Intencionalidad y producción gráfica / Intentionality and graphic production

**Dibujar para otros: influencia de la intencionalidad referencial en la producción temprana de dibujos**

**Drawing for others: Influence of referential intention in early production of drawings**

Romina A. Vivaldi and Analía M. Salsa

*Consejo Nacional de Investigaciones Científicas y Técnicas - CONICET*

**Resumen:** Este estudio examina si y cómo la presencia de un adulto como receptor de los dibujos infantiles influye en los primeros pasos de la producción figurativa al enfatizar la intencionalidad referencial del niño como dibujante. Para ello se comparó la producción figurativa con modelo de niños de 3 años en cuatro condiciones experimentales, tres condiciones con un receptor (CR) y una condición sin receptor. En las condiciones con receptor (CR Retroalimentación Lingüística, CR Demostración Gráfica y CR Producto Gráfico) los niños dibujaban para que un adulto usara las representaciones gráficas para identificar objetos escondidos en cajas idénticas; las condiciones variaban en función de las acciones del receptor frente a los dibujos no figurativos. Los resultados indican que la presencia del receptor impactó en la producción figurativa sólo cuando el adulto demostró a los niños cómo crear los dibujos con la intención de comunicar la identidad de sus referentes (CR Demostración Gráfica). Aunque el dibujo suele concebirse como una actividad solitaria, estos resultados sugieren que la producción figurativa emergería en contextos comunicativos entre dibujantes y receptores.

**Palabras clave:** dibujo; producción; intención; receptor

**Abstract:** This study examines if and how the presence of an adult as a receptive agent of children’s drawings has an effect on the early production of pictorial symbols by emphasizing the children’s referential intention as drawers. To this end, we compared 3-year-old children’s representational drawings with a model in four experimental conditions, three conditions with an adult as a receptive agent and one condition without a receiver. In the conditions with a receiver (Linguistic Feedback, Graphic Demonstration, and Graphic Product) children were explicitly asked to draw for an adult, who had to use the children’s pictures to find hidden objects in identical boxes; the conditions differed in the adult’s actions with non-representational drawings. The results indicate that the presence of the receiver had an impact on representational production only when the adult demonstrated how to create the drawings with the intent of communicating the identity of the objects (Graphic Demonstration). Although drawing is typically viewed as a solitary activity, these results suggest that representational drawings may emerge in communicative contexts between drawers and receivers.

**Keywords:** drawing; production; intention; receiver

Representational drawings consist of shapes sketched out on paper that are recognizable as specific, real objects (Cox, 2005; Golomb, 2004; Jolley, 2010). Unlike other graphic representations such as writing and numerals, this class of drawings possesses an iconic (Peirce, 1932) or figurative (Piaget, 1959) nature: its properties (shape, color, spatial position) directly refer to the same properties that its referents have. Yet, we are able to represent both an orange and the planet Mars with an orange circle. In both cases the drawings possess a certain similarity in shape to its referents, so its meaning will be almost exclusively determined by the drawer's referential intention; the picturewill be "an orange" only if it was created with the intention of representing an orange. The research presented here focuses on the role of the drawer's referential intention in the first steps of representational graphic production.

Studies interested in understanding how children develop their representational graphic production skills show that this process begins during the second year of life, that it is spontaneously manifested in representational drawings made between three and four years of age, and it continues to steadily develop during infancy and toddlerhood (Winner, 2006). That said, children do not usually produce their first drawings on their own, but in interaction with adults and other children (Rogoff, 2003; Vygotsky, 1978). Adults often provide children with verbal and nonverbal assistance during collaborative graphic activities, helping them to learn to create and to use these symbols (Braswell & Callanan, 2003; Yamagata, 1997). Children talk about their drawings with other children, including critiquing their own representations and those of their peers in terms of graphic skills and content (Boyatzis & Albertini, 2000; Thompson, 1999).

Drawings are therefore public representations that transmit information, for which the referential intention is an inherently communicative intention. Recent theories (Callaghan, 2013; Callaghan & Rochat, 2008) hold that representational production signals the beginning of a long and complex developmental process dedicated to the refinement of intentional communication with other people throughpictures. Despite numerous studies existing in the field of developmental research on graphic production and on social cognition processes that enable its development in children, the way in which referential intention and representational production are mutually related has been a relatively unexplored question up until now.

