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The Development of Representational Drawing

The chapter begins by considering the sources of the initial historical interest in studying children's drawings, and some of the key debates that drove this interest. These include the question of whether children's drawings provide an insight into understanding prehistoric art, and the development of art thereafter, and also the differing focus and appreciation artists and scientists had when they first began to take children's drawings seriously. I then present an in-depth examination of two theories of children's drawing development, that of Luquet (1927/2001) and Willats (2005). These two theories stand out as providing a detailed and innovative analysis of the developmental progression in representational drawing, and have been considerably influential to other researchers studying this area. The chapter ends by presenting an up-to-date overview of more specific debates and questions found in recent research into what develops and why in children's representational drawing.

Prehistoric and Child Art

We do not know when the first instances of mark-making occurred among our ancestors. It is likely that the earliest "pictures" were painted on their bodies, and in the open on wood, stone, sand and mud which are subject to decay from outside elements. Consequently, they have long since perished with the "canvases" upon which they

were made. Nevertheless, there is evidence that colored pigments may have been used up to 400,000 years ago (Barham, 2002; Cox, 2005). Although it is not clear whether such pigments at this time were used intentionally to make either decorative or symbolic marks, discoveries have been made of such activity dating around 77,000 years ago (Henshilwood et al., 2001; Spivey, 2005). The earliest forms of representational pictures we have remaining today are cave paintings that are dated from 40,000 to 35,000 years ago (Spivey, 2005).

One might imagine these early paintings to display very simplistic representational forms, revealing a skill similar to a young child's drawing nowadays whose pictures have begun to develop from scribbles to marks and shapes from which we can recognize something from life. We might also think that if we looked at how art has developed since these early cave paintings that it would portray a gradual progression in representational skill not dissimilar to that typically observed in the development of drawing throughout childhood. In fact, such a view was suggested and discussed widely at the turn of the 20th century,[1] and encouraged a belief that by studying child art we can gain an insight into the development of art among our ancestors. But commentators of cave art such as Bahn (1996) and Clottes (1996), as well as experts in the field of child art such as Golomb (2002) and Cox (2005), have argued persuasively against this view. Cave paintings that have been discovered do not show a linear progression towards realism over the time periods they have been dated. Instead, similar pictorial conventions reappear across different historic periods. The recent expressionist movement in art, with its focus on the communication of moods and ideas rather than visual realism, further attests to the nonlinear progression of artistic styles in art history. Nor do many of the early cave paintings that have been discovered suggest our ancestral artists were struggling with representational techniques, as we can see from a cave painting of a "lion panel" found in Chauvet, France, dated around 32,000–30,000 BC (see Plate 1). When one considers the remarkable visual likeness of the lions' faces, and also other animal cave paintings that were commonly painted around this time, we can only stare in wonder at the representational skills of our ancestors. For comparison purposes see three 4- to 5-year-olds' pictures of lions I recently collected (see bottom of Plate 1). Although delightful, their representational skills have some way to go before they can compare with our ancestral artist.

Despite a close connection between developments in child and primitive art being largely unfounded,[2] this debate around the turn of the 20th century did help to elevate child art to a wider audience. And this was long overdue. Considering that the historical engagement in picture making of one sort or another is unlikely to have been restricted to only adults, and that children surely would have been participants too, it is surprising how late an interest in children's picture making began. So when did adults begin to take child art seriously and for what further reasons?

Early Interest in Child Art

The study of child art came from two disparate sources. First, from the Romantic artists in the late 18th and early 19th centuries, and second, the scientists of the late 19th century. Fineberg (1997, 1998; see also Golomb, 2002) notes that artists in the Romantic tradition marveled in delight at the apparent simplicity and innocence of how children's drawings appeared. The Romantic artists rejected the previously learned conventions of making pictures look like copies of reality, valuing instead inventiveness and expressive creativity that appeared to be embodied in the drawings of young children in particular. Such children's drawings seemed to be uncorrupted by representational conventions, and were considered to reflect a direct access to the expressive creativity the Romantic artists strove for. This artistic appreciation of children's drawings received a new impetus around the turn of the 20th century with the growth of the modernist movement in art. The modernist approach also rejected the prevailing practice at the time of using pictorial conventions that captured the objective nature of reality, in favor of using formal properties such as line, color and composition for expressive and creative purposes. During the 20th century some of these modernist artists even studied and collected children's drawings in order to draw inspiration for their own art, and this can be seen clearly in the artistic works of Dubuffet, Kandinsky, Klee, Miró, and Picasso, among others (see Fineberg, 1997).

The later scientific interest in children's drawings needs to be seen in the context of a growing awareness of studying origins and change in the second half of the 19th century, an awareness that

was very much stimulated by Darwin's theory of evolution (Darwin, 1859). This interest led some to keep diaries of babies and infants, noting key developmental changes that were observed, such as can be found in Darwin's longitudinal study of his own son (Darwin, 1877). By the turn of the 20th century there were a number of baby biographies, articles and child development books that included a commentary on children's drawings (e.g., see Barnes, 1893; Clark, 1897; Lukens, 1896; Maitland, 1895; Major, 1906; Perez, 1888; Ricci, 1887). A typical approach was to describe stage and age progressions in the different forms of representation observed in the drawings, and in some instances to relate representational changes to the mental development of the child. In some notable cases the researchers gathered a massive collection of drawings. For example, Kerschensteiner (1905) collected around 200,000 drawings made by around 6,800 German school children. Interestingly, Kerschensteiner was initially hampered in this monumental task by many of the teachers doing the drawings themselves![3]

The artistic and scientific interests in children's drawings differed in the standards by which the child art was evaluated (Golomb, 2002). While artists appreciated the freedom of young children's drawings from visual realism conventions, the scientific approach in effect measured these same drawings by the adult standard of visual realism. Put another way, the artists were inspired by the *expression* of the children's drawings while the scientists analyzed the *representation* of realism in the drawings. In the next chapter I shall focus on the expressive aspects of children's drawings, but in this chapter I discuss the development of children's representational drawing. To set us on our way I first introduce you to what I consider are the two main (macro-developmental) theories of children's representational drawings, that of Luquet (1927/2001) and Willats (2005), which although differing in a number of respects I shall argue are complementary.

Luquet's (1927/2001) Theory of Drawing Development

There are a number of reasons why examining the ideas of Georges-Henri Luquet (1927/2001) in some detail is justified. First, Luquet's ideas have had a widespread and significant influence on many of

the subsequent researchers in this area (e.g., see Costall, 1995, 1997; Cox, 1992; Freeman, 1972, 1980; Golomb, 2002, 2004; Light & Barnes, 1995; Milbrath, 1998; Thomas & Silk, 1990; Willats, 1997, 2005). Second, despite being written some 80 years ago the first English translation of his main publication has only relatively recently become available (Luquet, 2001), thanks to the translation by Alan Costall. This not only allows a restatement of Luquet's ideas to a wider audience, but also provides this audience with a complete and definitive account of what Luquet actually said rather than having to rely on second- or multi-hand fragments in the literature that have sometimes been plagued with misunderstandings of some aspects of the theory. Third, and most importantly, Luquet's account provides us with a very useful introduction to the development of children's representational drawing.

