Into the Third Dimension:

An Exploration of Children's Human Figure Sculptures

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Abstract

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The effect of four different instructional sets on children's clay sculpture was investigated. The sets focused on the human figure and included making a person, a person wearing a backpack, a person playing catch with a ball and a parent bending down to pick up a child. The participants constituted three age groups: 4-5 years, 7-8 years and 11-12 years. Results indicated significant task and age effects on measures of three-dimensionality. Sex differences were found in the care and attention the children exhibited when modeling the figures. Patterns for sex and age emerged for the qualitative measures related to modeling style and the sequence of sculpture construction. Age-related trends were found for the type of representational model employed (one-, two- or three-dimensional figures). The findings support the position that three-dimensional concepts are present even in young children and that the use of such tactics increases with age. However, the particular developmental stage as exemplified by a given sculpture is largely determined by the task demands. Specific instructional support can encourage the use of the problem-solving techniques needed for modeling the human form in the round.

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Three-dimensional art activities, such as sculpture, encourage children to construct new knowledge about the properties of materials and objects in their environment. Sculpting in clay allows a child to explore and interpret the various surfaces of an object and opens new possibilities for creative expression and symbolic representation. As the body is the only instrument needed to manipulate clay, it offers a direct relationship with the medium. This uniquely physical experience can foster deep levels of tactile, perceptual and kinaesthetic awareness and understanding. It is no wonder that shaped clay has been called humankind's "primal artistic medium" (Feldman, 1988, p. 18) and can be traced back to Paleolithic times. Clay forms have evolved along with the human species, shaped to serve both utilitarian and aesthetic purposes. Human figurines (i.e., the Venus of Dolni Věstonice) and animals appeared first, followed by clay pots, jars and other functional structures (Bahn, 1998). Presently, ceramics and clay sculpture continue to be dynamic and vibrant modes of artistic expression as evidenced by the numerous schools, publications and galleries devoted to such art forms. Being a versatile medium, clay has also found a place in contemporary art therapy and child-centred psychotherapy approaches, which often utilize this material as a vehicle for communication and healing. Clay is a valuable interpretive tool that shows the process of cognition and perception through its manipulation (Kramer, 2000). As such, this medium has been integrated into treatments for a variety of psychological problems including Asperger's, aggression, and post-traumatic stress syndrome (Case &

Dalley, 2008). Clay is also central to the learning theories of alternative education practices such as Reggio Emilia. This particular approach uses clay as a means to better understand how young children explore, represent and learn (Smith & Goldhaber, 2004). Within typical educational settings such as elementary classrooms, modeling activities with Plasticine or Playdough are commonplace as these materials are accessible and affordable for teachers. Extracurricular ceramic programs for children are often structured and focus on basic construction techniques, and may provide information about the physical and chemical properties of the medium. Regardless of the setting, activities utilizing clay represent important and long-lasting experiences for many children (Davis, 1988).

