Chapter 10

The Relationship Between Production and Comprehension of Representational Drawing

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Introduction

In this chapter we consider a range of approaches to investigating the relationship between children’s production and comprehension of representational drawing. First, we present studies that examine whether children’s production lags their cognitive and affective comprehension of drawings, or if the two develop concurrently. Second, we report on the developmental shift in children’s estimation and self-efficacy of their own drawings. Third, we explore the relationship between children’s understanding of the developmental sequence in children’s drawing development, and the causes of its development, with their own production level. We interpret these findings in terms of the varying graphic models children represent both graphically and mentally. Finally, we suggest future lines of enquiry that will build upon both empirical knowledge and theoretical understanding of the interaction in development between production and comprehension in the drawing domain.

In order to explore the relationship between children’s production and comprehension of representational drawing we first need to consider what we mean by production and comprehension, and also to understand their underlying processes and elements. Picture production refers to the creation of the picture, and involves a number of cognitive, graphic and motor demands placed upon the child. For instance, when producing a representational drawing from memory the child may hold in mind a mental image of their chosen drawing topic or scene, and decide which features of this image they want to represent and how to depict them. Graphic schemas need to be chosen to reflect the child’s choices, the execution of which depends upon the child’s drawing skill and motor control of wrist and fingers. Furthermore, the child needs not only to attend to the line currently being drawn but also to its placement relative to other lines drawn or planned to be drawn, so that the finished drawing presents a coherent and spatially organized set of lines for the topic depicted.
Picture comprehension, in contrast to picture production, appears on the surface to be more straightforward. In the classic Hochberg and Brooks (1962) study the authors report a 19-month-old boy brought up since birth in an environment that provided only minimal exposure to pictures. Line drawings and photographs of objects and toys familiar to the boy were then prepared and presented to him. Despite the lack of experience with pictures he was able to name many of the pictures’ contents when presented with them for the first time at 19 months of age. There is evidence from habituation studies that even babies in the first months of life can notice a similarity between a three-dimensional object and its picture (DeLoache, Strauss, & Maynard, 1979). Such an early ability to recognize depictions of referents (a referent being the three-dimensional object that the picture refers to) is no doubt due to the iconic similarity that representational pictures have with their referents. The apparently simpler process of recognition compared to the processes of production is borne out by the developmental delay in children producing representational drawings compared to when they appear to recognize them. Even the most rudimentary representational drawing is not typically created by children until around 3 years of age.

Nevertheless, recognizing a referent from its symbolic representation does not mean that the child fully understands its meaning. For example, in the case of language a young child may recognize sounds and words but not necessarily understand their full meaning or significance. Similarly, in the case of pictures there is much more to learn about a picture than merely recognizing its contents. In the world of adult art an art critic may comment about a painting on a number of aspects of pictorial comprehension. For instance, the materials and processes used to create it, the intention and interpretations of the picture, its expression of mood or concepts, the style in which it has been painted, and the art tradition it falls under. Furthermore, these cognitive responses may be supplemented by the art critic’s affective and personal evaluation of the painting, such as whether he or she likes it or not, and how the picture affects the art critic’s feelings. These different facets of understanding a painting (both cognitive and affective) form a framework for the comprehension of pictures.

Although children are not expected to understand the deep complexities of adult art and the art culture that surrounds works of art, they nevertheless are able to cognitively and affectively respond to pictures beyond the level of mere recognition (see Trautner, Chap. 11). In the next section we will discuss some of the key responses children make to pictures from a developmental perspective, as well as outlining the developing progression of their own picture production.

**Development of children’s production and comprehension of pictures**

Since the latter part of the 19th century when children’s drawings were first being subjected to scientific study there has been a wealth of literature on the developmental changes in the representational forms children use. Considering the work derived from
natural observations of children drawing as well as experimental studies (for reviews, see Cox, 2005; Golomb, 2004; Jolley, in press) there is a general consensus that children’s drawing production develops from disorganized scribbles to representational forms of increasing visual realism. But a statement of shift from non-representation to visual realism is too simplistic as the development of realistic drawing in childhood does not follow a linear pattern of steady incremental shifts with age. For instance, in Luquet’s (1927/2001) account of drawing development he argued that children produce different styles of realism before embarking upon a desire to capture the visual likeness of topics. In particular, he discussed a graphic system of intellectual realism that children adopt prior to visual realism. In intellectual realism the child is concerned with depicting what they regard as the most salient or significant features of the subject matter as well as drawing the features in their generic shape. In effect this means that a drawing shows more features than could be seen from any single perspective, and that features tend to be drawn in their full shape rather than the partial shapes more typically observed when viewing an object or scene (e.g., because another feature in the foreground blocks one’s view of the whole shape of a behind feature). The child uses certain techniques to create this desired effect, such as separation of details, transparency, drawing some features from an air-view plan, and folding out certain parts of the topic.

Luquet observed that there then comes a point in the child’s drawing development that they begin to notice that their multi-perspective drawings do not reflect how objects actually look in reality. Consequently, they begin to try to draw only those elements of a scene that can be seen from one vantage point and in the shape that they appear from that perspective. Accordingly, they start to drop the aforementioned techniques of intellectual realism in preference of occlusion, suppression of some details and perspective. Children are in essence moving away from drawing an internal model of the subject matter towards a visual model (for further details see Jolley, in press).

Research on children’s comprehension of pictures has adopted a variety of different methodological approaches (picture selection tasks to semi-structured interviews) and pictorial forms (colored line drawings to adult paintings). Machotka (1966) asked children to select from artists’ paintings the ones they preferred and to justify their selections. Children younger than 7 years tended to focus on color and subject matter, while the most frequent responses made by 7- to 11-year-olds referred to the realism of the subject matter depicted. Parsons (1987) carried out semi-structured interviews with children and adults, asking them to comment on a selection of works of art. Color was a prominent feature among the younger children’s comments, whereas older children focused on the subject matter and preferred pictures of topics depicted realistically (see Trautner, Chap. 11). Furthermore, Parsons’ (1987) analysis of children’s interest in subject matter in paintings, developing from a preference for the depiction of schematic realism to photographic realism, seems to correspond closely with Luquet’s shift from intellectual to visual realism in children’s own productions.