Children's first experience of drawing is scribbling, or as Luquet calls it, trace making. Luquet claims that although very young children know that pictures can represent life they do not think initially that they can draw representations. They believe that they are making a creation when they scribble, and that is sufficient for their enjoyment. What then happens is that the child begins to notice a vague resemblance between some marks they have made and something from our world (Luquet called this experience "fortuitous realism"). For Luquet, once the child believes they can represent life then this belief will characterize their subsequent drawing development. Indeed, Luquet opens his chapter on "Realism" by saying, "nothing describes children's drawing in general better than the term realism" (Luquet, 2001, p. 77).[4] Our initial reaction to this assertion might be incredulity, as even drawings made by older children look far removed from how three-dimensional subject matter actually looks in reality. But Luquet argues that children's drawings develop through different types of realism, only the last of which is visual realism (which he recognizes only relatively few children succeed in producing anyway). I shall now describe Luquet's four types of realism which children progress through.

(i) Fortuitous realism

As described above the child (fortuitously) notices a similarity between a mark or marks (which will look like scribbles to the adult eye)

Figure 1.1 An example of Luquet's fortuitous realism: a "bird" drawing made by a girl (aged $2^1/_2$ years). Upon noticing a similarity between her scribble and a bird she then added two vertical lines for legs.

with something from life, such as a bird. Luquet refers to an Italian girl aged 2 years 6 months who upon noticing a similarity between her scribble and a bird then added two vertical lines for legs (see Figure 1.1). The child is therefore making a (post-hoc) realistic interpretation of her drawing that she had not intended when setting out to make the drawing. Luquet argues that in such cases the child will continue to happily scribble in subsequent drawings without having an a priori representational intention, but will increasingly notice such fortuitous similarities over time. There is no sudden shift to the child becoming an intentional realist. Rather, the growing willingness of the child to accept their "accidental" marks as representational leads the child to more frequently *start* a drawing with a representational intention. As adults we may still have difficulty in seeing the visual likeness referred to in the interpretations made by the child. For the child, however, they are gaining confidence in their ability to represent reality.

(ii) Failed realism

As the child becomes a more consistent intentional realist their drawings become characteristic of failed realism. Although their drawings now begin to take on a representational quality that adults can more easily recognize, there are a number of motor, cognitive and graphic obstacles the child is struggling to overcome. These lead to a number of "errors" in the drawing. Because the child is still trying to gain control over the motor movements of the hand as well as the drawing tool there can be a faulty use of line. A lack of attention

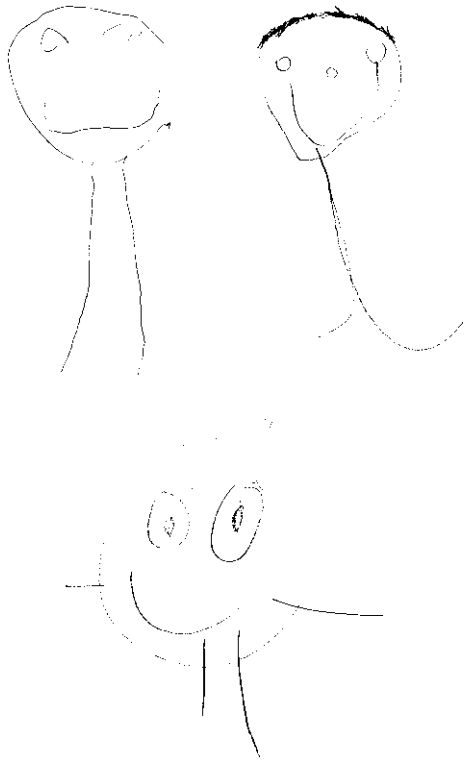

Figure 1.2 Three children's "tadpole" drawings of the human figure representing examples of Luquet's failed realism.

leads to only some of the details the child is thinking of to be included. Those details that are included may show technical graphic problems of poor position, orientation, and proportion. Furthermore, as the child's attention is concentrated on the detail currently being drawn there are apparent imperfections in the relations between the details. The "tadpole" form of the human figure (see Figure 1.2) is a good example of Luquet's failed realism. Although representational, a crucial element (the body) appears to be missing, and in some tadpole drawings the arms are omitted as well. Those parts that are drawn are aligned inappropriately (e.g., the arms and legs appear to be drawn from the head). Luquet used the term synthetic incapacity to

characterize the lack of relations between the individual elements of the drawn topic.

With improvements in the child's attention the child is more able to consider other elements in the drawing rather than just the feature currently being drawn. This allows the child to remember to include more details and to draw them within more appropriate spatial relationships. It is through a gradual process that the number of elements of a topic increases (while synthetic incapacity diminishes), leading to the child's drawings becoming more characteristic of the next type of realism, that of intellectual realism.

(iii) Intellectual realism

The child's idea of realism is now to produce as many of the essential items of a topic (from the child's wider knowledge of all the details pertaining to the topic), and to represent each item in its characteristic shape. In the case of the human figure the body is now included, and over time an increasing number of further details appear (see Figure 1.3 for examples). The child is also more adept in synthesizing the parts. In the conventional human figure, for example, the arms and legs now extend from the body. As the child becomes more able to hold in mind the features he or she considers important to the topic, and in relating the parts synthetically, an increasing number of details are depicted. Clothing, for example, may be added to their human figure drawings.

Intellectual realism is not just characterized by an advance in detail and spatial arrangement, but also by the child's desires to draw the details in their usual, generic shape (described as "exemplarity" by Luquet). As we look at subject matter from life the shapes of its constituent parts change as we move around it (or because it moves). From some views certain parts will appear to us partially or even be totally occluded. But Luquet argues that children who draw in the graphic system of intellectual realism do not want to draw parts in atypical shapes, let alone leave them out altogether. Instead, they use various techniques to ensure that as many features as possible are shown and in their entire shape. These techniques include separation of the details, transparency, drawing some features from an air-view plan, and folding out certain parts of the topic (such as rooms in a

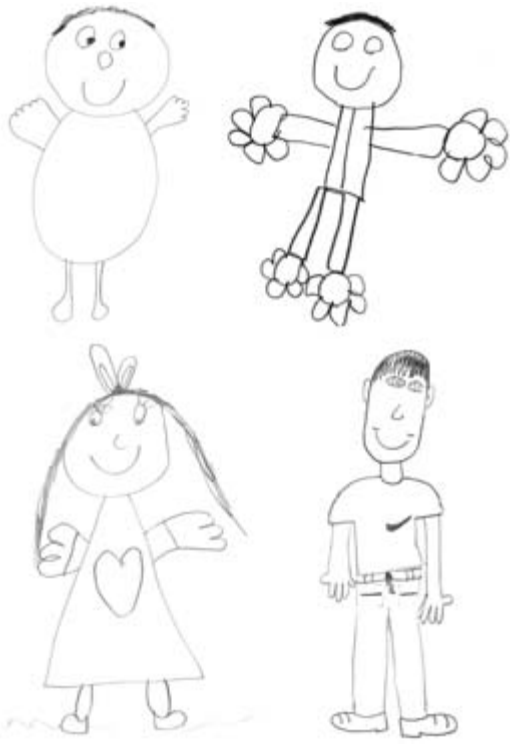

Figure 1.3 Examples of children's drawings of the conventional form of the human figure.

house or multiple sides of a cube). The use of these techniques (see Figure 1.4 for examples) often results in an "impossible" drawing, one in which the object or scene is drawn from a number of mixed perspectives. But according to Luquet, children are not drawing from a visual model (i.e. trying to capture how the topic looks from one particular angle) but from their internal model of the topic. This internal model is represented by the features the child regards as important or criterial for that topic (i.e. those they consider define that topic) and in their characteristic shape. Over time the child's internal model changes to include even more features.

