lines to distinguish them from the other objects. Frequency data indicated a similar proportion of children across SES achieving the score of "at least 1" but that many more children in the older groups of the MSES sample were drawing four representational drawings. Specifically, for the number of children producing at least one representational drawing there was no SES effect ($z = 0$, $p = 1$), whereas for the number of children producing all four drawings there was an SES effect ($z = 3.78$, $p = .001$). The SES effect for the number of children achieving the score of "all 4" was due to the 42-month-old ($z = 3.05$, $p = .002$) and 48-month-old ($z = 2.51$, $p = .001$) groups.

In sum, these data suggest that MSES children were representational drawers according to their free drawings at 48 months old and shifted to a representational mode when they were instructed to draw a simple object from its three-dimensional model at 42 months old. Contrariwise, the majority of LSES children seemed unable to produce representational depictions even in the model drawing task.

Table 2. Number and percentage of children making at least one or all four representational drawings in model drawing as a function of SES (Study 1).

	At least one				All four			
	MSES		LSES		MSES		LSES	
Age (months)	*n*	%	*n*	%	*n*	%	*n*	%
30	4	28	3	21	0		0	
36	8	57	5	36	1	7	0	
42	6	43	8	57	7	50	0	
48	7	50	9	64	7	50	1	7

Note. The total number of children in each age group in both socioeconomic strata (SES) was 14. LSES = low socioeconomic strata; MSES = middle socioeconomic strata.

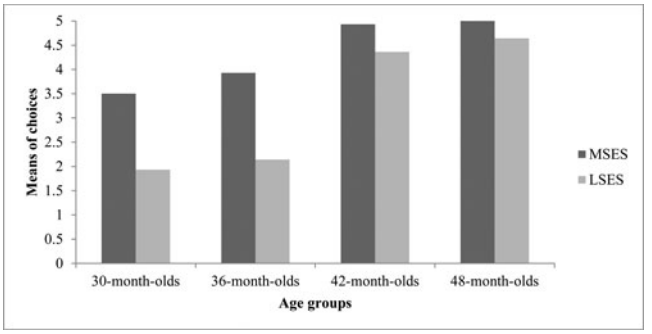

Figure 3. Mean number of correct choices in the comprehension phase of the task as a function of age group and SES (Study 1).

Comprehension of adult's representational drawings

The mean choice scores in the comprehension phase of the task are presented in Figure 3. The ANOVA carried out on the number of correct choices revealed significant main effects of age, $F(3, 108) = 24.19$, $p = .001$. In the MSES sample, a post hoc Tamhane's test indicated that 42- and 48-month-olds exhibited higher choice scores ($M = 4.93$ and 5.00, respectively) than did 30-month-old children ($M = 3.5$; $p = .039$ and $p = .028$, respectively). Nevertheless, we also calculated the number of children who had passed at least four of the five trials (80%), the number needed to perform significantly better than chance in this task (chance level = 0.20). These data showed that even the majority of the younger children had achieved comprehension of the symbolic function of drawings and used pictures to assist in the matching task. Eight (60%) of the 30-month-olds, 9 (64%) of the 36-month-olds, and all 42- and 48-month-olds achieved a score of at least four trials.

In LSES children, Tamhane's test indicated that the main effect of age was due to 42- and 48-month-old children ($M = 4.36$ and 4.64, respectively) performing significantly greater than 30- and 36-month-olds did ($M = 1.93$ and 2.14, respectively; all $ps = .001$). Additionally, there were no reliable differences between 42- and 48-month-olds or between 36- and 30-month-olds. This pattern was also reflected in individual performance: None of the 30-month-olds and only 2 of the 14 children in the 36-month-old group (14%) passed at least four trials, whereas 12 of the 42-month-olds (86%) and 13 of the 48-month-olds (93%) met this criterion.

Finally, the ANOVA yielded a significant main effect of SES, $F(1, 110) = 23.89$, $p = .001$, and an interaction of SES and age group, $F(3, 108) = 2.59$, $p = .05$. MSES children performed significantly better than LSES children did at 30 months old, $t(26) = 2.90$, $p = .007$, and 36 months old, $t(26) = 3.38$, $p = .002$, and there was no effect of SES in the other two age groups. In consequence, symbolic understanding of representational drawings seemed to emerge in the LSES sample at 42 months old, approximately one year later than in the MSES group.