Overall, there appears to be a broadly similar developmental path in production and comprehension from an initial interest in non-representation to a shift of attention to subject matter and its graphic systems of realism. But does production and comprehension of drawing develop at the same rate, that is, concurrently? Or does
the child’s comprehension of pictures develop quicker than for their production (as is the case for recognition), presumably because of the increased demands in the production process? In the next two sections we shall review research that is supportive of one or the other position.

**Concurrent development of production and comprehension**

In our discussion of Luquet’s (1927/2001) notion of intellectual realism in the previous section we commented that according to Luquet the child is drawing from their internal model of the topic. Although the specific nature of the internal model is difficult to define (e.g., see Freeman, 1972; Cox, 1993; Golomb, 2002; Kosslyn, Heldmeyer, & Locklear, 1977; Piaget & Inhelder, 1956) for Luquet it appears that it contains what the child believes are the criterial features of a topic that help to define it, assisted by showing the features in their full shape and not diminished by being partially occluded by other features. One argument that has been presented in the literature for production and comprehension developing concurrently is that the child’s internal model (or metaknowledge) drives their choice of drawing, whether it is one that they make themselves or select from an array of pictures presented to them (Brooks, Glen, & Crozier, 1988; Moore, 1986; Taylor, & Bacharach, 1981). If one extends this argument further then production and comprehension develop concurrently due to the child’s changing conception of the salient features of the topic and how they should be depicted. Indeed, this case can be extended even further to include the child’s subsequent shift in preference to a visually realistic style, as mentioned above in terms of children’s own drawings (Luquet, 1927/2001) and children’s attitudes to pictures made by others (Parsons, 1987).

Studies comparing children’s attitudes to pictures with their own productions have typically asked the child to draw a topic (the measure of production) and to select a picture of that topic (the measure of comprehension). For the selection task an array of pictures are presented to reflect the developmental range of forms that children produce of the topic. Taylor and Bacharach (1981) showed 3- to 5-year-old children three representational drawings of a man: a *tadpole* form (arms and legs protruding from the head with no body shown), a transitional figure (as in the tadpole form but with a suggestion of a body drawn between the head and the legs), and a complete figure (clearly defined separate areas of the head and body, with arms and legs protruding from the body). Children were asked to select from these three drawings the drawing that most looked like a picture of a real man. The children were then asked to draw their own picture of a man while the complete drawing of a man from the selection task was left in front of them to serve as a model. The findings indicated that the most frequent choice in the selection task made by the tadpole drawers and those children who drew a complete figure was the figure similar to their own level of drawing. We must be cautious, however, in interpreting this as strong evidence for production and comprehension developing concurrently. First, there were many tadpole and *complete* drawers who did not select a similar form of drawing that they drew themselves. Second, the
data from the scribblers are difficult to interpret as there was no similar (i.e., scribbled) drawing available to them in the selection task. Furthermore, the scribblers tended to pick the complete figure rather than the (developmentally closer) tadpole version.

Moore (1986) presented children with an array of drawings of houses which had chimneys and windows in each of two alternative positions, which also showed either one or two sides of the house (see Figure 10.1). The 4- to 9-year-olds tested were asked to select the best drawing from multiple paired drawings from this array, and also to draw their own picture of a house in a separate session where no drawing model was shown (the order in which the children participated in the two sessions was counterbalanced). Moore concluded from her data that children of all ages preferred those drawings which had the most features in common with their own productions. Brooks et al. (1988) extended Moore’s (1986) study by testing younger children (who are likely to suffer from production problems), and by comparing children’s production and selections of the human figure as well as houses. Three- to four-year-olds were asked to draw a man and a house, and then in a later session instructed to choose the best drawing from pairs of man drawings and pairs of house drawings (see Figure 10.2 for complete array of drawings). Consistent with Moore’s (1986) data and interpretations Brooks et al. (1988) reported that the children significantly preferred representations which were most in common with their own drawings, and that children’s drawings are not inferior forms of their ideal because of any production difficulties.

Figure 10.1 Drawings of a house used as stimuli in Moore’s (1986) selection task.
Figure 10.2 Drawings of a person and house used as stimuli in Brooks et al. (1988) selection task.
A fundamental problem with both Moore’s (1986) and Brooks et al.’s (1988) studies is the formulaic representations the children saw in the selections tasks. Moore’s (1986) drawings varied only on the placement of windows and chimneys, and whether an additional side of the house was shown. Such variations reflect poorly the range of house drawings that children typically produce (see Barrouillet, Fayol, & Chevrot, 1994). A similar problem is evident in the drawings of houses and people presented in Brooks et al.’s study. The drawings only varied in number of details and so did not take into account other distinguishing properties of children’s drawings such as placement, spatial relationships and proportion.

In conclusion, although Taylor and Bacharach (1981), Moore (1986) and Brooks et al. (1988) found some evidence that children may select drawings for the best or most real that have a similar developmental level to their own drawing, the evidence is not wholly convincing. We shall now consider whether the evidence for children’s production of drawing lagging behind their comprehension of drawings is more persuasive.

Production lagging comprehension

We commented earlier in this chapter on the extensive cognitive, graphic and motor demands on producing a representational drawing. These demands lie at the core of the argument that production of drawing lags comprehension. Thus, although children have an intention of what to draw and how to draw it, they struggle to translate this on to the paper. Such an account is supported by the observation made by many researchers that drawing activity declines in the pre-adolescent period (e.g., Cox, 1989; Gardner, 1980; Golomb, 2002; Jolley, in press; Kellogg, 1969; Luquet, 1927; Mathews, 2003; Mortensen, 1991; Thomas & Silk, 1990; Winner, 1982). One of the reasons suggested for this decline in older children is that they become increasingly frustrated at producing drawings of less visual realism than they would like. A variation of this view is that children are aware they cannot produce what they regard as an ideal image of a topic, and therefore construct a simplified form that they are content with for their drawings. In contrast, their choices in selection tasks reveal a more accurate reflection of their preferred form of the topic. Further support for the production deficit hypothesis comes from other domains in the child’s development where comprehension develops faster than production. In the case of language, for example, there appear to be similar production demands as found in drawing production. For instance, in order to convey an oral message the child has to consider what needs to be said, translate this mental conception into words, and pronounce these words appropriately and in the correct order. Even babies and young infants have some level of understanding of what is being said to them a long time before they can vocalize words and construct sentences (see Jusczyk, 1997, for a discussion on the relationship between production and comprehension in language). Given the similarity between the production demands of language and drawing one would expect that production lags comprehension in the drawing domain too.
An early study that compared children’s drawings and selections was reported by Kosslyn et al. (1977). They presented 4- to 11-year-olds with the following three-dimensional objects: a cube, a flat surface with sticks protruding out of it, a house (although it was shaped more like a warehouse or barn!), and a prism. All four objects were presented at an angle so that the depth of the object was visible to the child. The children were then shown an array of drawings that represented a range of graphic forms of each of the presented objects, such as the front face only, a diagrammatic or fold out drawing, or different types of perspective drawing (see Figure 10.3). Within each topic drawings were presented in pairs from which the children were asked to pick the best drawing of what they saw of each object (on half of the trials the object remained in view). Additionally, the children were asked to draw each object themselves, with the objects in front of the child as models.