Despite the utility of clay as a learning and expressive tool there remains little empirical research examining how children use this or other three-dimensional media. To date, the majority of research on children's representations has focused on drawing and to a lesser extent on other two-dimensional depictions such as paintings (e.g., Beach & Bressler, 1944; Lewis, 1990; Sinha & Misra, 1975). There are a number of reasons for this neglect as researchers interested in clay work are quick to identify. One explanation is the physical characteristics of clay, which can present several difficulties sufficient to deter extensive investigations of children's work (e.g., Arnheim, 1974; Golomb & McCormick, 1995). While in its wet state, clay is relatively forgiving and can withstand a certain amount of stress if kept adequately moist. However, the preservation and transport of dried clay can be problematic as it becomes extremely brittle and is prone to disintegration. Although properly kiln-fired clay is highly durable and long lasting, this too can be an unpredictable process. This is especially true with items made by novice sculptors as improperly dried, conditioned or joined pieces will often not survive the kiln and may crack or explode. Air-drying clay is a more recent innovation that does not require kiln firing; however, I have yet to discover a strong and long-lasting product. In addition to these drawbacks, dominant modes of thinking within academic communities have regarded clay productions as aesthetic objects with little emphasis placed on their educational, behavioural, and social implications (Feldman, 1988). Developmental researchers have largely overlooked clay as a pathway to understanding sensorimotor learning and complex thought patterns, but have instead focused their attention on graphic productions (Burton, 1988). For some time psychologists and educators have investigated drawing as it relates to aspects such as visual perceptual skills (Lord & Hulme, 1988), creativity (Ryan & Winston, 1978), cultural factors (Toku, 2001), diagnostics (Di Leo, 1973) and general cognitive development (Baldy, 2005). Drawings also offer greater accessibility, as they demand far less effort on the part of the researcher. They involve virtually no cleanup, a minimum of space for transport and storage, and do not require energy intensive curing processes. However, if clay and other similar sculpting materials are to be successfully incorporated into learning environments, it is imperative to investigate how children represent and understand media specific information. While existing investigations of sculpture production in children have yielded invaluable data, the research remains incomplete. Without additional methodological approaches that examine a range of specific clay modeling tasks, the practical utility of research in this area is limited.

The purpose of the present research study was to systematically examine children's production of clay human figure sculptures and investigate the effect of various instructional modifications. Modeling development was selected as an area of study in order to add to the extant research investigating children's relationship to three-dimensional media. The human figure was the chosen subject matter, as considering it is the most familiar object, it is primal and evocative. Our embodiment of the human form provides great potential for interpretation, expression and the creation of meaning. Children seem especially drawn to the human figure. Burton (1988) states that this curiosity may originate from "profound personal experiences with bodily change" (p. 32). Young people are equally fascinated by their own bodies and the bodies of others. As a result, children often search out information related to aspects of the body such as anatomy and appearance. Burton goes on to suggest that children represent the human figure in an effort to discover, reflect on, and make sense of ideas about what it means to be human. Indeed, as a favourite subject for many children, people are one of the first recognizable structures to emerge in their drawings and clay manipulations and this interest tends to persist through the childhood and adolescent years (e.g., Brown, 1975; Burton, 1998; Cox, 1993; Golomb, 2002; Jolley, Knox & Foster, 2000). The topic is of particular importance because of my strong interest in cognitive, perceptual and developmental psychology. Of specific concern is the acquisition of the knowledge and skill related to the three-dimensional properties of objects and environments. Also inspiring this investigation is my longstanding fascination with small-scale, realistic sculptures and miniatures made from a variety of materials including naturally occurring clay and synthetic clay compounds, such as polymers (see Figure 1, 2). The questions under investigation in the present research study included:

- What are the effects of different instructional sets on children's clay sculptures of the human figure?

- What are the characteristics of children's clay sculptures of the human figure at various developmental periods (4-5, 7-8 and 11-12 years of age)?
- What are the differences between the clay sculptures of girls and boys?
- What are the similarities and differences between modeled and drawn representations of the human form?
- What are the cognitive, physical, and verbal activities involved in a child's exploration of clay and what are the effects of practice and learning?

Graphic Development and the Human Figure

Beginning in the later years of the nineteenth century, the study of children's drawings emerged as a topic of enquiry for researchers interested in the acquisition of artistic knowledge and broader developmental trends (e.g., Baldwin, 1895; Brown, 1897, Lukens, 1896; Sully; 1896). Within the fields of art, education and psychology children's graphic development has remained the focus of scholarly attention, leaving other media largely overlooked. Consequently, some inferences about the development of sculpture have been the result of relating clay creations to the stages observed in drawing (e.g., Arnheim, 1974, Brown, 1975; Lowenfeld, 1952). Unfortunately, the direct transference of a developmental model from one domain to another often leads to erroneous assumptions, as each medium is subject to unique possibilities and constraints. Still, this does not mean that drawing and modeling have no developmental commonalities, and information within the two areas is unconnected. Therefore, for the purposes of the present study, it is useful to discuss the pre-existing information regarding both graphic and modeling development. When considering developmental theories, it should be noted that growth is not solely dependent on chronological age and that there are multiple pathways to the same destination. The course of knowledge acquisition may differ greatly from one child to the next as learning depends on the diverse interaction of biological, cognitive, emotional, and sociological factors. There are however, identifiable representational systems that emerge during a child's exploration of particular media. I will begin with an examination of the general phases that have been observed in drawing, with an emphasis on the evolution of the human form.