On the basis of the developmental trends found within and across SES in Study 1, we considered necessary to extend the age range in the LSES setting to include older children, from 54 to 60 months old. This manipulation enabled us a further examination of symbolic abilities in LSES children, especially when they begin to make representational drawings.

Study 2

Method

Participants

Eighteen children with a mean age of 58.02 months (age range: 54–60 months; 8 girls and 10 boys) were included in Study 2. Children were recruited from the two public county daycare centers that participated in Study 1.

Materials and procedure

The materials were the same as those used in Study 1 and the experimental session was conducted in exactly the same manner as in that study.

Results

We first analyzed the data from Study 2 and then compared these data with the data from Study 1 to examine age-related changes within LSES and SES differences on children's performance.

In the free drawing task, of the 18 children observed, 10 produced representational drawings (55%); however, of the eight children who made prerepresentational drawings, seven children intended to draw animals and objects and not the human figure. In the model drawing task, the mean number of representational drawings produced by children was 2.88 (range = 0–4), with seven children (39%) achieving the score of "all 4." This pattern of results is clearly different from the one observed in the LSES group of 48-month-old children (Study 1), in which only one child produced a representational free drawing and the mean performance in model drawing was 1.64. Finally, as their counterparts of 42 and 48 months old, this LSES group was very successful in using the drawing–referent relation; they scored 94% correct choices ($M = 4.72$) and 16 children (89%) met the success criterion (at least four correct choices).

To estimate the age at which children would achieve a comparable level of performance across SES, we compared children's performance with the age groups of MSES of Study 1 in which the majority of children passed the production phase of the task. The analysis revealed that this LSES group of children did not differ significantly from the MSES 48-month-olds in free drawing; $\chi^2(1) = 0.22$, $p = .637$, and from MSES 42-month-olds in model drawing, $t(30) = -0.59$, $p = .58$. Thus, the first representational drawings in LSES children were found approximately 1.5 years later than in MSES ones.

General discussion

In Study 1 our aim was to determine age-related changes and SES differences (MSES and LSES) in early understanding and production of representational drawings with children between 30 to 48 months old. For that purpose, we used a methodological approach that has rarely been adopted in literature with young children: a unique single procedure to measure comprehension and production. Children from MSES families were reliably passing the comprehension phase of the task within the studied age range, and the production phase at 42 months old; LSES children were only successful on understanding the symbolic function of drawings, with a delay of one year with respect to those from the MSES group. In Study 2, we extended our investigation to include older LSES children to explore the emergence of representational graphic production around 60 months old.

The first set of results deals with age-related changes. The findings reported here support the view that drawing development undergoes a qualitative shift over the preschool years (Callaghan, 2008; Golomb, 2004; Winner, 2006). On one hand, in the MSES sample, comprehension and production performance of 30- and 42-month-olds evolutionarily complement the results reported by Callaghan (1999) with 24-, 36-, and 48-month-old children, providing new evidence to the documented shifts in pictorial competence in short periods of time (DeLoache & Burns, 1994; Salsa & Peralta, 2007; Troseth, 2010). In addition, the differences we have found between 42 and 48 months old in representational drawing production (model vs. free drawing) are consistent with the concern regarding the discrepancy between drawing from a three-dimensional model rather than the imagination: Young children will often successfully represent a simple object when the task (materials and instructions) directs them to do so (Callaghan, 1999; M. V. Cox & Parkin, 1986; Vivaldi & Salsa, 2017).

On the other hand, although a considerable age gap has been observed in children's understanding and production of drawings across SES, the same order of emergence of these abilities was found in both socioeconomic groups. Understanding the symbolic function of drawings was the easiest task, followed by drawing from a model, and finally drawing from imagination. This common developmental trajectory for drawing development is in line with Callaghan's (1999, 2008) claim that the production of representational drawings relies on the comprehension of their symbolic nature. Only once children

understand that drawings are used to symbolize a given referent can they begin to produce their own representational graphic symbols.