*Figure 10.3* Drawings of a *cube*, *sticks* figure, *house* figure and a *prism* used as stimuli in Kosslyn et al. (1977) selection task.
The authors reported that whereas many children drew diagrammatic pictures (which displayed all the components of the object but was deficient in visual accuracy as the drawings lacked perspective) few children preferred them. Instead, they often selected perspective drawings as the best representation of each object. Kosslyn et al. (1977) commented that many children who consistently picked the perspective drawings seemed frustrated in their failed attempts to draw what they had preferred. These anecdotal reports are consistent with the view that children’s internal representations of an object are subjected to production difficulties when children try to draw them, and provide further supporting evidence that children’s production lags behind their comprehension of drawing. We should be careful, however, not to apply this conclusion to all levels of drawing ability found in children. For instance, a closer examination of Kosslyn’s et al.’s (1977) data reveals that many older children both drew and chose drawings showing conventional perspective. Could it be possible that any lag between production and comprehension may diminish with age?

This was the claim made by Fayol, Barrouillet, and Chevrot (1995). They asked 3- to 10-year-olds to draw a house and a man, and in a later session to choose the drawing from pairs of other children’s drawings of houses and men the one they considered was made by an older child. They aimed to test two hypotheses. First, that children’s internal models are similar to those held by adults but that difficulties with production lead the child’s own drawings to be inferior to those which they prefer. This hypothesis predicted that the child’s tendency to select more advanced drawings declines with age as children’s own production skills increase. The alternative hypothesis was that if children’s own drawings and selections are both dictated by their internal model of the topic, then there would be no lag in production compared to comprehension. These two hypotheses Fayol et al. (1995) entertained are particularly interesting as they are directly derived from the opposing theoretical positions in this literature. Fayol et al. (1995) found that children did choose more advanced drawings than they drew themselves but this production gap decreased with age, a finding consistent with their first hypothesis. Both Kosslyn et al.’s (1977) and Fayol et al.’s (1995) findings, therefore, appear to support the view that although production lags comprehension, this lag diminishes in older children as they become more accomplished in producing drawings which reflect their visually realistic internal model.

As is the case for the studies reported in the previous section that support production and comprehension developing concurrently, there are methodological problems also inherent in Kosslyn et al.’s (1977) and Fayol et al.’s (1995) studies. In the case of Kosslyn et al.’s (1977) study children made their drawing with the three-dimensional object in view. Giving a child a model to draw from is likely to influence what the child draws, compared to how the child would choose to draw the topic if given no direction (a similar problem applied to Taylor and Bacharach’s (1981) selection task where children were presented with a drawing of a complete figure of a man while they drew). A more serious problem in Kosslyn et al.’s (1977) study is the choice of unfamiliar topics. One has to look at many children’s drawings before one finds a drawing of a cube, prism, or a flat surface with protruding sticks! Such unusually subject
matter is likely to lead to production difficulties for children due to their inexperience of drawing them (see Jolley, in press). Indeed, as we noted above, Kosslyn et al. (1977) observed that many children made frequent revisions as they struggled to draw a representation of the presented model which they felt satisfied with.

In contrast, Fayol et al. (1995) used the more common topics of the human figure and house as the basis of their investigation. The human figure in particular is not only the most common topic children draw, but also there has been much research on it facilitating our knowledge of its developmental pattern in children’s drawings (see Cox, 1993). Although Fayol et al. (1995) presented actual children’s human figure drawings in the selection task (and not adult-generated stereotype drawings that plagues much of the research in this area), the drawings did not reflect the full developmental range of forms that would be expected from the age range of the children they tested. For instance, all drawings included a body. The youngest children tested (from 2 ½ years of age) were therefore only given forms to choose from that were far in advance of the drawings they could produce. This artifact of the experiment would no doubt have contributed to the overall effect of children drawing inferior forms to those they selected. At the other end of the developmental scale the oldest participants were not presented with drawings made by those older than themselves. Consequently, Fayol et al.’s (1995) finding that the lag between production and comprehension reduces with age is compromised by the very real possibility that the older children may have chosen a more advanced drawing compared to their own production level if they had been presented with such an option.

**Separating out cognitive and affective responses**

It is clear that making sense of the conflicting evidence is problematic due to concerns of methodology and interpretation of data. Another notable methodological issue in this literature is the variety and ambiguity of the instructions in the selection tasks, particularly in respect of the basis in which children are asked to make their selection. Brooks et al. (1988), Kosslyn et al. (1977) and Moore (1986) asked children to choose the best drawing. Taylor and Bacharach (1981) asked their participants to pick the most realistic drawing, and Fayol et al. (1995) asked children to pick the drawing made by the oldest child. The instruction to pick the best drawing is somewhat ambiguous. Brooks et al. (1988) and Moore (1986) appear to interpret best as the one which the child likes the best as they conclude from their data that children are satisfied with their drawings. An alternative interpretation of best, however, is the drawing that is the most visually realistic. Whereas one interpretation of the best drawing seems to be based on an affective response to the pictures, the other interpretation is grounded in a cognitive understanding of the respective levels of realism among the drawings. Consequently, we should not assume that these two alternative interpretations would lead children to selecting the same drawing from the array. Recall our earlier discussion regarding the complexity of measuring comprehension, and in particular that a viewer can respond cognitively and affectively to a picture. It is clear,
therefore, that any methodological refinements to the existing body of work should separate out children’s cognitive and affective comprehension responses to drawings.