The area of children's graphic representation of the human form is well documented (e.g., Barnes, 1894; Bennet, 1964; Karmiloff-Smith, 1990; Kindler & Darras, 1997; Morra, 2008; Reith, 1997; Spensley & Taylor, 1999; Willats, 2005). Like most objects, the portrayal of a figure tends to begin with one-dimensional lines and dots, progresses to two-dimensional pictures drawn in orthographic projection then finally to the representation of multiple sides indicating depth and volume (Golomb & McCormick, 1995). In most Western Cultures, children as young as 12 to 14 months discover drawing by making gestural motions that leave marks on the page or what is often referred to as a *scribble* (Figure 3A). It seems that the child may be motivated to produce them by the motor movement it involves (Haris, 1963) or the great visual interest that the scribbles create (Morra, 2008). There has been much speculation about exactly what is going on during the scribbling stage and whether these non-pictorial efforts reflect an early representational intention (Cox, 1993; Wolf & Perry, 1984) or can best be described as pre-representational creations accompanied by post hoc verbal descriptions (e.g., *romancing*, *reading off*) which link them to real objects or events (Golomb, 2002). It appears that the mostly likely explanation is that the drawings themselves are one part of a complex behavioural structure in which speech, gesture and markings together form a representation (Matthews, 1984). Nonetheless, most investigators agree that these scribbles are not purposeless and unorganised actions, but reveal an awareness of pattern and the development of hand-eye-coordination (Thomas & Silk, 1990). The first recognizable representations occur anywhere from 18 to 30 months when there is the emergence of more controlled forms created from dots, lines, angular curves and circles. Children begin to be aware of similarities between these shapes and objects in their environment. The recognition of pictures within the scribbles seems at first to be accidental but between approximately 2 and 3 years, children progressively construct arrangements that share more visual-spatial similarities with the objects they are attempting to symbolize (Cox, 1993). An important factor in the child's recognition of these corresponding shapes in their scribbles is the ability to create loopy, circular outlines. It seems that this "primordial circle" (Arnheim, 1974, p. 174) can stand for almost any object.