**Referential Intention and Graphic Production**

Several studies on language acquisition have shown that the understanding of communicative intentions starts to develop in the second year of life (Bloom, 2000; Tomasello, 2003). “Reading”intentions in communicative exchanges is essentially “reading”intentions in the symbols produced by other people. Therefore, Tomasello (1999) suggested that to learn to usepictures, children need to understand that these symbols are motivated by a communicative intention that takes place within the context of a jointedattentional scenewhich provides its social-cognitive foundation. In this context, children come to understand that their communicative partner is using a drawing as a means for conveyinginformation, as well as understanding what the meaning of that representation is. As children increase their communicative experiences with drawings created by other people, they learn about the purpose that drawings serve and apply this knowledge to the production of their own graphic representations.

Freeman (2008) also emphasized the importance of intentionality by maintaining that the comprehension and production of drawings involves the recognition of relationships between the representation and three elements: the referent, the producer (drawer), and the receiver (observer). Knowledge of the images requires an understanding that these representations are tools that transmit information from one person to another, from the drawer to the receiver. In addition, the drawing's users develop expectations around the drawers and their intentions. From this perspective, drawings are manifestations from the mind of the drawer, of the receiver, and their interconnections (Wollheim, 1993).

Empirical studies addressing referential intention and the development of drawing in childhood have been mainly focused on the adult as drawer and the child as receiver, examining when and how young children’sunderstanding of the drawer's intention emerges as a determining factor for knowing the meanings of pictures(Armitage & Allen, 2015; Browne & Woolley, 2001; Gelman & Ebeling, 1998; Hartley & Allen, 2014; Preissler & Bloom, 2008; Vivaldi & Salsa, 2014). Up until now, little has been known regarding children's recognition of intention in situations in which they themselves produce drawings.

Among the studies that have considered children as drawers, we should point out, on the one hand, the study performed by Bloom and Markson (1998). The authors asked 3-year-old and 4-year-old children and an experimenter to draw a balloon and a lollypop in order to obtain pairs of drawings that did not reflect substantial differences in their shapes (balloon, lollypop, child/experimenter). However, when the children had to name the drawings they correctly identified their referents. Thus, the children from both age groups demonstrated an understanding of the drawings' meanings on the basis of their referential intention, even when the shape did not allow for these intentions to be distinguished.

On the other hand, in a recent study, Hartley and Allen (2015) showed 3-year-old and 5-year-old children a series of ambiguous drawings, with shapes that could refer to more than one specific referent; half of the children explained that the drawer's intention (a fictitious person) had been to represent a certain object (a sun) and the other half that the drawer had created the pictureby accident. The children then drew the picturethat the experimenter displayed. The results showed that the children had taken the fictitious drawer's intention into account when creating their own drawings: they produced representational drawings if the drawer had deliberately created the model pictureand ambiguous representations if it had been created by accident.

Callaghan (1999) employed a different procedure for exploring the relationships between the child as drawer and an adult as receiver. In this study, 2, 3, and 4-year-old children drew, with the model present, simple objects that could be graphically represented with circles and lines. Afterward, a game was played in which the children had to use their drawings for communicating to an experimenter, who had not observed them drawing, what object to throw through a tunnel*.* Finally, the children drew the objects a second time. The hypothesis was that the children would improve their graphic production if during the game they discovered that their drawings did not communicate the object's identity to the adult.

Before the game, the 2-year-old children produced a lesser number of representational drawings than the 3-year-olds, who in turn produced less representational drawings than the 4-year-old children. The same developmental tendency was registered in the second series of drawings, with significant differences between the first and second series drawn by the 3 and 4-year-olds. In the second study, linguistic feedbackfrom the experimenter was incorporated into the game in the face of the non-representational drawings: in these cases, she said to the children "when I look at these picture I can’t tell which one goes with this". This experimental manipulation had a greater effect on the 4-year-olds; in both studies the performance of the 3-year-olds was around 50% of representational drawings.