In our own work carried out at Staffordshire University we have conducted a number of studies with this aim in mind. In two studies reported by Jolley, Knox, and Foster (2000) children produced human figure drawings which were categorized as either a scribble, pre-conventional, simple conventional or an advanced conventional drawing. We used the term conventional in the sense that conventional figures included the main criterial features of person that are found in older children’s drawings (i.e., head with facial features, body, arms and legs), and corresponds with Taylor and Bacharach’s (1981) term complete. Drawings considered to be non-representational were assigned to the scribbling category. Pre-conventional drawings were representations of the human figure in which only some of the main parts were included, and those parts that were represented were on some level displaying an inadequate spatial relationship between them. A typical example of this category is the tadpole form, with the body apparently omitted and the arms and legs protruding from the head. In simple conventional drawings all the salient body parts were depicted (head, facial features, body, arms and legs). Although the spatial arrangement of these features was accurate the features were drawn simply, and out of proportion to each other. In the fourth category, the advanced conventional drawings portrayed more details, a higher standard of proportion, and showed evidence of being drawn from a single perspective. The overall impression of the advanced conventional drawings was that they could represent a particular person, rather than the basic generic form of the simple conventional drawings. In both studies the reliability of the production measure was checked by having each drawing rated by two independent raters.

In the standard presentation of the selection task each child saw four drawings made by other children, each drawing representing one of the aforementioned drawing categories (see Figure 10.4 for one set used in Study 2). For each set of four drawings children were required to make three choices: “Which picture looks most like a real man?” (eliciting a cognitive response), “Which picture do you like the best?” (affective response) and “Which picture looks most like how you draw a man?” (estimation response). The estimation question was included to gain insight into how children comprehend their own drawing ability.

Sixty-one 2- to 9-year-olds participated in both the production and comprehension task in the first study. All but one child selected a conventional drawing in response to the realism question. More importantly, almost all the scribblers, pre-conventional and simple conventional drawers chose a drawing from a higher category than their own drawing. This was also true for these three categories of drawers in their preference responses to the “like the best” question, although there was a small minority who preferred a similar standard of drawing to the one they produced. The advanced conventional drawers preferred and considered most realistic the advanced conventional drawing. In respect of the estimation data, scribblers and pre-conventional drawers generally overestimated the level of their own human figure drawings. Simple conventional drawers showed some improvement with approximately half successfully estimating their own drawing level. It was only the advanced conventional drawers where the majority estimated their drawing level correctly.
Figure 10.4 One example set of four children’s drawings of a man used in the selection task reported by Jolley et al. (2000, Study 2).
Children’s responses to all three questions clearly indicated that production lagged comprehension for most developmental points of drawing behavior, the exception being children who drew at the most advanced level. It would appear, therefore, that our findings were consistent with that of Fayol et al. (1995). But a significant methodological weakness of our first study, as was the case in Fayol et al.’s (1995) study, was that the most advanced drawers were not presented with a drawing of a higher standard in the selection task compared to the level of their own human figure drawing performance. Accordingly, it would be wrong to concur with Fayol et al.’s (1995) interpretation that the lag between production and comprehension declines with age.

One of the amendments of our second study reported in Jolley et al. (2000), therefore, was to present the advanced conventional drawers with a set of four children’s drawings that included an additional drawing depicting a higher visual realism standard (made by an artist, see Figure 10.5 for an example). There were a number of other methodological refinements adopted in our second study. Children were asked to draw a man in two sessions to gain a more reliable measure of children’s own level of production. Similarly, the reliability of the comprehension measures was improved by asking all the children the three comprehension questions (realism, preference and estimation) to each of three sets of drawings instead of just one set. The upper age range of children tested was extended to 14 years old to examine the relationship between production and comprehension in drawing up to early adolescence.

One hundred and three children aged between 3 and 14 years participated in Study 2. The realism data supported the findings from Study 1. Almost all the scribblers, pre-conventional and simple conventional drawers chose a drawing from a higher category than their own drawing, while the advanced conventional drawers chose a figure from the same category as they drew themselves. However, when the advanced conventional drawers were presented with the set that included the artist’s drawing almost all of them chose the artist’s drawing. A similar pattern of responding was observed for the preference data: Children preferred drawings in advance of those which they themselves produced, with all but one of the advanced conventional drawers selecting the artist’s drawing. Accordingly, a more advanced human figure depiction was preferred and considered more realistic by all levels of drawers. The estimation data was also broadly in concordance with Study 1. The scribblers and pre-conventional drawers often overestimated their own drawing ability. A majority of the simple conventional drawers estimated correctly and all of the advanced conventional drawers did so (even in the set that included the artist’s drawing).

In our two studies reported in Jolley et al. (2000), therefore, there was a strong indication that production lags comprehension for all drawing levels of children. In a further series of studies (Jolley, Knox, & Wainwright, 2001) we sought to replicate and extend Jolley et al.’s (2000) findings. In our first study we included three methodological amendments to our earlier work in relation to the selection task.
It is possible that asking children to respond to the realism, preference and estimation questions within each set of drawings may result in children’s selected drawings not being independent from one another. This is not desirable as the rationale of unpacking the cognitive and affective responses to pictures is to tap into potentially different forms of comprehension. Therefore, Jolley et al. (2001) asked only one comprehension question to any given set. Each child saw nine sets of four children’s drawings (from a pool of 15 sets), and each form of question (realism, preference or estimation) was asked for three sets each (consecutively). Children were allocated to six order of presentation groups so that the order in which they answered the forms of questions was counterbalanced.

The second amendment to the selection task was to show all the children sets that included an artist’s (visually realistic) drawing of a man. In Jolley et al. (2000) only the advanced conventional drawers had seen such a set. This amendment allowed us to examine how the presence of an artist’s drawing affected the comprehension responses from other levels of drawer. Three sets of five drawings (four children’s drawings plus an artist’s drawing) were shown one at a time after the child has responded to the nine sets of children’s drawings. Each of these three artist sets was assigned one of the three comprehension questions. The children’s drawings for these three sets were taken from the pool of fifteen sets, but they varied for each child and were always different from the nine sets they had been shown earlier in the selection task. The artist’s drawing was randomly chosen by the experimenter from a pool of five artist’s drawings.
The third amendment in the selection task related to an additional measurement of children’s ability to estimate their own human figure drawing standard. It is possible that children’s poor estimation ability reported by us in Jolley et al. (2000) was partly contributed by the child not being able to see one of his or her own drawings to compare to the other children’s drawings presented. In Jolley et al. (2001) we tested children in a second comprehension session approximately six to eight weeks after the selection task session. After responding to a developmental seriation task in this second session (to be reported in the next section) children were asked to draw a man with no children’s drawings in view. Then the three sets of four children’s drawings that had been used for the developmental seriation task were presented again one at a time, with each child asked for each set the estimation question, “which one looks most like your drawing?”.