Examples of intellectual realism are not only found in children's spontaneous drawings but can also be induced in experimental studies. As part of my undergraduate project that was supervised

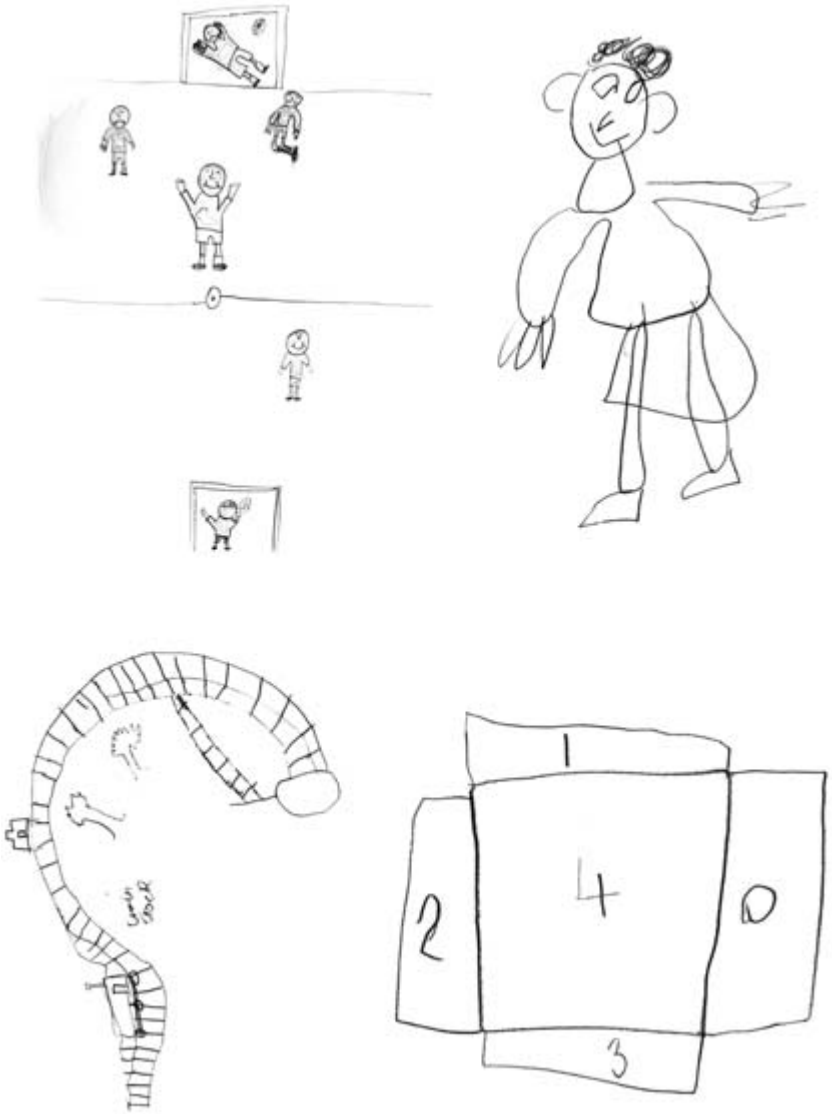

Figure 1.4 Drawings showing the use of separation of details (top left), transparency (top right), air-view plan (bottom left) and folding-out technique (bottom right) typical of Luquet's intellectual realism.

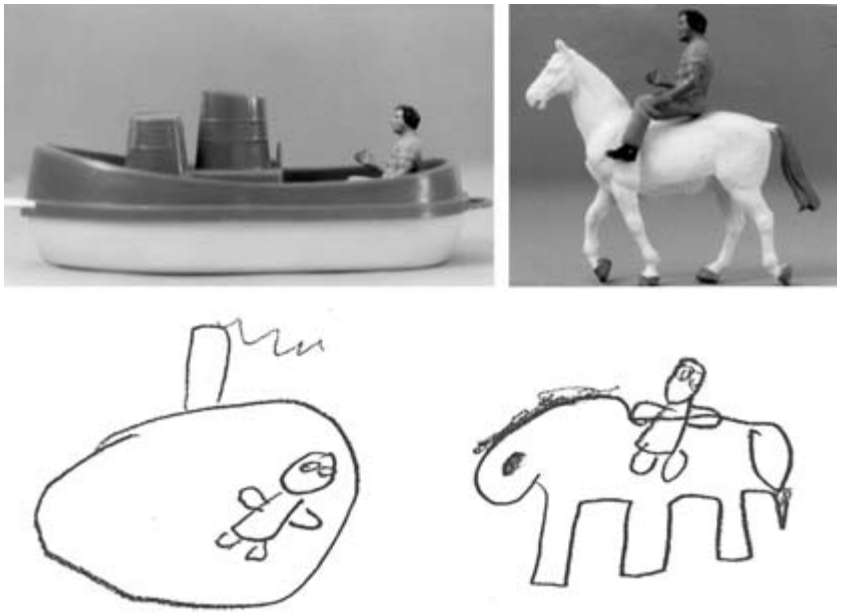

Figure 1.5 Seven-year-old girl's drawing of a "man-in-a-boat" and "man-on-a-horse" showing multi-perspective views and transparency, produced while viewing three-dimensional models (pictures of models shown above).

by Maureen Cox I asked children to draw a man riding on a horse and a man in a boat (Jolley, 1991; see also Cox, 1992, 2005). In one part of the experiment I showed children two three-dimensional models depicting these scenes (see Figure 1.5). In each case the model was presented so parts of the man were occluded by the horse and boat from the child's view, specifically, both legs in the "man in the boat" and the furthest leg in the "man on a horse". In Figure 1.5 we can see two drawings made by a girl approaching 7 years of age that are typical of the intellectual realism system. In the "man on a horse" drawing we see a side-on (profile) view of the horse but a frontal view of the rider. The child has used transparency so that no part of the horse or man is occluded by the other, and crucially both of the man's legs are depicted. Why does the child draw the horse in profile? The simple answer – that the child felt bound to reflect the same view as she saw of the model horse – will not do

because she was willing to change from her profile view of the rider to draw him in frontal view. The child stays with the profile view of the horse because it is the best one to depict the optimum number of the features that define a horse, while a frontal view would result in features being distorted or omitted. In the "man in a boat" drawing the girl appears to have drawn the main body of the boat from air-view, with the funnel drawn in a side-on view. The man has been drawn with all the criterial features shown, including his legs, and separated from the lines of the boat. The use of these graphic techniques has allowed this child to show both the main features of the boat and man in their entirety. Thus, both drawings honor the child's knowledge of the main features of the topics and their characteristic shapes. In other words, the girl's internal model (or mental image as it is sometimes called) dictated how each scene was drawn, not what the girl could actually see from her view of the models. It may now be apparent to you that this stage is called intellectual realism because the child is drawing from what he or she *knows* about a topic not from what he or she *sees* from one viewpoint.

Luquet argues that children during the intellectual realism stage eventually become aware that although their drawings show the criterial features of topics in their full and complete shape, their representations are not good depictions of how they are often seen in reality. That is, they do not look visually realistic. This begins to bother children, which leads them to attempt to draw in a more visually realistic style.