Finally, little is known about the differential impact of different types of support from adults on children's drawings. A set of studies (Burkitt, Jolley, & Rose, 2010; Rose, Jolley, & Burkitt, 2006) inquired into the ideas of school aged children regarding intervening external support in the learning of drawing. The children said that the graphic demonstrations from adults and their explicit verbal instructions were sources of learning in their development as drawers.

**Aims and Hypothesis**

The present study's objective consists of looking in depth at the emergence of representational production in a socio-referential context in which the children's intention as drawers is emphasized to them. Specifically, we examine if and how the presence of an adult as the receptive agent of the children's drawings influences the representational production. To do this, we adapted the task designed by Callaghan (1999), starting from the idea that 3-year-old children would benefit if the adult provided graphic support, with the purpose of influencing their referential intention, emphasizing the drawing activity's goal. To this end, we compared 3-year-old children’s representational drawings with a model in four experimental conditions, three conditions with an adult as a receptive agent and one condition without a receiver. In the conditions with a receiver (hereinafter WR) children drew for an adult, who would use their representational drawings to solve a task: to identify a series of objects hidden in identical boxes. The Linguistic Feedback WR, Graphic Demonstration WR, and Graphic Product WR differed in the adult's behavior in the face of the children's non-representational drawings: they verbally signaled the non-representational character of the drawing, they drew the object in front of the child, or they presented a finished drawing.

This study intends to address two important shortcomings in previous research. On one hand, although various studies have examined the communicative function of graphic representations by asking children of different ages to write down information so that the other person can solve a problem (Bolger & Karmiloff-Smith, 1990; Lee & Karmiloff-Smith, 1996), the representations were not actually used by the other person and so the children therefore never knew if they had been useful to the receiver. On the other hand, there is little evidence regarding the differential impact of linguistic and graphic support from adults on children's drawings.

Our hypothesis was that linguistic feedback from an adult would direct the children's attention only to the representational (therefore, non-communicative) nature of the graphic production; in contrast, conditions with graphic support would additionally demonstrate to the receiver how to depict the drawer's referential intention on the paper. The adult's graphic support would make it easier for the children to discover that their drawings were to be a communicative resource understood intersubjectively from both sides of the drawer-receiver interaction.

With respect to differences between the Graphic Demonstration CR and the Graphic Product CR, our hypothesis was that to observe the receiver draw would be a better clue for the drawer's intention since the adult would emphasize the goal of the graphic actions (the drawing's representational nature) to the children, as well as the means of achieving it. Thus, a role-reversal imitation process would be produced (Tomasello, 1999, 2003): the child would learn to create a drawing for the adult in the same way in which the adult created it for him.

**Method**

**Participants**

Fifty-eight 3-year-old children (age range: +/- 1 month), who attended preschool in the city of Rosario (Santa Fe, Argentina), participated in this study. The families had a medium socioeconomic status, based on educational level (associate degree courses and university studies) and the mother and fathers' occupation (professionals and business men and women). The children were randomly assigned to the four experimental conditions: Linguistic Feedback CR(*N* = 15, *M*age = 2 years and 11 months, 8 girls), Graphic Demonstration CR(*N* = 14, *M*age = 3 years, 7 girls), Graphic Product CR (*N* = 14, *M*age= 3 years and 1 month, 6 girls), and No Receiver (*N* = 15, *M*age= 3 years, 6 girls)*.* Two children were not included in the study since they gave up on the task before it was completed.

 Regarding ethical concerns, after receiving authorization from the schools, the responsible adults were informed of the study's details and requirements and were asked to provide written authorization for their child's participation, guaranteeing them information confidentiality.

**Materials**

Five blue objects were used. These were built with expanded polystyrene spheres and wooden sticks, similar to those designed by Callaghan (1999): (1) a ball (33 cm in diameter); (2) a ball the same size as the first, with wooden sticks throughout its diameter; (3) a smaller ball than the first and second (12.5 cm in diameter); (4) two linked balls (22 cm in diameter each); and (5) a wooden rod (23.5 cm in length). These objects could be drawn with circles and lines and had no distinguishing name to identify them so that the effects of verbal labels in graphic production could be controlled.

No. 2 pencils and sheets of A4 paper were used, and in the conditions with a receiver, five equally sized, green boxes were also used (20 x 32 x 11.5 cm). In the Graphic Product WR, five drawings of the objects, made in black pencil on A4 paper, were also used. These drawings and images of the objects are shown in Figure 1.