In this first study reported in Jolley et al. (2001) we categorized 128 children aged between 18 months and 12 years of age as either a scribbler (30), pre-conventional (29), simple conventional (35), or advanced conventional drawer (34). The child’s classifications were based on two human figure drawings they provided for us in two production sessions.

Findings from the first nine selection trials (the sets with four children’s drawings only) replicated Jolley et al. (2000) with scribblers, pre-conventional and simple conventional drawers typically selecting a more advanced drawing in response to the realism and preference questions than they produced themselves (see Table 10.1). Also consistent with Jolley et al.’s (2000) findings for the estimation data was that very poor performance was observed for scribblers (3% accuracy), and pre-conventional drawers (10%), while the percentage of estimation accuracy of the simple conventional drawers was below half (42%). Of the many children who estimated incorrectly all but five of them over-estimated. In respect of children’s responses to the sets of drawings that included the artist’s drawing most advanced conventional drawers chose the artist’s drawing as the most realistic and preferred, but resisted picking it for the estimation question (the majority correctly choosing the advanced conventional drawing). This pattern of responses for the advanced conventional drawers replicated the findings reported in Jolley et al. (2000).

The data for the selections made by the other levels of drawer to the artist sets revealed some unexpected findings. The scribblers infrequently chose the artist’s drawing for the realism and preference questions. Although more pre-conventional drawers did so the numbers were still under 50% of them for both realism and preference question. Even the 60% of the simple conventional drawers who considered the artist’s drawing the most realistic seems a low proportion considering that the artist’s drawing was so much more realistic than even the presented (child’s) advanced conventional drawing. Furthermore, under half of the simple conventional drawers preferred the artist’s drawings. For the estimation question the previously reported pattern of estimations was replicated with a considerable majority of scribblers and pre-conventional drawers over-estimating, and more than half of the simple conventional drawers doing so. However, it was reassuring that most of these three categories of drawers resisted picking the artist’s drawing, which at least indicates there is a limit to how deluded they are in their perception of their human figure drawing ability!
Table 10.1 Numbers of Children Selecting Four Levels of Human Figure Drawings to the Realism, Preference and Estimation Questions by the Category of the Children’s Own Human Figure Drawings (Jolley, Knox, & Wainwright, 2001; Study 1)

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<th>Comprehension Performance</th>
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<td>Estimation of own drawing level</td>
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<tr>
<td>Advanced Conventional</td>
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<tr>
<td>Inconsistent Responders</td>
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<td>Σ</td>
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But were children more able to accurately estimate their own drawing standard when they had one of their drawings they had just produced in front of them to compare? Sadly, no! In the second comprehension session children’s production level was categorized according to the human figure drawing they drew in that session. Their drawing level was compared to which drawing from three sets of children’s drawings they had estimated as being most like their drawing. The pattern of estimation responding was very similar to the estimation selections they had made in the earlier comprehension session where they did not have one of their own drawings present. That is, most of the scribblers and pre-conventional drawers estimated inaccurately, over half of the simple conventional drawers also did so, with most of the advanced conventional drawers estimating correctly. Again, the vast majority of inaccurate estimations were over-estimations. Our previously reported findings of over-estimations made by children cannot be attributed therefore to a difficulty trying to recall how they draw a man.

The data collected in the three selection tasks reported by us (Jolley et al., 2000; Jolley et al., 2001) had clearly shown that children of all drawing levels understand
and prefer higher levels of drawing than they produce themselves. However, because we had not asked children to explain their selections we could not be sure about children’s rationale for making their selections. In Study 2 reported in Jolley et al. (2001) we explored the reasons children gave for their selections. A pilot study indicated that the verbal demands of the task would be too much for very young children, and accordingly there were no scribblers assessed in the second study. Children aged from 4 to 13 years participated in two sessions within a fortnight of each other. In the first session children were asked to draw a man. In the second session they were again asked to draw a man, and on the basis of these two drawings a sample of 76 children were categorized as either pre- (24), simple (34) or advanced conventional (18) drawers. Following their second drawing they were asked a number of questions in a mini-interview about their drawing, and then the children were shown nine sets of five drawings one set at a time. These sets included four children’s human figure drawings (scribble, pre-, simple and advanced conventional drawing) and one artist’s drawing. The sets had been used in Jolley et al.’s (2001) first study. As in Study 1 children were asked only one question per set, with each form of question (realism, preference or estimation) asked for three sets each (consecutively). The human figure drawing the child had produced earlier in the session was presented for the estimation question to facilitate comparison. Children were asked to explain each selection they made.

In respect of their selections children once more predominantly selected a more advanced version for the realism and preference question compared to their own developmental level. The children’s explanation for their realism and preference selections revealed a similar developmental shift. In each case there was a shift away from merely stating a body part or clothing feature in their chosen drawing (pre-conventional drawers), to more holistic responses related to detail, realism and the use of formal properties to portray realism (advanced conventional drawers). The realism-based justifications provided by the advanced conventional drawers, and some of the simple conventional drawers, confirmed therefore that these children were recognizing the visual realism in the drawings they selected. Realism-based explanations in the justifications provided by the children for their preferred drawings also grew to be more common with higher levels of drawing ability. This confirmed that children’s preferences for more developmentally advanced drawings were based on an interest in realism, at least among older and more experienced drawers.