Indeed, the first human form appears as an irregular circular form. This enclosure often contains a few facial details and is referred to as a *global figure* (Golomb, 2002; Figure 3B). Some argue that while such depictions resemble only a head, they are intended to represent a person in its entirety (Cox, 1993; Golomb, 2002). Around the age of 3 to 4 years, this shape often becomes a *cephalopod* (Ricci, 1887) known more commonly as the *tadpole figure* (Figure 3C) with the addition of legs and sometimes arms attached to the sides of the head. This form is then reorganized by lengthwise elongation to create either a stick figure or an *open-trunk figure* (Golomb, 2002; also termed the *transitional figure*, Cox & Parkin, 1986) with an arm attached to each leg rather than the head (Figure 3D). Approximately, between ages five and six, a separate unit for the torso is used to create a *full-fledged* or *conventional figure* (Figure 3E). However, instead of adapting the open-trunk figure by putting a cross line between the legs, often a new circular or oval torso is created (Cox, 1993). From 5 to 7 years onward, size relationships and proportion become increasingly important, and children may replace their segmented figures with a single body contour (Cox, 1992; Golomb, 2004), a technique also called *threading* (Goodnow, 1977). Occasionally, the entire body (except for the head) is drawn in outline, giving it a "gingerbread man" appearance (Cox, 1993). These images increasingly possess essential characteristics of the humans they are intended to represent, and undergo further differentiation of body parts (Figure 3F). Children continue their experimentations with attempts to portray the view-specific appearance of people and scenes (Golomb, 2002). Up to about age twelve, children add more and more body parts to their drawings (Koppitz, 1968). Following this period, if not practiced and encouraged, graphic development tends to level off with progress occurring in smaller increments, and with interest in drawing declining (Golomb, 2007). It is important to recognize that with some children, the different styles of the human figure appear to represent distinct stages but with others, tadpoles, open-trunk and transitional figures overlap, exist concurrently or are skipped altogether (Cox, 1993; Mathews, 1984; Wolf & Perry, 1988). The particular model employed also seems to be related to the child's intentions and their interpretation of the task at hand (Golomb, 2002). Specific age ranges have been found to correspond with the use of various representational devices (e.g., Cox, 1993, 1997; Thomas & Silk, 1990). That being said the progression of human figure drawings is not strictly age related nor does it necessarily follow a rigid time trajectory (Golomb, 2007).

Modeling Development and the Human Figure

Although much is known about the development of the human figure in the drawings of young children, there are significantly fewer studies that have sought to explore children's work in clay (e.g., Brown, 1975; Golomb & McCormick, 1995; Grossman, 1980; Hagan, Smilansky, & Lewis, 1988; Sherman, Landau, & Petcher, 1977). Despite the important contributions of these investigations, much of how children approach clay and other materials used in sculpture remains unexplored. Moreover, although similarities have been noted between the developmental patterns in drawing and sculpting, the exact nature of the relationship between the two domains is not completely clear.

One of the most complete accounts of the developmental characteristics of modeling comes from the analysis of children's work in Playdough and clay by Claire Golomb (e.g., Golomb, 1972, 1973, 1974, 2002, 2004, 2007; Golomb & McCormick, 1995). What follows is a condensed description of Golomb's detailed observations on the progression of modeling. Beginning at approximately 2 to 3 years of age, a child will approach the medium rather hesitantly. They may touch the material timidly, handle it purposelessly, or use it with other toys. It is not until a few months later that more active behaviours are exhibited. Children will then manipulate the clay by pounding, stretching, pulling, poking, slapping, squeezing, flattening and the like. Golomb contends that these early actions do not demonstrate a true representational intention but that children simply enjoy the tactile sensations that the clay provides. Eventually, children discover that rolling the clay backwards and forwards either between their hands or on the work surface "yields the first visually coherent and pleasing unit" (Golomb, 2004, p. 334), the stick or snakelike shape. Following this innovation, children begin to roll the clay into rounded balls or elongated spheres. These basic shapes will later form the basis for an array of more complex configurations.

From these early feats, the human figure is brought into being as a minimally differentiated, asymmetrical formation. The emergence of representational forms occurs at approximately age three. At this point, there are three distinct models that appear: the featureless upright column, the blob or slab with facial features, and to a lesser extent the *layout model* composed of unconnected parts. The most frequent model is the erect column or lengthened blob of clay whose features are often verbally assigned (see Figure 4A). Golomb (2002) asserts that this prototype has no counterpart in drawing; however, in a very early account Brown (1897) noted column-like figures dubbed "little girls" by a 40-month-old female participant. These figures lacked appendages and had minimal or no facial features. Szabad-Smyth (1992) also found evidence of elongated mandalas and figures in her longitudinal study of her young daughter's spontaneous drawings. Although such accounts are infrequent, these drawn forms and the clay columns may in fact share a similar developmental foundation. The clay column begins as a crudely shaped cylinder but has an upright posture and may be held in the hand or placed erect on the work surface. While most of these figures are vertical, there is the rare flat or horizontal form. Later on, body parts are minimally pressed out of the main structure (see Figure 4B). Then, a more differentiated head and appendages appear, as the column is internally subdivided through pinching and pulling (see Figure 4C). This single unit structure is then divided and an individually formed head, legs and sometimes arms are attached to the torso (see Figure 4D). Each part is modeled separately and is assembled in sequence using an additive method, usually beginning at the top or the bottom. While this figure may remain faceless for some time, little by little, the form becomes more detailed and the overall proportions improve.