---------------------------------------------------------

Insert Figure 1 approx. here

---------------------------------------------------------

**Procedure**

The experimental sessions were carried out individually in an available room in the schools that the children attended. In the four experimental conditions the children drew the five objects twice, once before and once after playing (Series 1 and 2). The sessions began with a brief familiarization period in which the children were told about the activities that would occur on that day. Once that familiarization period was completed, the drawing task began.

**Conditions with a receiver (WR).** Beginning in the familiarization phase, the children worked with two experimenters (henceforth E1 and E2) present in the room. In the *Linguistic Feedback WR*, E1 explained to the children: "We are going to play with toys and drawings. What you have to do is draw pictures of the toys. Then together we are going to hide the toys and E2 will have to use your drawings to figure out where we hid each one." E2 left the room and E1 showed the objects one by one, offering them to the child so that he/she could examine them for several seconds. E1 would then introduce the five identical boxes and ask the child to help her place each object in a box. The boxes with the objects were lined up along the floor, near the desk that was used for drawing, in view of the child.

After the materials had been presented, E1 said: "E2 is going to use your drawings to figure out where we hid the toys. In order for E2 to be able to use them, the drawings have to look like the toys. For example, the drawing for this toy (object 1) has to look like it and not like the other toys (pointing to the remaining objects in the boxes)." Afterward, E1 picked up a single object, held it in front of the child and asked him/her to draw it (Set 1). E1 provided the child with a new sheet of paper for each drawing and identified the object represented by writing the name on the back of the paper. Upon finishing the drawing, E1 and the child placed the object in its box, closed it up, and placed the drawing over the top. The order of presentation of the objects was offset in such a way that half of the children drew the objects in one order and the other half in the reverse order. One of the orders of presentation began with object 1 and the other with object 5: these drawings were requested first because they demanded the production of simpler forms, a circle and a line.

Once Series 1 of the drawings was completed, E1 called E2 back into the room. E1 took a closed box, held the drawing next to the child and E2 said "Look! (pointing to the drawing) Here you drew...". If the drawing was representational, E2 identified the content of the box (for example, with the representational drawing of object 3, E2 said "A small ball"); E1 and the child opened the box and E2 exclaimed "I guessed it!". If the drawing was not representational, E2 named a different object (for example, with a non-representational drawing of object 3, she said "A ball with a lot of sticks"); E1 and the child opened the box and E2 exclaimed: "Oh, that's not the toy! I could not guess what the toy hidden in this box was by using your drawing." This procedure was repeated with the remaining boxes.

Once all the boxes were opened, E2 invited the child to play again. E2 left the room and E1 asked the child to draw the objects again on other sheets of paper (Set 2). After the child finished a drawing, the experimenter and the child put the object in its box and then placed the drawing over the top. The objects were presented in the reverse order to the one assigned to the child in Set 1. When E2 returned to the room, the game was repeated using Set 2 drawings. In this phase of the task, E2 correctly identified each hidden toy even if the drawing was not representational so that the child would have a positive experience from the experimental session.

The procedures for Graphic Demonstration WR and Graphic Product WR were identical to those from Linguistic Feedback WR, with the exception of E2's behavior in the face of the non-representational drawings. In the *Graphic Demonstration WR*, after saying "Oh, that's not that toy! I could not guess what the toy hidden in this box was by using your drawing", E2 explained: "I would draw the toy (pointing to the object) this way to be able to guess what toy it is." E2 would then take a sheet of paper and a pencil, look carefully at the object and draw it slowly. Upon finishing, she would show the drawing ("Look at my drawing!") and then remove it from the child's view.

In the *Graphic Product WR*, with a non-representational drawing, E2 would say: "Oh, that's not the toy! I could not guess what the toy hidden in this box was by using your drawing. I already played this game with one of your classmates and I am going to show you how he/she drew this toy in order to guess what it is." E2 immediately presented a finished drawing of the hidden object ("Look at my drawing!"), held it in front of the child for several seconds and then removed it from the child's sight.