(iv) Visual realism

Luquet argues that the development of the child's attentional capacities makes him or her aware that their mode of depiction (intellectual realism) is not representative of how things are seen in reality. Children begin to notice that the relations between elements change as we move our viewpoint of the subject matter. This leads to a dropping of separation, transparency, plan, and folding-out techniques, and instead they begin to get to grips with the graphic techniques of visual realism that include occlusion, suppression of details, and perspective (see Figure 1.6). The child now attempts to select only those details and how they are seen from one visual perspective for their

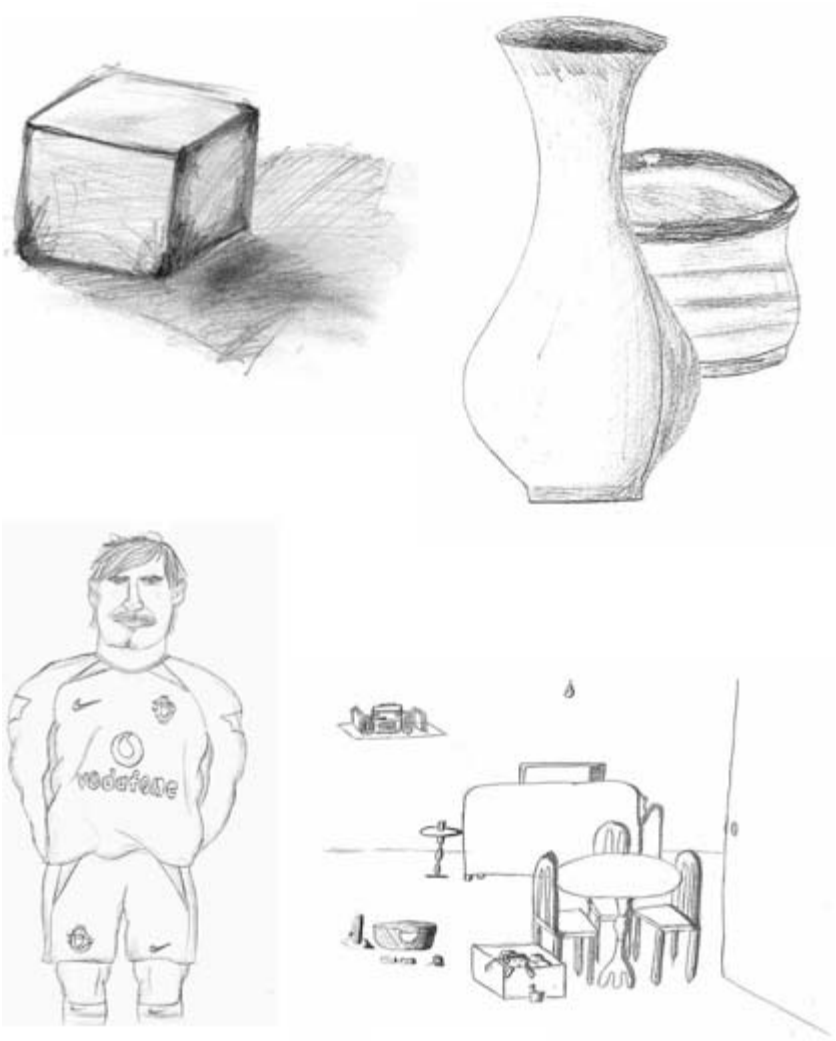

Figure 1.6 Drawings showing the use of visual realism techniques typical of Luquet's visual realism.

drawing. In essence, they are attempting to draw visual models (even if they do not have a physical model in front of them) rather than internal models. A related development is the drawing of particular examples of a topic rather than a generic version. Human figure representations, for example, begin to look like a particular individual

rather than a generic example of a person (see Figure 1.6 for a very good likeness of Eric Cantona, the former French and Manchester United footballer).

Although children ultimately enter the stage of visual realism Luquet argues that this stage is more a stage of intention rather than achievement. The laws of perspective are as much a convention that has to be learned as the conventions of intellectual realism, and few children succeed in becoming very successful in acquiring the visual realism conventions. As Luquet points out, even many adults fail to draw in a visually realistic style. Luquet notes that many children stop drawing between 10 and 12 years of age (and this is still evident today), and that it is easy to find adult drawings similar to those produced by 12-year-olds and even those that use the intellectual realism system.

Evaluation of Luquet's Stage Theory

The popularization and incorporation of Luquet's "stage" account by Jean Piaget into his own stage account of children's thinking (Piaget & Inhelder, 1956, 1969) led initially to an assumption that Luquet conceived that children moved through his four forms of realism in qualitatively distinct stages. One criterion of traditional stage theory, at least as it is understood in psychology (e.g., see Flavell, 1963), is that children are "fixed" in a stage until some point whereupon they rapidly lose the characteristics of that stage in favor of the characteristics of the next stage. Consequently, a multitude of studies surfaced during the 1970s and 1980s testing whether children's drawings were fixed in a stage, or alternatively, whether children could easily be persuaded through simple contextual manipulations of drawing tasks and instructions to draw features that exemplified a higher stage (for reviews, see Cox, 1991, 1992; Freeman & Cox, 1985; Light & Barnes, 1995; Thomas & Silk, 1990). Much of the focus of this research was on the intellectual realism stage. Studies typically presented objects to children in a perspective whereby an important feature of a topic was partially or fully occluded (e.g., a cup with its handle hidden) or with one object behind another so that part of the behind object was hidden (e.g. two balls whereby only the top part of the "behind" ball could be seen). Early studies showed that

children around the age of 5 to 7 years would, for example, include the "hidden" handle in their cup drawing and draw both balls in their entirety, providing evidence that children around this age do draw in an intellectually realistic style (Cox, 1978; Freeman & Janikoun, 1972). Researchers then asked whether children who typically drew intellectually realistic drawings in such experiments could be encouraged to draw in a more visually realistic style. An increasing body of research showed that such children could omit an occluded feature under certain contextual conditions (e.g., see Arrowsmith, Cox, & Eames, 1994; Bremner & Moore, 1984; Cox, 1981; Davis, 1983; Lewis, Russell, & Berridge, 1993). These conditions included asking the child to draw only what they could see of the model, not naming the identity of the model, preventing the child from touching the model, and presenting an occlusion scene that made more sense to the child (e.g., a robber partially hidden behind a wall). As children could be induced easily to draw different types of representations of a topic through simple experimental manipulations researchers rightly concluded that children's drawings do not develop in stages.

Costall's English translation of Luquet's original French text (and his introduction to it) confirmed what many had already begun to realize that there had been important misconceptions of Luquet's ideas in some parts of this historic literature.[5] By reading Costall's translation of Luquet's 1927 book (Luquet, 2001) it is easy to see that Luquet had never intended for his account to be a stage theory (although he does use the word "stage"). Luquet was at pains to point out that the transition between "stages" is gradual, frequently commentating that representations typical of a previous stage are still seen when the child adopts a mode of representation characteristic of the next stage. Furthermore, Luquet did not accept that visual realism was an advance on intellectual realism.[6] In his mind they were merely different systems of representation each having their own advantages and disadvantages.