Children’s estimation data again replicated our previous findings. The majority of the pre-conventional and simple conventional drawers over-estimated their drawing ability, while most of the advanced conventional drawers correctly selected the same standard of drawing. The explanations given by all three categories of drawer were dominated by comments referring to a particular part or feature of the selected drawing (a body part or article of clothing). The developmental change we did observe in the comments was that there were an increasing number of references to formal properties, detail, proportion and movement/posture made by children of higher drawing categories. Nevertheless, it was not readily apparent from children’s
justifications why more accurate selections were a function of drawing standard. For instance, many of the advanced conventional drawers justified their choice of drawing by referring to a perceived likeness to a particular body part, clothing or formal property (e.g., size, shading and color), rather than a holistic comment on a similar overall structure and realistic detail of their chosen figure. It appears, therefore, that the shift toward accurate estimations of drawing standard relied on an implicit understanding, rather than an understanding they were able to explicitly verbalize.

**Children’s understanding of what develops and why in children's drawings**

The literature we have cited so far has limited children’s comprehension responses to the selection of a single drawing from an array. In this section we will extend our consideration of children’s comprehension of representational drawing by examining their knowledge of the developmental sequence of children’s drawings and the factors that stimulate developmental change. Continuing our focus on the relationship between comprehension and production we shall compare children’s knowledge of what develops and why in children’s drawings with their own drawing production level.

**Children’s knowledge of the developmental pattern in children’s drawings**

Asking children to choose the most realistic drawing from a developmental sequence of children’s drawings not only taps into their awareness of visual realism but also represents a measure of their understanding of the end-point of children’s drawing development. But what about their knowledge of earlier points in the developmental sequence? When are children able to differentiate between standards of drawing ability, and is this skill related to the child’s own production performance? Goodnow, Wilkins, and Dawes (1986) tested children aged between 4 and 11 years on whether they could distinguish between a younger and older child’s drawing, and investigated if this ability was related to the child’s own drawing skill. From a total of eight drawings representative of drawings made by 4- to 10-year-olds according to the Goodenough-Harris Scale (Harris, 1963), the authors presented the children with all possible pairs of human figure drawings. In a previous session the participating children had drawn their own human figure to enable their own drawing level to be assessed. Goodnow et al. (1986) reported that the 4- and 5-year-olds’ ability to distinguish between the younger and older children’s drawings was not above the level of chance. In contrast, the 7-year-olds’ judgments
were well above the chance level, and all the 9- and 10-year-olds were successful with all pairs of drawings. What is most interesting for the present discussion was that the children’s own drawing level was significantly and positively correlated with their ability to distinguish between the pairs of older and younger children’s drawings. A possible explanation of this correlation is that as a child progresses in their own drawing ability they gain knowledge of the developmental pattern up to their own level, but remain uncertain of future developments (see Jolley, in press; Trautner, Lohaus, Sahm, & Helbing, 1989). Consistent with this suggestion, the correlation reported by Goodnow et al. (1986) for the 7- and 9-year-olds ($r = 0.36$) was stronger than that for the 4- and 5-year-olds ($r = 0.13$). However, Goodnow et al. did not report where the developmental errors in children’s judgments occurred, so we do not know whether they tended to relate to differences above the child’s own production level or not.

Trautner et al. (1989) carried out a study designed to examine the possibility that children’s knowledge of the developmental sequence was constrained to those levels which they had already achieved in their own drawing development. Children aged between 5 and 10 years of age were presented with sets of five drawings where each set had each been made by a child longitudinally once a year between the ages of 5 and 9 years (i.e., a similar age span to the children tested in their study). Each child was asked to arrange the sets in the correct age-related sequence. Contrary to Goodnow et al.’s (1986) findings the authors reported that even the youngest group of children (5-year-olds) ordered the drawings with an accuracy above chance levels, and that the skill improved progressively with age. Further, Trautner et al.’s (1989) data provided no evidence for errors in the seriation task predominantly occurring for developmental points in advance of the child’s own production level. Judgment errors for the youngest children were as high for drawings around their own age level as they were for the drawings beyond their own drawing level. However, one difficulty with this interpretation from Trautner et al.’s (1989) study is that the drawing level of the participating children was not assessed.

This limitation was addressed in our second study reported in Jolley et al. (2000). Recall from our earlier discussion of this study the production level of 103 children (3- to 14-year-olds) was assessed by asking each child to make two human figure drawings over two production sessions. In a further comprehension session the children were administered a developmental seriation task (after they had participated in the selection task). Children were presented with four portrait photographs of children aged 2, 4, 6, and 10 years of age. The photographs were presented horizontally in chronological order of age. The names and ages of the children depicted were written below each picture and were read out to the participating children in the task. The particular ages of the children depicted had been chosen to represent the typical ages in which the four forms of human figure drawing presented to the children in this task (a scribble, pre-conventional, simple conventional, and advanced conventional drawing) are drawn. Children were told, “Each of these children has drawn a picture. Can you tell me which picture they have drawn?” The procedure was repeated for two further
sets of four children’s drawings (where two further sets of children’s photographs were shown).

In accordance with Goodnow et al.’s (1986) correlations our results indicated that children’s level of awareness of the drawing sequence was positively related to their own ability within the sequence. Additionally, performance on this developmental sequence task was significantly correlated with the child’s production level when age was statistically partialed out. This significant positive correlation was replicated by a further developmental seriation task we conducted in Jolley et al. (2001) first study (also with age partialed out). Removing likely age effects was important to assessing the direct relationship between production and comprehension. Both Goodnow et al. (1986) and Trautner et al. (1989) found that the ability to order the drawings developmentally was an age related skill, and of course children improve their drawing skill with age.

Figure 10.6 Percentage responses of matching each category of drawing to its appropriate position in the developmental seriation task by the four levels of drawers (Jolley et al. 2000, Study 2).
Consequently, our data showing a relationship between children’s understanding of the developmental sequence in children’s drawings and their own production level confirmed and extended the earlier studies of Goodnow et al. (1986) and Trautner et al. (1989).

In Jolley et al. (2000) we analyzed where children’s errors were occurring in the developmental pattern by the child’s own drawing level. Our analysis of the errors supported Trautner et al.’s data that children’s ability to understand the developmental sequence was not constrained to the levels which they had achieved in their own drawing productions. From Figure 10.6 one can see that the only group of drawers which displayed any indication of being restricted in their knowledge to their own production level was the scribblers. They showed a high degree of accuracy for matching the scribbled drawings to the picture of the two year old, but performed less well on matching the three representational drawings. Very young children may be more inclined to focus on the colors and the lines for their own sake (Luquet, 1927/2001; Parsons, 1987) rather than as potential representations. Nevertheless, there were still many scribblers who accurately matched the representational drawings to the correct photographs.