**No Receiver Condition.** This condition allowed control over the possible learning effects from the graphic task.The children worked alone with E1. After presenting the objects in the same way as in the WR conditions, E1 invited the child to draw them and explained: "Your drawings have to look like the toys. For example, the drawing for this toy (object 1) has to look like it and not like the other toys (pointing to the remaining objects)." Afterward, E1 picked up a single object, held it in front of the child and asked him/her to draw it (Set 1). The child played for a few minutes with E1 after finishing the drawings. Special attention was paid to the duration of the free play so that it was similar in length to the playtime with E2 in the CR conditions. Immediately after, E1 asked the child to draw the objects again, on new sheets of paper, before leaving the room (Set 2).

**Coding**

The dependent variable was the number of representational drawings produced by the children in Set 1 and 2. In line with the study from Callaghan (1999), the drawings were coded as representational if they possessed the four possible distinctions between object 1 and the other objects:

* Combination of shapes (circles and lines). The drawing of object 2 had to contain lines that departed from the circle, unlike the drawing of object 1;
* Size. The object 3 drawing had to be a smaller circle than in the object 1 drawing;
* Combination of shapes (circles). The object 4 drawing had to consist of two circles, unlike the object 1 drawing;
* Shape.The object 5 drawing had to be an open line.

In accordance with these criteria, the children could obtain a mark of 0 to 4 on the representational drawings in each set. The coding system's reliability was controlled for by randomly selecting pairs of drawings from each distinction from 25% of the children. These drawings were then independently coded by two researchers who did not participate in the data collection. Cohen's Kappa coefficient was applied in order to analyze coincidence in the coding of the drawings. The interjudge agreement was high (95%, *k* = .90).

**Results**

In order to determine if and how the presence of a receptive agent of children's drawings had an effect on representational production, the data analysis first compared the number of representational drawings in Set 1 and 2 according to the experimental condition and then in each condition according to the series. These analyses are shown in the first part of this section. The second part presents an analysis of the children's individual graphic performance. Nonparametric statistical tests were applied in all the cases given that the Kolmogorov-Smirnov test showed that the contrast distribution did not conform to the norm (*z* = .192, *p* = .001). The SPSS statistical software package, version 20, was used for the analyses.

It should be noted that effects in graphic production according to the children's gender (*U* = 1105, *p* = .636) and the order of presentation of the objects (*U* = 1112, *p* = .271) were not recorded, therefore these variables will not be discussed hereinafter. In order to facilitate the interpretation of the information, percentages were used in the text and in the figures.

**Effects of the Experiential Condition**

The production of representational drawings in Set 1 and 2 of the four experimental conditions can be seen in Figure 2. In Set 1, the number of representational drawings was lower than in the ER and No Receiver conditions (from 27% to 43%). When comparing representational production, the Kruskal-Wallis test did not show a significant effect in the condition variable, *χ*2(3, *N* = 58) = 1.16, *p* = .657. Therefore, although the presence of a receptive agent involved emphasizing to the children in a socio-referential context for whom and for what reason they were drawing, it did not impact the children's drawings.

---------------------------------------------------------

Insert Figure 2 approx. here

---------------------------------------------------------

In SeT 2 the statistical analysis yielded significant differences in the number of representational drawings according to condition, *χ*2 (3, *N* = 58) =14.43, *p* = .002. Through comparisons of pairs (*Mann-Whitney U test*), it was observed that the children's graphic performance in the Graphic Demonstration WR (77%) was significantly higher than performance in the Linguistic Feedback WR (38%) (*U* = 45, *p* = .008) and No Receiver (26%) (*U* = 183.5, *p* = .001), not registering differences between these two last conditions (*U* = 138, *p* = .389). The comparison between conditions with graphic support, Graphic Demonstration WR and Graphic Product WR (57%) yielded a marginally significant difference (*U* = 60, *p* =.085). Finally, representational production in the Graphic Product WR did not differ from production in the Linguistic Feedback WR (*U*= 139, *p* =.146), but did differ in terms of performance in the No Receiver condition (*U* = 161, *p* =.018).