A second commonly used model is a ball or disk with distinct facial features that are inscribed on the surface or represented as indentations or separately formed pieces of clay (Figure 5A). Unlike the aforementioned column technique, typically this global structure does not stand upright. And, although this method often results in a three-dimensional form, the figure may also appear as a two-dimensional slab and is similar to early graphic experimentations. In the event that the spherical form is flattened, usually with the palm of the hand, children frequently comment, "Got to make it flat". Golomb interprets this as meaning, "Got to make it *flat like paper*" (2002, p. 56). For many children, unless flattened, the clay seems unusable. As with drawing, the global evolves into a two-unit tadpole figure that varies from a sphere to a disk with stick-like cylinders to serve as legs (see Figure 5B). The legs can range from quite stubby to longer appendages. The majority of clay tadpoles lie horizontal but about one third of children make vertical figures with rounded legs. If the form has been flattened, the surface may then be scratched into directly or the child may create cookie-cutter versions of features, placing them on top of the clay. Similar to the column method, the tadpole figure gradually undergoes a further differentiation of the appendages and torso (see Figure 5C). A distinction is also made between the upper and lower torso (see Figure 5D), which may be accompanied by the addition of a neck, and clothing. Smaller details such as fingers and hair also begin to appear.

The third but atypical approach described by Golomb begins as a layout model, which usually consists of facial features and occasionally a stomach and limbs (Figure 6A). Each part is formed separately and placed in the proper spatial arrangement on the work surface. As this form evolves it can become a full-fledged *graphic model* (see Figure 6D). Such figures are often symmetrical and contain many distinguishing features. The graphic model may also develop from the tadpole figure, however the form is not bulky or rounded but is distinctly "graphic" and outlined with lines of rolled clay (see Figure 6B). Often this outlining technique may be combined with other strategies, for example, a figure may have a slab-like head but the remaining features are comprised of rolls of clay. Golomb describes the graphic model as a linear model that evolves from the representation of individual elements and borrows two-dimensional concepts and procedures from drawing. The child uses the clay similarly to lines drawn with a pencil. A child may also produce one- or two-dimensional graphic models that resemble the "stick people" (see Figure C) or the open-trunk figures seen in drawings. These figures begin as a series of linear fragments of clay; either attached or detached and arranged on the work surface like puzzle pieces. In drawing, the stick figure and similar variations are often employed as a representational technique; however, this tendency is not as frequent in modeling. The construction is also quite different as the individual parts are sculpted before they are assembled rather than following one another in a particular order such as from top to bottom. With experience, any detached parts are connected and the figure becomes either a proper graphic model or a conventional sculpture of solid construction (Golomb, 2002).

As Golomb's research revealed, models such as the upright column and ball with facial features seem to indicate a basic understanding of three-dimensionality. The two-dimensional linear or flattened products that share a close resemblance to drawn figures often emerge slightly later, as the desire to create a greater number of distinctly modeled and detailed parts increases (Golomb & McCormick, 1995). In addition, the human figure is a rather difficult form to depict as the elongated body balances precariously on only two relatively small feet. Gravity too works against the securing of multiple pieces of lengthened clay. As Golomb (2002) noted, the creation of a well-proportioned and differentiated standing sculpture can prove quite frustrating, a problem that is often solved by adopting a horizontal posture analogous to the drawn page. However, use of the graphic models is short-lived as they are fragile and cannot withstand much movement. They tend to be swapped for more stable and solidly modeled figures that exhibit a closer approximation to the human form. If not yet able to stand on their own, they may be held up by the child or given support in the form of furniture and other accessories. With continued practice and guidance, early models can eventually grow into three-dimensional freestanding, differentiated representations. While there are identifiable trends in modeling development, the adoption of a particular model for one task does not necessarily imply that children are incapable of modifying their representational schemas or even that only one general internal model exits. Children are also responsive to assignments and often less fitting models are abandoned as new discoveries are made. For example, a child may model a "man" as an open-trunk figure lying down while a "snowman" is created to convey a body and is upright in stance (Golomb, 2002).