It appears, therefore, that children’s understanding of the developmental sequence in children’s human figure drawing is related to their production level, but that their understanding relates to points both prior and beyond their own drawing ability.

**Children’s knowledge of causation in developmental change in children’s drawing**

A further extension of our examination into the relationship between children’s production and comprehension of representational drawing was to examine children’s knowledge of why children’s drawing develops, and whether such understanding is related to children’s own production level. In Jolley et al. (2001) we investigated just this in our third study. Sixty seven children were initially assessed for their own human figure drawing level (pre-conventional, simple conventional and advanced conventional). Additionally, each child participated individually in a semi-structured interview in which questions were asked concerning the child’s own picture making, their preferences/dislikes about drawing, what they believed were difficult or easy things to draw, what made a good picture, and how drawing skill is improved. Content analysis was used to identify themes of responses to these questions, but for the purpose of the present discussion we shall focus on the different reasons children gave on developmental change in drawing. The most popular themes mentioned were maturation (e.g., age, getting bigger, intelligence, inheritance), application/enjoyment (e.g., practice, concentration, trying hard, more experience, motivation) and teaching/learning (e.g., watching and being shown by others, seeing other drawings, education). A full list of themes and a breakdown of the number of children by drawing level who cited them is described in Table 10.2.
To examine the relationship between the child’s production level and understanding of developmental change we initially gave each child a score depending upon the number of themes of developmental change they cited (excluding miscellaneous) in their interview (i.e. a score between zero and six). The positive correlation between the child’s production level and the number of themes which they referred to was highly significant, even with age partialed out. To examine this relationship further we investigated which themes differentiated the levels of drawer. We found that the numbers of children citing reasons categorized as application/enjoyment and teaching/learning increased significantly with more advanced production levels. In other words higher drawing levels of the children were associated with a recognition of both internal (e.g., practice and motivation) and external (e.g., observation and demonstration of drawing from others, education) resources in drawing development.

**Interpretations and future directions**

Evidence assimilated by Jolley and his colleagues (Jolley et al., 2000; Jolley et al., 2001) strongly supports the argument that production lags comprehension among children of all drawing standards, from scribblers to experienced representational drawers. It is likely that the cognitive, motor and graphic demands involved in producing a drawing play a significant role in the developmental delay of production, and that these demands continue to exert their influence throughout children’s drawing experience. Although much of the supportive evidence for the production lag has been derived from studying human figure drawings, there is no reason to suppose that different findings would be obtained from using other topics. Indeed, it is likely that due to

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**Table 10.2 Numbers of Children Citing Each Theme of Change by Production Level (Jolley, Knox, & Wainwright, 2001; Study 3)**

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<td>Pre-Convent. (n = 22)</td>
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<td>Advanced Convent. (n = 23)</td>
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the demands of production the lag between production and comprehension would be enhanced for topics less practiced in the drawing activity of children. Furthermore, the gap may be expected to widen during adolescence and adulthood where drawing is practiced minimally for most people, and hence drawing performance would be expected to be in stagnation or decline.

The alternative account that production and comprehension of drawing develop concurrently must be rejected. The theoretical underpinning for concurrent development is that the child’s current conception of how a topic should best be graphically represented dictates both their comprehension and production of that topic. Researchers who have held this view have tended to adopt Luquet’s (1927/2001) internal model, broadly defined as the child’s notion of the important features of any given topic and represented in such a way so that the individual features are displayed unambiguously. It has long since been accepted in the children’s drawings literature, however, that children’s drawings are not simply print outs of their mental images. The way in which children comprehend drawings and produce them is more dynamic than being dictated by a single unitary source. The research carried out by ourselves, as well as other independent work, has conclusively shown that the drawings children choose as the most realistic and preferred are developmentally different from those they produce themselves. Even within children’s comprehension and production there is evidence of varying graphic models. In our research we have noticed that children do not always pick the same drawings for the most realistic and most preferred. Where different selections have been made there is a tendency for children to prefer a drawing that is not as developmentally advanced as the one they recognize as the most realistic. Such choices indicate that some children hold different cognitive and affective comprehension models in selection tasks. In respect of children’s own productions we only need look at children’s drawings to see examples of children depicting different developmental versions of the same topic (see Jolley, in press). Furthermore, children may produce diverse drawings depending upon the audience, such as drawings they produce for themselves, their teachers or an experimenter (Anning, 2002; Goodnow et al., 1986).

The different production and comprehension graphic models children hold raises the question of whether children are aware of, and are satisfied with, the developmental inferiority of their productions. In terms of awareness the estimation data we have reported from our own studies clearly identifies many children who over-estimate their drawing ability. When asked to choose a drawing similar to how they themselves draw very few scribblers and pre-conventional human figure drawers select a drawing similar to their own standard, choosing instead a more developmentally advanced drawing. Around half of simple conventional human figures drawers over-estimate, while almost all advanced conventional human figure drawers accurately estimate their own drawing ability. Although the advanced drawers appear to be at ceiling it would be interesting to include among the drawings in the selection task a drawing depicting a level of realism someway between their own standard and that portrayed by an adult’s drawing. The adult artist’s drawings that we have used in our studies communicate a level of visual realism far beyond that shown in children’s advanced conventional drawings, and therefore may be relatively easy to discriminate.
Whether children are satisfied with their drawing products appears to be a function of development. In our second study reported in Jolley et al. (2001) we asked children whether they liked, disliked or considered okay/alright their human figure drawing they had just made. Whereas all of the pre-conventional drawers (n = 27) and most of the simple conventional drawers (27/34) liked their drawings, only 4 of the 18 advanced conventional drawers did so. The common complaint made by the advanced conventional drawers was that their drawing was insufficiently detailed and visually realistic. It appears, therefore, that the production lag may only become a disconcerting issue for older children.