The effect of the receptive agent's actions in the face of non-representational drawings was clearer when comparing the graphic output in each experimental condition (Set 1 *vs.* Set 2). These analyses (Wilcoxon signed rank test) showed changes in representational production only in the Graphic Demonstration WR, *Z* = 3.169, *p* =.001. No statistically significant differences were found between Set 1 and 2 in the Linguistic Feedback WR (*Z* = 1.633, *p* = .102), Graphic Product WR (*Z* = 1.512, *p* = .131), or No Receiver (*Z* = .513, *p* = .608).

From these results it follows that, as we predicted, the linguistic feedback from the receiver who explained the non-representational nature of the children's drawings to them did not have any effect on representational production. Moreover, performance in the Linguistic Feedback CR was similar to that in the No Receiver condition. The children adapted the representational nature of their drawings when the adult provided them with graphic support, creating drawings for them that communicated the objects' identity.

**Individual Graphic Performance**

As we previously mentioned, in each Set the children could obtain a scoreof 0 to 4 representational drawings. In order to study individual graphic performance, we grouped together the children who produced "at least 1" representational drawing and those who achieved a scoreof "4" (Table 1). Children tend to create at least one representational drawing in this task when they use a circle to represent all the objects, a strategy that would demonstrate a transition between a scribble and a representational drawing (Callaghan, 1999). To achieve the "4" scoreit was necessary to not only represent the distinction of shapes between a ball and a stick with a circle and an open line, but to also depict combinations of shapes on the paper (circles and lines for object 2 and two circles for object 4) and differences in size between the shapes (object 3) (see Figure 1).

---------------------------------------------------------

Insert Table 1 approx. here

---------------------------------------------------------

The analysis of individual graphic performance generated a pattern of results similar to that reported in the previous section. As shown in Table 1, in the four conditions a similar proportion of children scored "at least 1" and "4" representational drawings in Set 1. Nevertheless, upon comparing the number of children with "4" in Set 1 and 2, McNemar's test indicated significant differences in the Graphic Demonstration WR (*p* = .016). Whereas in Set 1 the production from only one child (7%) was representational, the support from the receiver drawing the objects made it possible for eight children (57%) to create representational drawings of the contents of all the boxes at the end of the task (Set 2). There were no significant differences in the remaining conditions regarding the number of children with a mark of "4" according to the series (*p* = 1 in the three cases).

With that said, what changes did the children introduce into their drawings after the receptive agent drew for them? To answer this question we had to take into account the number of representational drawings by object in the Graphic Demonstration WR. The frequency analysis (McNemar) according to series was significant for object 2 (Set 1 = 14%, Set 2 = 64%, *p* = .016) and for object 5 (Set 1 = 43%, Set 2 = 93%, *p* = .004), but was not so for object 3 (Set 1 = 64%, Set 2 = 86%, *p* = .250) and 4 (Set 1 = 29%, Set2 = 50%, *p* = .125).

Figure 3 includes examples of drawings of objects 2 and 5 that enable us to better understand these results. When the children drew with a model present, they controlled the movements performed and compared the drawing with the model that they had in front of them. They began by sketching the details that they considered important and then continued with those that, in their judgment, were less relevant. In the case of the drawings of object 2 (upper part of Figure 3), most of the children from the Graphic Demonstration WR incorporated the lines departing from the new circle in Set 2. The receiver's drawings would have led the children to interpret and depict what the distinctive details for that object were so that the drawing could communicate its identity.

---------------------------------------------------------

Insert Figure 3 approx. here

---------------------------------------------------------

In order to be representational, the drawings of object 5 required the representation of an open line; however, a large number of the children used a closed line for their representation (lower part of Figure 3), in the same way as had been done for the other objects. The high performance level achieved in Set 2 for this model (93%) showed the effect of the receptive agent's drawings, as this type of line was also present in the children's drawings. Therefore, the difficulties in representing object 5 in Set 1 (43%) did not seem to be due to the task's graphic demand, but because ofthe communicative function of drawing.

**Discussion**

The results indicate that the presence of a receiver has an impact on representational production only when the adult demonstrates how to create the drawings with the intent of communicating the identity of the objects. In this way, the present study contributes empirical evidence to the theoretical developments of Tomasello (1999), Freeman (2008), and Callaghan (2013), who uphold that children learn to produce and use images in socio-referential contexts in which the producer assigns meaning to the representation and the receiver interprets this meaning by decoding the drawer's intentions. In this respect, the study expands on the findings from previous research on intentionality and graphic production (Bloom & Markson, 1998; Hartley & Allen, 2015) from a new perspective: referential intention is an inherently communicative intention.