Information from early reports indicated that children's sculpture might progress in a manner similar to drawing (e.g., Arnheim, 1974; Brown, 1975) and other three-dimensional media such as building blocks (Guanella, 1934). When this linear-graphic hypothesis is applied to clay sculpture, modeling development would progress from one- to two- then the three-dimensional use of the material. Children would begin with rolled snakes of clay, move on to flattened slabs, and then finally represent all sides of an object by sculpting in the round. From preliminary analyses of children's depictions of people, it would appear that many of the underlying processes in modeling are shared with or borrowed from drawing. However, additional research has demonstrated that there is not a direct, one-to-one relationship between the developmental patterns of drawing and modeling. There are characteristics that are particular to the medium of drawing that are not readily transferable to clay and vice versa. For example, students are better able to sculpt from clay a figure in a complex position, such as sitting, than draw to it (Colbert, 1991). Alternatively, the quality and detail of clay figures lags behind figures drawn by the same students (Brown, 1975). Specifically, the proportion of clay renderings of humans lacking facial features is high but drawings of the same subject rarely lack this detail (Golomb, 2002). Golomb's account in particular indicates that modeling does not follow the same linear pattern of drawing development but instead begins with the three-dimensional use of clay. While it is apparent that the domains of drawing and sculpting differ in a number of aspects, the reasons for these discrepancies are more difficult to explain. Children are often given pencils and paper at an earlier age than they are given access to clay. Bonoti, Vlachos, and Metallidou (2005) found that children's drawing scores and performance on several writing tasks were correlated. This suggests that mastery of implements such as pencils and pens is closely tied to the teaching of subjects such as writing and math, which occupy considerably more of the young child's school curriculum than three-dimensional art activities. It is not surprising that for many, the creation of a satisfactory rendering in clay proves to be a more difficult task than a drawing of the same subject matter. Nevertheless, clay is a three-dimensional material and thus befits the representation of three-dimensional objects. It seems that greater access to and knowledge of this versatile medium would allow for increased sensorimotor learning and representational possibilities.

Flexibility and Children's Representations

Human beings possess the capacity for flexible behaviour, to move beyond simply performing a task, to reflecting on the necessary knowledge constructs and applying them to novel problems and situations (Spensley & Taylor, 1999). Theories of cognitive or symbolic flexibility have been created to describe many types of learning processes, including those involved in children's graphic development as representation can be seen as a form of problem solving. A potential explanation of drawing flexibility was suggested by Karmiloff-Smith (e.g., 1986, 1990) who proposed that children's learned drawing procedures enabled them to depict successfully many items, such as *a man*, but that they could not access their own mental procedures and examine them at a higher level of awareness. Therefore, they would be constrained by inflexible procedures that resulted in stereotyped drawings. This inflexibility was thought to be the result of the child's drawing schema, or the tendency to repeat established visual formulas. Systematized human figure drawings appear in frontal orientation; the straight legs are placed slightly apart and the arms are drawn out to the side. This method of depiction is often called the *canonical* view (e.g., Freeman, 1980), or the view that best displays the defining features of the object. The theory that young children have great difficulty breaking this particular pattern of representation was dubbed the Representation Redescription Model by Karmiloff-Smith. The evidence for this hypothesis came from her study of 54 four- to ten-year-olds who she asked to draw a man and a man "who does not exist". The majority of the children succeeded in drawing a non-existent man but the four- to six-year-olds and the eight- to ten-year-olds differed on the types of alterations they made. Unlike their older peers, the younger children tended to make changes to the general shape of their regular man schema or changes in shape of particular elements. They were also able to delete certain aspects. According Karmiloff-Smith these changes took place only at the end of the drawing sequence indicating an inability to react flexibly. On the other hand, the older children modified their drawings in a greater variety of ways and were capable of making deletions or additions throughout the course of the drawing task. Karmiloff-Smith believed these results to indicate that the sequential order of the elements in the children's drawings was very rigid and that there was a gradual progression towards flexibility as the children gained the skills required to think about their own cognitive processes.