A combination of graphic intention and cognitive factors may account for this development shift in self-efficacy. Arnheim (1974) has argued that children invent a graphic representation of topics in their drawings that stand for the referents in their environment. For Arnheim (1974) children's drawings are symbolic and not an attempt to capture a visual likeness. Such a view takes a more positive view of children's drawings rather than the production lag hypothesis (see also Golomb, 2002), and implies that for at least for younger and more inexperienced drawers children may be satisfied with their inventions. For older drawers many authors have acknowledged that children become more critical of their drawing performance (e.g., see Cox, 2005). Furthermore, this shift in self-efficacy in the drawing domain is consistent with a more general developmental shift in children becoming more self critical of their abilities (Blatchford, 1997; Plumert, 1995; Stipek, 1984). In contrast, there is a general tendency for younger children to overestimate their abilities (Schuster, Ruble, & Weinert, 1998). Cognitive factors and engaging in wishful thinking have been suggested to account for young children's over estimations (Hungerige, Trautner, Uredat, & Wagner, 2000; Schuster et al., 1998; Stipek & Maclver, 1989; Stipek, 1984). Furthermore, it is possible that there is an interaction between children's estimation ability and self-efficacy. Younger and more inexperienced drawers may be content with their drawings because they are deluded in thinking they are better than they are!

Our studies investigating children’s understanding of deeper levels of picture comprehension revealed a potentially interesting link with production performance. We found that children’s understanding of what develops and why in children’s drawings is related to their own production level, and that the relationship could not be accounted for solely by a third variable of age improvements in both production and comprehension. An understanding of developmental change is derived from Piaget’s interest in diachronic thinking (Piaget, 1969). Previous research on diachronic thinking has shown that children’s ability to explain a present situation from past events, and to predict future events from the present, is age-related (see Montangero, 1996; Tryphon & Montangero, 1992). Our data in the drawing domain suggests that production performance also is related to comprehension.

Nonetheless, any causal nature of this relationship is not straightforward, nor as yet adequately understood. The simple explanation that children understand developments in drawing only up to the point of their own production level can be dismissed. The data shows a spread of errors in matching drawings to age-related developmental points in seriation tasks that includes errors both prior to, as well as beyond, the child’s
own production level. In respect of the relationship between understanding the causes of developmental change and the child’s own production level, we found that children citing more casual factors were more advanced drawers. Again this relationship was independent of the age of the child. In particular, an awareness of the external and internal resources to drawing development was differentiated between the three levels of representational drawer we tested (Jolley et al., 2001). How may this be explained? On the one hand children who have an explicit awareness of these internal and external resources may be more motivated to use them, leading to advances in their own drawing level. Conversely, improvements in the child’s own drawing might provide them with insights as to why this might have occurred, and potentially give the child a clearer understanding of developmental change in representational drawing.

The evidence we have found for a relationship between the child’s own production level and their understanding of what develops and why in drawing development suggests further work. For instance, is there a relationship between children’s understanding of other aspects of pictures and their production level? We know that children of different representational drawing standards vary in respect of self-efficacy in their own drawing behavior (Jolley, Knox, & Wainwright, 2001, study 2) but do they also systematically vary in other attitudes towards their own drawings and pictures in general? Rose, Jolley, and Burkitt (2006) asked 260 5- to 14-year-olds about their drawing behavior and attitudes to their own drawing activity and to other pictures. This survey included questions about what they liked/disliked about drawing, their attitudes to the decline of drawing activity among older children, and what they thought made a good/bad picture. Although we did not ask children to draw themselves, it would be useful to explore in future work children’s answers to these and other similar questions in relation to the child’s own production level. An interesting and more holistic approach to studying the potential links between production and comprehension would be to study Norman Freeman’s model on the child’s developing framework theory of pictures (see Freeman, 1995, 2000, 2004; Freeman & Parsons, 2001; Freeman, Chap. 3) in relation to the child’s production performance. Freeman argues that children develop their theory of pictures based on their understanding of the relationships between the referent, picture, artist and viewer. How such understanding develops in relation to their own production performance is unknown, but studying such a relationship may highlight some interesting links.

Another line of enquiry is to investigate the role of seen drawing models on children’s own drawing development. Some years ago now a preliminary investigation was carried out by Wilson and Wilson (1977) who asked children about where their ideas had come from for their current and past drawings. Children were asked a number of questions including: “Did the drawing originate with you?” , “Is it a copy of something?” , “Did someone show you how to do it that way?” The authors concluded that nearly all drawing could be traced back to an existing graphic source; however, they provided no data in their paper. As far as we are aware this promising line of enquiry has not been developed. If pursued it might prove fruitful in providing insight into the extent to which comprehension of drawing models influences production in children’s drawings. However, we must be a little cautious and refrain
from conceiving that any casual relationship between production and comprehension is necessarily uni-directional.

Many of the approaches to studying the relation between production and comprehension would benefit from longitudinal studies. These should provide us with a more precise outline of how the development of production and comprehension in drawing interact with each other. In addition to the empirical work there is also the need for theories to explain the developing interaction between production and comprehension of drawing. The development of our empirical and theoretical knowledge of picture production and comprehension would not be complete without including the growing body of literature into children’s making and understanding of expressive drawing (e.g., Carothers & Gardner, 1979; Davis, 1997; Jolley, in press; Jolley, Cox, & Barlow, 2003; Jolley, Fenn, & Jones, 2004; Jolley & Thomas, 1995; Jolley, Zhi, & Thomas, 1998; Lin & Thomas, 2002; Winston, Kenyon, Stewardson, & Lepine, 1995; see also Burkitt, Chap. 6).

Summary

In this chapter we have considered the relation between children’s production and comprehension of representational drawing on a number of levels. First, we have shown that children of all drawing standards understand and prefer more developmentally advanced drawings than they produce themselves. Second, the child’s estimation of their own drawing ability and self-efficacy is a function of their own drawing level. While over-estimation and satisfaction with one’s own drawing ability is associated strongly with the more inexperienced drawers, the most advanced drawers are aware of their own drawing ability but are much less content with it. Third, we found that understanding what develops and why in children’s representational drawers is related to the child’s own production level. The different graphic models children use for production and comprehension have been discussed in terms of the extent to which children are aware and satisfied with their own drawings. A number of lines of enquiry are suggested to develop our understanding of children’s developing and interacting relationship between production and comprehension in the drawing domain.

References


10. The Relationship Between Production and Comprehension of Representational Drawing
Richard P. Jolley and Sarah E. Rose

Children's Understanding and Production of Pictures, Drawings, and Art

Theoretical and Empirical Approaches