The second set of results deals with the influence of SES on the developmental trends observed, from an early age. Although sociocultural approaches (Rogoff, 2003; Vygotsky, 1978) specifically address possible SES differences in pictorial competence, at present there is scant extant research in this area to empirically support such claim. In this sense, our hypothesis that production and comprehension of drawings would vary across SES within a cultural group was verified. The present studies extend research on symbolic development and SES by moving beyond oral language (Hoff, 2003; Hoff-Ginsberg, 1991; Ninio, 1980; Peralta & Salsa, 2001), writing (Korat & Levin, 2001; Treiman et al., 2015) and number (Anders et al., 2012; Gunderson & Levine, 2011; Jordan & Levine, 2009). Thus, our results illustrate that the socioeconomic contexts in which children grow and develop seem to play an important role in the process of creating and understanding pictures, as do face-to-face interactions (Braswell, 2001; Braswell & Callanan, 2003; Braswell & Rosengren, 2005; Yamagata, 1997). If SES is an additional dimension of the social nature of drawing development, what might be the specific ways in which SES operates?

Callaghan et al. (2011) pointed out that children who have received little exposure to pictures in their early environments (villages in India and Peru) will have had less opportunities to learn the cultural conventions for those symbols and will therefore be less likely to develop a full understanding of their representational function. Although the exploratory nature of the interviews done in Study 1 (due to the small sample of mothers who participated), it is possible to think that the delayed drawing competence reported in the LSES groups was not necessarily related with differences in children's exposure to pictorial symbols since LSES mothers claimed that their children were surrounded by family photos, pictures in magazines and newspapers and moving images at home. However, this group of mothers also reported less social support for these symbols, such as joint reading interactions and parental assistance during drawing production. It would seem, then, that adults in LSES contexts may be less likely to engage their infants and young children in social forms of symbolic interactions. These specific experiences, as well as support from expert symbol users, may be critical to children's mastering of drawing skills and may help us to understand the possible influences SES might have on drawing development.

For instance, as posited in the training study conducted by Callaghan and Rankin (2002), 30-month-old children perform better on drawing–object matching and production tasks when they were exposed to an adult producing and then using pictorial symbols. Nevertheless, the crucial factor of adult scaffolding and its impulse in the acquisition of pictorial competence has been studied exclusively in MSES groups. It will be critical for future researchers to explore not only whether drawing development is influenced by adult social support in LSES contexts, but also how it is related to distinct styles of interactions in joint activities in which young children experience and converse about pictures with adults.

From this perspective, a more accurate account of the social factors that could originate SES differences in children's performance will require a combination of methodologies, including ethnographic studies that explore the pictorial symbol environments of the children by naturalistic observations as well as extended interviews with parents to explore their beliefs about drawing. Additionally, social practices outside of the home (e.g., educational materials and activities in preschools, learning about specific graphic techniques) that may influence drawing competence also need to be analyzed to clarify the variety of contexts in which drawing development first occurs.

It has also been reported that another group of factors that impact drawing performance comes from variables associated to task constraints. Tasks that manipulated the use of language (verbal labels), familiarity with the objects depicted, or complexity of the stimuli to be drawn were systematically examined in MSES children (Callaghan, 1999, 2000; Golomb, 2004) and were used in these studies to explore how children of different socioeconomic groups assign referential identities to very simple drawings that have not been verbally labeled. However, the question of whether these factors, as well as scaffolding, could have a facilitative effect in LSES children's performance, whereby affecting the emergence of comprehension or production of graphic representations, remains to be answered.

Finally, these future investigations would be complemented by exploring the cognitive abilities that underpin pictorial competence. For example, social-communicative understanding and theory of mind are in direct relation to drawing developments (Callaghan, Rochat, & Corbit, 2012; Tomasello, 1999).

These skills need to be studied in young children from different SES within a cultural group with at least two purposes. First, from a theoretical point of view, to deepen our understanding of why drawing development progresses rather than when and how it does so. Second, from a practical perspective, to design decisive childhood interventions to reduce SES developmental inequalities that may affect symbolic competence. This approach would have a crucial impact on early formal education in general and pedagogy in the arts in particular.

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