If one reads Luquet's account without the prejudiced trappings of a stage theory one finds a number of gems. As I mention in my review of his book (Jolley, 2004), Luquet's opening chapter on intention represents a wealth of ideas on why children draw, an issue that is often strangely neglected by those working in this field. The second chapter on interpretation emphasizes how children's graphic mistakes can

cue ideas for new topics to develop, which puts a more positive slant on how their production difficulties are normally considered. The third chapter on type has many ideas that reflect contemporary debates. For instance, Luquet's views on the conservative nature of children's repeated drawings (showing resistance to change) as relating to preference and habit, indicate an alternative position to the recent theory of representational redescription (RR) which states that such drawings occur due to an underlying cognitive constraint of not having explicit access to the elements of a topic (see this book, chapter 6). In the graphic narration chapter Luquet discusses the different techniques children use in showing action in their drawings, and could form a useful basis to a developmental account of children's representations of dynamic events.

It is important to recognize that Luquet's account was derived from the "monographic study" approach in which he directly observed the child creating their drawing, while listening to the child's comments. He was interested in studying the drawings children initiated for themselves, rather than drawings created on request as is typical of experimental studies. In that sense his account refers to children's *natural* drawing development. As Costall (2001) notes, Luquet was so serious about children's drawing development that he observed the development as it naturally occurred. For that reason alone any reader serious about understanding the development of children's representational drawing development would do well to begin their study with Luquet.

You can find descriptions of the graphic changes found in children's drawings in the many subsequent books on this topic (e.g., see Cox, 1992, 2005; Gardner, 1980; Golomb, 2002, 2004; Thomas & Silk, 1990; Winner, 1982). Although many of these descriptions are intended to provide only an overview of children's drawing development, rather than a formal theoretical account in the sense that Luquet proposed, they are consistent with the graphic changes Luquet described. That is, researchers agree that children's drawings initially develop from a period of scribbling to representations that become increasingly lifelike. This gradual progression is served by the use and improvement in detail, spatial alignment, proportion, depth, partial occlusion and on occasions even perspective. As in Luquet's account, this literature also discusses the psychological processes (e.g., cognitive, motor, spatial understanding) that shape these graphic changes (summarized

later in this chapter). A notable and alternative approach in which the primary focus is on the graphic changes themselves can be seen in the work of John Willats (1977, 1985, 1987, 1992a, 1992b, 1995, 1997, 2005), which I shall turn to now.

Willats' Representational Drawing Systems

John Willats was educated in mechanical sciences and psychology, and until his recent death was a practicing artist with an interest in projective geometry. In work spanning across four decades he has set about analyzing the different drawing systems used in a wide variety of pictures that are created by artists, engineers, photographers, mapmakers, as well as by children. Although his theory is therefore a general theory of picture perception, part of his work has been devoted to children's drawings, and he recently dedicated a whole book on the subject (Willats, 2005). Willats argues that because children's drawings are often studied by developmental psychologists, their developmental accounts are influenced by their analysis of the child's mental processes involved in drawing. In reference to Luquet's account, for instance, he states that children drawing what they know rather than what they see is a way of describing the child's mental state not of the drawings themselves (Willats, 1997, 2005). Willats considers that mental processes can only be inferred from the picture, and that the validity of such interpretations cannot be attained without first gaining an accurate description of the developmental representational systems that children use.

Nevertheless, Willats was in agreement with Luquet in his view that children intend their drawings to represent realism, "what children look for in their drawings is realism, and what they want to produce are what I have called 'effective representations' " (Willats, 2005, p. 18). Over a series of publications Willats' aim, therefore, has been to describe the different drawing systems that children use to make effective representations of topics and scenes from life. In his experimental studies he has asked children of different ages to draw tables and unfamiliar rectangular objects. From the drawings Willats has formulated a developmental progression of drawing systems that represent different ways in which the spatial relationships in the real-world scene are mapped on to the spatial relationships of

the lines in the picture. By interpreting the drawings Willats has derived five drawing systems that can be summarized as follows:

1 Topology
2 Orthogonal projection
3 Horizontal and vertical oblique projections
4 Oblique projection
5 Perspective

It is easier to understand these drawing systems of spatial relationships if we look at Figure 1.7 taken from one of Willats' earlier studies (Willats, 1977) in which 5- to 17-year-olds were asked to draw a table (with a variety of objects on it) from a fixed vantage point. Drawing (a) displays what the children saw, whereas drawings (b) to (g) represent children's drawings of the table and contents that corresponded to Willats' five drawing systems. In his commentary on the different drawing solutions the children came up with, Willats (2005) stated that drawing (b) is an example of a topological system in which the spatial relations between the objects on the table and the table itself are incoherent. The rest of the drawings reflected different (projective) drawing systems of displaying the front-to-back spatial relations of the scene. Drawing (c) is of orthogonal projection where the front-to-back relations are ignored (e.g., notice that only the front edge of the table is shown). The depth of the table in drawing (d) is shown by up-and-down lines typical of vertical oblique projection (in horizontal oblique projection depth is shown by side-to-side lines). But this results in the picture looking "flat" because one direction on the picture has been used to represent two different directions in the three-dimensional scene. This problem is solved in drawing (e), Willats notes, by using a more complex rule where the front-to-back sides are shown by oblique lines (oblique projection). Nevertheless, Willats argues, such drawings did not correspond to the view that the children actually saw of the scene. This is achieved by drawing both sides with converging lines. In drawing (f), called "naive" perspective by Willats, is an example of this, whereas drawing (g), Willats argues, is more or less true perspective because the converging lines lead to a suitable "vanishing point." As the children's drawings fell into these categories according to an age-related sequence Willats argued that children's drawings developed through these drawing systems.