Until more recently, there was common agreement that young children develop and maintain strict drawing "formulas" that are highly resistant to change and often fail to convey a specific example of an object that they have been asked to depict. This view has been subsequently revised as researchers such as Spensley and Taylor (1999) have shown that young children are capable of showing considerable flexibility in their graphic depictions. Their study, which required children to draw a person with specific modifications (e.g., a man with a beard, a strange man, a normal man interrupted), showed that young children have the ability to make these alterations even if they do not do so spontaneously. In other words, once a child learns a satisfactory way of depicting an object, there is a tendency to reproduce it on other occasions but only until a new pictorial problem is encountered that requires a new solution. Examination of the order of drawing production also indicated that the sequence is not as rigid as previously assumed. The children appeared to be capable of conscious self-monitoring as was evidenced by their spontaneous comments during the tasks. As a possible explanation, it was suggested by Spensley and Taylor that the younger children did not spontaneously produce certain types of modifications to their drawings in Karmiloff-Smith's experiments because of their difficulties in understanding the requirements of the tasks.

The notion that deviations from schematic rigidity can occur with instructional modifications was proposed early on by researchers such as Lowenfeld (1952). He suggested that schematic changes took place in one of two ways. They could be expressed as a *value emphasis,* whereby a feature of a figure is modified to portray increased salience. To illustrate this point, Lowenfeld described the figures drawn by his five-year-old son. The child usually represented the mouth with a small horizontal line but when asked to draw a "cannibal" he drew an elongated rectangle with several pointed teeth. According to Lowenfeld, changes in the human figure schema could also result from bodily experiences. While observing a man trying unsuccessfully to lift a heavy load, one student drew a figure with elongated arms. After seeing the man successfully lift the load, he drew a second figure with shorter, thicker arms.

The view that drawing schemas could be adapted in response to contextual changes did not gain additional support until it was subsequently explored in detail. The effect of verbal instructions on children's ability to modify their depictions of the human figure was examined by Smith (1993), who asked children aged 4 to 10 years to draw a figure standing absolutely still and a person walking very fast. In addition to the task requirements, the children were told that the drawings would later be shown to a grownup who should be able to tell just by looking at the drawings which person was which. The action words in the instructions were also stressed. By using this communicative method even the youngest children (4 to 6 years) were able to alter their drawings in a manner that conveyed a change in the locomotor activity of the people they drew. Between 4 and 10 years, new distinguishing features were added and integrated such as the head in profile or both feet pointing in the same direction. The prevalence of these features tended to follow a developmental trend with their usage increasing as a function of age. While young children may not be able to modify their drawings to the same extent as older children these findings suggest that when age appropriate instructions are employed, young children are capable of making alterations. This also raises the question of the suitability of Karmiloff-Smith's original assignments. She did present the task using a variety of different explanations such as draw "a pretend man" as opposed to "a man that does not exist". Yet, the outcome of the task may have been confounded by the difficulty of creating a representation of something that had no clear point of reference.