These results allow us to arrive at several conclusions. The presence of an adult using the children's drawings and providing support when the productions were non-representational had the aim of explaining to the children that drawings are public representations that can communicate information to other people and that some drawings can be more useful than others in achieving this purpose. The creation of a context that stressed the communicative function of drawing allowed the representational performance of the children in the Graphic Demonstration WR to not only be higher than what was reached in the No Receiver condition, but also in other studies with 3-year-old children and tasks with similar graphic models (Callaghan, 1999; Callaghan, Rochat, & Corbit, 2012; Salsa, 2013).

However, in order to produce a functionally communicative drawing the children needed to bear in mind that their knowledge of the boxes' content was different from the receiver's knowledge at the time of interpreting and using the drawings. The qualitative analysis of production in the Graphic Demonstration WR reveals that in Set 1 the children failed to completely represent the information that they had to communicate, including distinctive details of the objects in Set 2. This difficulty was not based on the task's graphic demand, which was relatively low compared with other studies (Bolger & Karmiloff-Smith, 1991; Lee & Karmiloff-Smith, 1996), since the children had to only represent the object's identity and draw a simple graphic repertoire (circles and lines) to do this. Consequently, we can conclude that before the receiver made any drawings, the children were not aware that their drawings could be viewed as incomplete when the adult had to use them. According to Beal (1989), this data could be interpreted as a difficulty in distinguishing between the two states of knowledge and in understanding that the drawing was the means by which this difference could be reduced. Knowing what information to represent so that an pictureis useful to another person requires the consideration of said representation's purpose: the receiver's drawings would appear to have captured the children's attention regarding the features of the objects that communicated its identity.

With regard to the receptive agent's actions with the non-representational drawings, this study enabled a comparison to be made between linguistic and graphic support, which are external aids that impact the learning of drawing according to the perspective of school-age children (Burkitt et al, 2010; Rose et al., 2006). In the first place, performance in the Linguistic Feedback WR was lower, but had a similar trend as that of the results reported by Callaghan (1999) for this age group. Just as we predicted, verbally signaling to children that their drawings were not useful for the receiver in solving a task could have helped the children to place themselves within the user's intentional space and to establish the reason that they were creating the drawing for, but was not effective for adapting the drawing's representational characteristics to the receiver's needs.

In the second place, for the Graphic Demonstration WR and Graphic Product WR, in both cases the children observed a graphic model from the receiver that could have acted as a pictorial source of learning: these models displayed the already determined shape and the amount of the graphic composition's elements, their relative proportion, and their disposition within the space (Echenique, Márquez, & Scheuer, 2014). However, over and above the fact that the graphic models were identical in the two conditions, a differential effect was recorded when the drawing was performed in front of the children. It is therefore possible to think that in the Graphic Demonstration CR the adult placed into play the means to be used for arriving at a graphic model, causing the children to divide their attention, which could have favored a role reversal imitation process. According to Tomasello (1999, 2003), in order to learn to use a communicative symbol, a child needs to reverse roles with the adult in the cultural learning process and then use with the adult what the adult has used with him/her. This imitative learning creates an intersubjectively understood symbol, which is essential in the proposed task for the children to understand what information to depict on the paper in order for the drawing to fulfill a referential and communicative function for the receiver.

Imitative learning has been observed in children of very young ages with regard to pictorial competence. Callaghan, Rochat, MacGillivray, and MacLellan (2004) demonstrated that children between the ages of 1 year and 1 and a half years imitate the referential (pointing) or manipulative (shaking) actions of an adult with graphic representations. The children increasingly contemplated the pictureswhen the adult modeled referential actions and tended to touch them when the adult modeled manipulative actions, thus showing that they were in tune with the intentions of others with this particular type of objects. We believe that future studies on the comparison and production of drawings should deepen their analysis of the imitative learning process, studying the acquisition of linguistic symbols in detail.