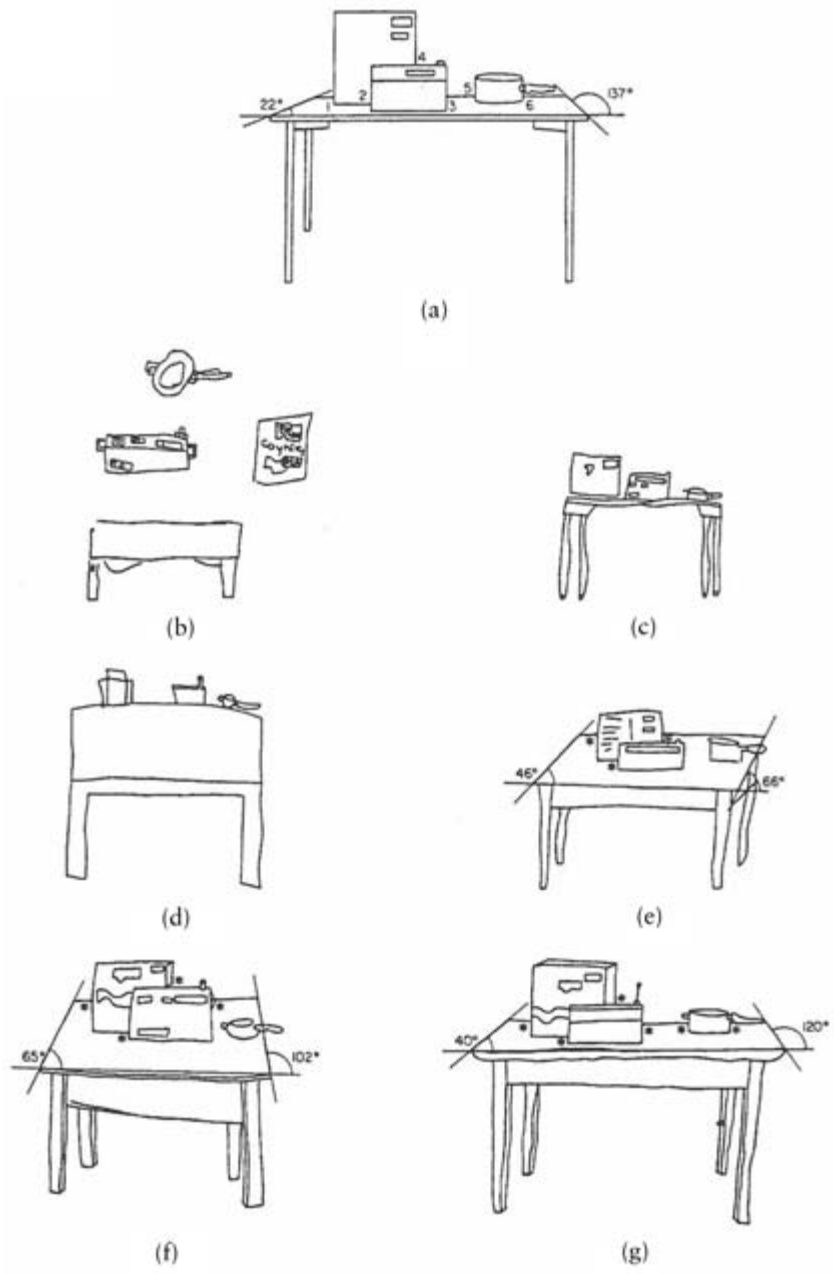

Figure 1.7 Children's drawings of a table depicting Willats' drawing systems: (a) the child's view of the table, (b) topological system, (c) orthogonal projection, (d) vertical oblique projection, (e) oblique projection, (f) naive perspective, (g) perspective.

While these drawing systems have extended our knowledge of the different ways children use line to represent spatial relationships, Willats (2005) notes that the systems are not adequate on their own in informing the viewer about what each line represents. Consequently, Willats has proposed and developed over the years an additional representational system, called denotational systems, in which lines denote the volumes, surfaces and edges of the topics drawn. Children's early representational drawings, according to Willats (2005), show enclosed two-dimensional shapes called regions that denote the volume of the topic, and accordingly are *not* the contours or edges of the drawn feature. In the case of a young child's drawing of a cube or a house that shows a singular circular or square shape, Willats argues this region represents the whole cube or house, and not the contours of their frontal face.[7] According to this analysis Willats speculates that in the tadpole form of the human figure (an early developmental representation of a person) the single enclosed area is a region probably intended by the young child to denote the volume of the whole (three-dimensional) head. Willats refers to the term extendedness to describe how the shapes in the drawing can be extended to reflect the relative dimensions of the elements in the real scene that the picture depicts. Specifically, Willats notes that young children use round regions for round volumes (e.g., heads) and long regions for long volumes (e.g., arms and legs). But of course most things in life are not purely round or long. In order to make more effective representations Willats argues that children further develop their drawings by varying the extent to which the shapes they employ are round and long, and also apply "shape modifiers" to these round and long regions. To cite two examples that Willats (2005) gives, a child may extend the body of her drawing of a horse longer than the legs to show this distinction in relative "longness" that is evident in the body and legs of horses. Further, a child will often modify their earlier "roundish" shaped enclosed area denoting a house to have straight sides. Willats comments on a range of other shape modifiers (e.g., corners, pointed line, bends in a line, dents, bumps, etc.) that children learn to use to make their denotations more effective representations of the features found in the three-dimensional scene.[8]

According to Willats, the developmental path of children's representational drawing temporarily diverges for topics that have flat faces with well-defined edges (e.g., houses) to those that have smooth and

curved surfaces (e.g., people, animals, balls, fruit, etc.). For topics that have flat faces the child now attempts to draw some of the faces of the object (rather than just one enclosed shape standing for the object's volume). In the case of drawing a house, for example, the child may attempt to draw the faces of the house (rather than its volume), either in their true shapes or something approximating to them. The trouble with this approach, as Willats (2005) notes, is that it is difficult to make the faces of rectangular objects like houses join up properly, particularly if they have each been drawn in their true shape. Accordingly, such drawings give an impression of a fold-out drawing that is produced from a number of view-points (e.g., see the cube drawing in Figure 1.4).[9] Only with the use of more advanced drawing systems (such as perspective) and the acquisition of line junctions ("L," "Y," "arrow," and "T" – examples of which can be seen in Figure 1.6)[10] do the lines in children's representational drawings begin to denote the edges and contours of the objects drawn from a view (and not regions for the faces of a topic drawn each in their true shape).

The drawing of smooth and curved objects presents even more of a problem for children. Willats (2005) defines these objects in a strict sense as varying smoothly in three dimensions, without edges, creases or other abrupt abnormalities. Willats discusses how the representation of such objects is a particularly difficult graphic problem to surmount. Consequently, he argues that when children move from drawing the volumes of flat objects to the faces of such objects (as described above), they continue to use round and long regions (with varying extensions) to denote the volumes of smooth objects. But with the use of threading and further shape modifiers in their drawings of smooth and curved objects the child's use of line begins to denote regions in the visual field (i.e. the shapes of the elements in the scene from an actual view). In the case of threading (a term often attributed to Goodnow, 1977), for example, continuous outlines are used to join elements of a scene, rather than using lines for separate regions for each element. This developmental shift is most clearly displayed in the change one observes in children's human figure drawings. For instance, compare the segmented figures shown in Figure 1.3 (particularly the two top figures and bottom-left figure) with the threading of the arms to the upper body in the human figure drawing shown in Figure 1.6. Furthermore, Willats (2005) argues that

children also start to use T and end-junctions in their drawings of smooth objects to illustrate points of occlusion and where contours end respectively. When the divergent paths for denoting flat and smooth surfaces come together Willats argues that the lines in the child's drawings are no longer denoting regions for volumes but true views of scenes.[11]

To summarize, the denotation system informs us about what the lines stand for (e.g., volumes or contours) while the drawing systems explain the spatial arrangement of the parts drawn. Willats not only encourages us to analyze each drawing in terms of the drawing and denotation systems but also to see the developmental connections between the two. For instance, regions denoting volumes is often accompanied by the simplest spatial arrangement, such as non-overlapping elements, that is characteristic of the topological drawing system. Similarly, drawings showing lines as contours and junctions are likely to show some evidence of a more advanced projective drawing system. For instance, the partial occlusion seen in a perspective drawing system is aided by the lines being used as contours and junctions between elements, giving an overall impression of a more view-specific drawing.

In Willats' lifelong work he has attempted to understand the "rules" of drawing in the same way as linguists (notably Chomsky) had previously set out to describe the rules of understanding language. Willats (2005) made a tentative comparison of his drawing and denotations systems with syntax and vocabulary respectively in language, and that shape modifiers served a similar purpose in drawing as adjectives do in language.

Evaluation of Willats' Representational Systems

Willats' drawing systems provide a more comprehensive and detailed graphic description of the variety of spatial relationships children use in their drawings than is available in Luquet's account. While he acknowledged Luquet's intellectual and visual realism styles of drawing, Willats' own drawing systems unpack the dichotomy of intellectual and visual realism. For instance, whereas topology can be associated with intellectual realism, the projective systems (orthogonal, oblique, and perspective) give more information on the developmental

systems children move through between the extremes of intellectual and visual realism. Willats' approach of not being driven by the division of the mental processes from "draw what they know" to "draw what they see," but focusing instead on the drawings themselves, has allowed him to provide a more formal scheme for classifying drawings. Consequently, his account helps us to appreciate the variety of drawing systems children create as they get to grips with representing objects and scenes from nature. More generally, his thorough approach of analyzing the meaning and grammar of line before considering the psychological processes is innovative and largely absent in the previous literature on children's drawings. His account therefore acts as a timely reminder that we should not get carried away with making psychological interpretations to a drawing and its creator without understanding first what the lines represent and their spatial relationship.

Nevertheless, there are limitations to Willats' account. Because it is a relatively novel approach to studying children's drawings it needs further development. In respect of his drawing systems the experimental evidence that Willats provides is restricted to scenes and objects that are rarely found in children's drawings (e.g., tables, cubes, etc.). Studies into how well these systems of spatial relationships can apply to the drawings children spontaneously produce are needed to verify and extend Willats' drawing systems. Conducting such an analysis into the more natural drawings children produce, rather than collecting drawings of a single scene or object, may be less straightforward. For instance, some drawings no doubt display more than one projective system. Even in Willats' own studies his categorization of children's drawings of rectangular objects into different projective systems partly relied on his somewhat arbitrary coding of the angles of the lines (see Willats, 1977), which reminds us that even using systematic coding does not eradicate the subjective nature of interpreting children's drawings.

Although Willats' denotation systems are a vital supplement to the drawing systems, merely looking at a child's drawing will not always tell us unambiguously what the lines stand for. This is particularly relevant to the question of whether a single enclosed area denotes a three-dimensional volume or a two-dimensional contour of a surface (i.e. potentially a view). For instance, it is not usually possible to tell from looking at a tadpole drawing of a person whether the child

intended the single enclosed outline to represent the entire volume of the head or the contours of the two-dimensional surface of the face. Similar problems are evident in interpreting a single enclosed line for a house. Willats acknowledged this problem, and presented some experimental findings that appear to indicate a developmental shift from children using line to denote volume and later line for contours of two-dimensional regions (see Willats, 2005). But unless you do further probing of the child, either through discussion or further experimentation, the interpretation as to what the lines stands for in some instances is left to speculation. For instance, Willats' (2005) opinion that children's early stereotyped drawings of houses with the windows attached to the lines of the house are indicative of the child intending the drawing to represent the whole volume of the house is definitely speculative, and requires further investigation. Perhaps because of Willats' approach to remove the psychology of the child from his or her drawing has given him at times too much freedom of interpretation of the lines. One must always be careful in becoming too exuberant in applying meaning to every aspect of a child's drawing. Willats acknowledged that some marks in children's representational drawings are accidental (see Willats, 2005, p. 122), and this should remind us that, particularly in young children's drawings, some marks just happen and are not meant to denote anything in particular let alone spatial relationships. To press this point further, perhaps some tadpole drawers do not give much thought about whether the enclosed region denotes the whole head or just the face?

By only recently giving some serious attention to the engagement of the child's mental processes in his or her drawing (Willats presented two chapters on this topic in his 2005 book) Willats' writings over the years on children's representational (drawing and denotation) systems ran the risk of appearing somewhat "dry" and bereft of context. Luquet's constant attention to the psychology of the child as it impacts upon drawing development gives his account a psychological richness that is lacking in Willats' representational systems. But Willats' account provides more information than Luquet's account on what the lines in a drawing stand for and in what spatial relationship. In this sense, therefore, Willats' and Luquet's theories complement each other, as each goes some way in providing what the other is lacking.

These two theories are relatively rare examples in the literature on children's drawings in that they attempt to provide a detailed analysis and holistic framework for understanding the developmental pattern of children's representational drawing. Most researchers, on the other hand, examine more specific micro-developmental changes in children's drawings and/or emphasize particular psychological influences on drawing and its development. In the next section I shall provide a brief overview of this approach.

Micro-developmental Accounts of Children's Drawing

Some questions have been directed to a particular developmental oint in children's drawings. For example, there is an ongoing discussion on developmental changes within the scribbling period. Some key questions are whether children intend their scribbles to be representational, what provides the child with insight that he or she can draw representationally, and what marks and forms children adopt from their scribbling period to make recognizable representations (e.g., see Adi-Japha, Levin, & Solomon, 1998; Callaghan, 1999; Cox, 2005; Golomb, 1981, 2004; Kellogg, 1970; Mathews, 1984, 1999; Yamagata, 1997). Luquet (1927/2001) considered trace-making (scribbling) to be activated by imitating adults' drawing (although he thought young children would do it anyway without adult models), and driven by the child's pleasure of their own creative power. For Luquet, children who scribble know that pictures can be representational, but they do not initially consider that they too can draw representationally. For Luquet it is through a gradual process of noticing vague resemblances of their marks to something from our world (fortuitous realism) which encourages the child to consider that he or she too can make representations.

Luquet's emphasis on the representational insight deriving from the child, however, neglects the role of representational suggestions coming from others. When a child presents an adult or an older child with their scribble they will often be asked, "What is it?" This no doubt sets up an expectation in the child that his or her drawing can be of something, rather than merely marks on the page. Adi-Japha et al. (1998) reported findings that confirmed the potential influence

of adult questioning on scribblers' representational interpretations of their own drawings. They asked scribblers "What is this?" while pointing to the whole and parts of their drawing, as well as recording their spontaneous comments. Children tended to give representational meanings when the experimenter pointed to parts of the drawing rather than its whole. In particular, directing the child's attention to the angular curves induced representational interpretations from the scribblers, perhaps because angular curves give information to the contours of real objects. Furthermore, the frequency of such comments increased with age. However, these representational interpretations from the child occurred only after the drawing had been made, and usually in response to the interviewer's pointing rather than from the child's own spontaneous comments. Furthermore, such representational interpretations were not stable over time, as when presented with the same drawing a few weeks later the child was likely to attribute a different representational meaning to the angular curves. Nevertheless, these findings are consistent with Luquet's assertion that scribblers over time increasingly make post-hoc interpretations of representational meaning into their marks, and that the shift is gradual and interpretations flexible. But additionally they also suggest a potential role of the adult in provoking children to make representational interpretations into their scribbles.

The role of social interaction in the shift from scribbling to representational drawing was studied more extensively by Yamagata's (1997) longitudinal study in which she monitored the conversations between two mother-infant dyads on drawing activities. The interactions began when the infants were about 12 months old and continued for a further 18 months (the time of study covered therefore the period in which the children scribbled). Yamagata noticed that the infants from 12 to 15 months would regularly ask their mothers to draw for them, and by 18 months of age would suggest drawing themes to their mothers. After the mother had drawn these themes the child would add marks to their mother's drawings, and even draw particular parts of the topics by 22 months. Suggestions of drawing themes by the mother initially preceded those suggested by the child, but with older children the latter predominated over the former. One needs to be cautious in generalizing findings from such a small sample, but Yamagata's longitudinal study indicates the important role of social interaction in children's drawings becoming

representational, and the developmental path in which this process may take place. The relative extent to which infants' representational interpretations of their scribbles derive from their own insights or are provoked by social interactions requires further research, but available data carries a consistent message that scribblers understand that marks on a page can refer to some wider reality (see chapter 5)

At the other end of drawing development there are investigations into children's acquisition of particular graphic techniques that allow a drawing to appear more visually realistic. These include integrating parts of a figure into a continuous contour (e.g., Fenson, 1985; Lange-Küttner, Kerzmann, & Heckhausen, 2002), depth and occlusion (Cox & Martin, 1988; Cox & Perara, 2001; Light & MacIntosh, 1980; Morra, Angi, & Tomat, 1996; Radkey & Enns, 1987), the use of spatial axes (Lange-Küttner, 2004), and the depiction of movement and action (Cox, Koyasu, Hiranuma, & Perara, 2001; Goodnow, 1977). A related discussion is to what extent children's drawings ever become truly visually realistic (Costall, 1995; Golomb, 2002; Luquet, 1997/2001; Thomas & Silk, 1990).