Finally, drawing in front of children, used as a clue towards the drawer's intention, has effects over the comprehension of the drawings when the adult is the drawer and the child is the receptive agent. Various studies (Preissler & Bloom, 2008; Vivaldi & Salsa, 2014) show that creating a drawing in front of children, unlike presenting a finished drawing, facilitates the understanding of the drawing-referent linkfor children between the ages of 2 and 2 and a half years. The results from our study expand upon this finding to include the emergence of representational production. Just as Callaghan (2013) argued, representational production is based on symbolic comprehension and communicative intentions play a central role in both processes.

It is important to point out certain limitations of this study. On the one hand, the objects to be drawn were monochromatic devices designed to facilitate the production of figurative representations in very young children (who were developmentally found in the transition between scribbles and representational drawing) and to control the impact of verbal labels (Callaghan, 1999). The decision to use these objects as models prompted the shape to be the only property to depict on the paper, so that the drawings would have a communicative function. In future studies, providing the students with the possibility of drawing familiar objects of distinct color would allow for the examination of how they adapt their production to the needs of the receiver even if they were incapable of reproducing the shape of the objects to represent.

On the other hand, given the particular characteristics of the graphic production task, we considered the graphic demonstration variations (process plus production) and the finished product. Nevertheless, the possibilities that linguistic feedback can provide should be investigated more in depth, designing a more informative condition in which the adult would verbally signal the graphic actions that the children observe during the demonstration (for example, with object 2, "I would draw this toy this way, with a large circle and many sticks").

In addition, the changes registered in production between Series 1 and 2 in the Graphic Demonstration WR would be at a microgenetic level, in other words, changes that occur within the limits of an experiential session. There is some controversy regarding whether external intervention might generate changes in childhood graphic production and in what kind of permanence these changes would have over time. On the one hand, Karmiloff-Smith (1992) contends that the changes in the drawings are predominately produced due to endogenous causes, through the construction and modification of children's representations regarding how to draw. On the other hand, some studies (Braswell & Callanan, 2003; Yamagata, 1997) have successfully introduced modifications exogenously, with adult feedback. The use of longitudinal designs may be able to more clearly explain the development of graphic production within an interplay of endogenous and exogenous causes.

Another challenge for future studies would be to create situations in which the same child is both drawer and receiver, who must draw to solve a problem, and to also create socio-referential contexts in which the receptive agent is another child of equal or same age as the drawer. The propagation of picturesin existing cultural practices challenges researchers and educators to look deeper into the understanding of knowledge regarding drawings within a framework between drawer, picture, and receiver; privileging the communicative contexts in which these linksoccur and relegating the solipsistic conceptions of children's drawings.

Acknowledgements:

This study was performed thanks to funding granted by the Agencia Nacional de Promoción Científica y Tecnológica de Argentina (PICT 2012 Nº 1319) and by CONICET (PIP 2012 N° 0864). The authors also wish to thank the students and teachers who participated in the research.

Table 1

*Number (and percentage) of children who reached a score of "at least 1" and "4" representational drawings in Set 1 and 2 according to the experiential condition*

|  |  |  |
| --- | --- | --- |
|  | "At least 1" | "4" |
| Condition | Set 1*n* (%) | Set 2*n* (%) | Set 1*n* (%) | Set 2*n* (%) |
| Linguistic Feedback WR (*n* = 15)  | 9 (60) | 9 (60) | 2 (13) | 2 (13) |
| Graphic Demonstration WR (*n* = 14)  | 9 (64) | 5 (36) | 1 (7) | 8 (57) |
| Graphic Product WR (*n* = 14)  | 8 (57)  | 10 (71) | 2 (14) | 2 (14) |
| No Receiver (*n* = 15) | 7 (47) | 9 (60) | 1 (7) | 0  |



*Figure 1.* Images of objects and examples of the adult's drawings used in this study.



*Figure 2.* Percentages of representational drawings in Series 1 and 2 according to the experiential condition.

**TN:** Along left side of graph: Percentage of representational drawings.

 Along bottom of graph from left to right:

 No Receiver Linguistic Graphic Graphic

 Feedback Demonstration Product

 WR WR WR

 Along right side: Set 1

 Set 2



*Figure 3*. Examples of drawings of objects 2 (upper part) and 5 (lower part) in the Graphic Demonstration CR.

**TN: (**Set 1) (Set 2)

 (Set 1) (Set 2)