Another approach has been to describe the developmental pattern of drawing a particular topic, such as the human figure (e.g., Cox, 1993; Jolley, Knox, & Foster, 2000; Koppitz, 1968), houses (Barrouillet, Fayol, & Chevrot, 1994), cats (Richards & Ross, 1967), cubes, cylinders, sticks and disks (e.g., Bremner, Morse, Hughes, & Andreasen, 2000; Caron-Pargue, 1992; Cox, 1986; Deregowski & Strang, 1986; Freeman, 1986; Phillips, Hobbs, & Pratt, 1978; Toomela, 1999; Willats, 1992a, 1992b). In some cases researchers have taken an interest in a particular form of a topic typically drawn by children, such as the tadpole form of the human figure (e.g., see Arnheim, 1974; Cox, 1993; Cox & Mason, 1998; Freeman, 1975; Golomb, 2004; Willats, 1985, 2005). In the case of the tadpole form, theories for the apparent omission include the child having an incomplete internal model, having information processing constraints on attention and memory, having production difficulties, and that the single enclosed area represents both the head and body for the child.

Such theories remind us of another body of work that explains the many and varied factors involved in drawing and that bring about its developmental change. Some attempt has been made to relate

theories of perception, most notably those proposed by Gibson and Marr, to intellectual and visual realism in drawing (Costall, 1995; Hodgson, 2002; Willats, 1987, 2005). There have been discussions on the nature of the internal model (Freeman, 1972; Cox, 1993; Golomb, 2002; Piaget & Inhelder, 1956). In chapter 6 we will look at a recent (representational redescription) theory that tries to explain children's developing flexibility in drawing in terms of an implicit to explicit shift in children's internal representations (see also Barlow, Jolley, White, & Galbraith, 2003; Karmiloff-Smith, 1990). Developmental changes in children's drawings have been related to other cognitive, conceptual and perceptual changes in the child, such as intelligence (e.g., Harris, 1963; Naglieri, 1988), symbolic understanding (Callaghan, 1999), a shift from to figurative to operative thought (Lange-Küttner & Reith, 1995; Milbrath, 1998), their understanding of space (Piaget & Inhelder, 1956, 1969) and visual attention to a scene (Reith & Dominin, 1997; Sutton & Rose, 1998). Factors involved in the process of drawing have been highlighted, particularly the information processing of attention, planning, monitoring, and memory (Freeman, 1972, 1980; Morra, 2002; Morra et al., 1996; Morra, Moizo, & Scopesi, 1988; Thomas, 1995). There are numerous papers on the graphic difficulties children need to overcome in translating three-dimensional subject matter onto a two-dimensional page (for reviews, see Cox, 1992, 2005). Children's metacognition of pictures, particularly their understanding of the developmental sequence in drawing and their preference for more advanced drawings than they produce themselves, may influence their own graphic development (Cox & Hodsoll, 2000; Jolley et al., 2000; see also chapter 4). A related debate is the extent to which children's drawings are influenced by children observing and getting ideas from other graphic models or inventing their own graphic schema (Arnheim, 1974; Golomb, 2002, 2004; Wilson & Wilson, 1977; see chapter 9).

One should also remember that drawing is an activity engaged in by not only typically developing children but also children from special populations with learning difficulties and deficits attributable to a clinical disorder. In chapter 3 we shall see that the study of such drawings raises some interesting questions, such as whether the drawing development from such children is similar but delayed to

that found in the wider population, or shows signs of qualitative differences.

This is by no means an exhaustive review of all the lines of research into the graphic changes we see in children's representational drawings, but these factors remind us of the complexity of drawing and the multitude of psychological influences on it.

Summary

The early scientific interest in children's drawings around the turn of the 20th century focused on the developmental changes observed in the representations children made, and how the drawings may inform us in regard to the mental development of the child. Although another approach of identifying links between children's drawings and prehistoric art proved to be largely unfounded, it nonetheless contributed to raising the profile of studying children's drawings. Luquet's (1927/2001) account of drawing development has perhaps been the most influential during the 20th century and beyond in suggesting how children develop their drawings through various forms of realism, and how such changes are influenced by psychological changes in the child. Much of the subsequent research into more specific questions relating to representational changes in children's drawing, and the discovery of the many psychological factors that influence these changes, pays credit to Luquet's ideas either directly or indirectly. In work spanning four decades Willats has developed an alternative approach of studying children's drawings by analyzing what the lines in a child's drawing stands for and the spatial relationships that lie therein (Willats, 2005). Nevertheless, both Luquet and Willats were committed to the view that children's drawing activity is driven by the child's desire to make realistic representations of the world around them. Also, I have argued that the differences between the two accounts actually complement each other to provide us with a more complete and comprehensive framework for understanding the development of children's representational drawing. But Luquet's and Willats' allegiance to representational drawing in childhood neglected the clear *expressive* communication of moods, feelings and ideas found in children's art. It is children's expressive drawings that we now turn to in chapter 2.

Notes

1 This view was an example of the now discredited recapitulation theory (Haeckel, 1906) which argued that the physiology and mental growth observed from the embryonic period to adulthood repeats the evolutionary stages of forms and mental growth of the human race.
2 Although Cox (2005) agrees with this generally accepted view she does comment on some potentially interesting similarities between child and primitive art.
3 I am indebted to Robin Campbell's talk to the developmental section of the British Psychological Society on Kerschensteiner's work (Campbell, 2004).
4 Luquet distanced himself from the opposing views that children are idealists in their drawing (making nature more beautiful than it really is by adding additional features) or that their drawings are schematic (graphic inventions that "stand for" the topic referred to).
5 For earlier commentaries by Alan Costall alerting us that some key aspects of Luquet's ideas had been misinterpreted see Costall (1989, 1995, 1997; see also Cox, 1993).
6 A criterion of stage theory is that each subsequent stage is an advance on the previous stage.
7 This idea is very similar to Luquet's (1927/2001) assertion that children first draw lines to represent the whole of the topic (and only later unpack the parts).
8 Willats (2005) acknowledges that young children may initially use single extended lines for long volumes (as is the case of single lines for arms and legs) before using a long enclosed area. They also continue to use dots and patches of scribble that had been initially acquired while they were scribblers as they serve to make effective representations of certain elements (e.g., dots for eyes and a patch of scribble for hair).
9 Note that Luquet (1927/2001) also commented on fold-out drawings, although he saw it as one graphic technique of intellectual realism rather than an error (as Willats seems to conceive it).
10 Willats discusses lines as junctions as denoting corners and overlap. For example, an "L-shaped" junction is good for showing a corner while a "T-shaped" junction denotes where one foreground object meets a background object (the cross-bar of the "T" shows the foreground edge and the stem shows the edge of the rear surface; see also Kennedy, 1997, for his commentary on this).
11 Note the similarity with Luquet's stage of visual realism.