In addition to the manner in which children are given instructions, the order of the tasks also appears to affect the degree of change found in children's human figure drawings. Morra (2005) examined children's graphic flexibility by including tasks of drawing human movements (e.g., picking up a ball), which were compared to a control condition (stereotyped or static person). The first of three experiments involved altering the order of the tasks so that some of the children drew the static person first while the others drew the moving person first. Results showed that across age groups, presenting the person who was standing still first led to higher scores than when the moving person was first. There was however, a developmental increase in the children's ability to modify their graphic stereotypes. This trend was related to aspects of working memory or the amount of information that can be held in awareness at one time, a theory also put forward by other researchers (e.g., Picard & Vinter, 1999). Morra stated, "An implicit request to make a different picture from the previously drawn stereotype could lead the child to...be alert, while drawing, to possible differences between a person in movement and a static person" (2005, p. 22). In other words, contextual aspects (i.e., specific task order) emphasized the differences between the tasks thus leading to an increase in scores for the figures in movement.

While Golomb and McCormick (1995) did not set out to examine cognitive flexibility per se as it related to clay modeling, their study included similar human figure tasks to that of studies that looked at this aspect of drawing (e.g., Morra, 2005). Central to their investigation was a complex measurement system designed by the authors to assess the degree of three-dimensionality, differentiation, construction style, construction sequence and representational model of children's clay objects (see proceeding Scoring Criteria section). Several specific variables, which were determined to affect three-dimensional representation, were considered. The variables included complexity, symmetry, balance and familiarity. Eight modeling tasks were chosen along these dimensions: a Cup, Table, Man, Woman, Person Bending to Pick up a Ball, Dog, Cow and Turtle. The cup and the table were made first followed by the humans and animals. The order of the man and the woman tasks alternated as the third and fourth assignment followed by the Person Bending. The order of the three animal tasks was counter balanced. The participant sample included children aged 4 to 13 years and an adult sample of liberal arts students. These subjects constituted the following six age groups: preschool (M = 4.50 years), kindergarten (M = 5.20 years), grades one/two (M = 7.30 years), grades three/four (M = 9.30 years), grades five/seven (M = 11.80 years), and adult (M = 30.00 years). The independent variables were age, task and sex. Results indicated that modeling development began with a basic three-dimensional understanding as even children as young as 4 years exhibited a conception of verticality and represented up to six sides of an object. This trend in modeling development was coined the "global modeling hypothesis" by the authors. The simple, symmetrical, easily balanced, and familiar objects (e.g., a dog) were modeled using a greater number of three-dimensional tactics compared to more involved assignments (e.g., a man). However, it was shown that the participants were also responsive to the meaning of an assignment as implied by the instructions. In particular, as the specificity of the task increased, as with the Person Bending to Pick up a Ball, the tendency to model an upright three-dimensional figure also increased. For the Man and the Woman tasks, some children exhibited a tendency to produce a stereotypic frontal view of a figure, which was usually placed horizontally on the work surface (equivalent to the canonical view seen in drawing). When the task included a particular motion/posture (as with the Person Bending) the tendency to place the figure horizontally was offset by the verticality implied by the instructions. Even children who produced relatively flat, two-dimensional models of a Man or a Woman often created a more three-dimensional model of a person bending. The authors concluded that "the previously held notion that the singular attention to frontal aspects of the human figure represents the child's conceptual limitation regarding dimensionality no longer remains tenable", (p. 47). This suggests that while the developmental patterns of drawing and modeling are different, when human movement is specified by the task instructions, children are capable of producing a modified figure. In the case of clay, it appears that this tends to manifest as the more frequent use of three-dimensional modeling tactics.

The purpose of the present study was to replicate and further extend the research of Golomb and McCormick (1995) by examining modeling and drawing tasks that involved multiple figures in motion and those interacting with one another. In accordance with the findings of Golomb & McCormick the following predictions were made: Regarding the General Dimensionality Scale, it was hypothesized that the dimensionality scores for the clay figures would increase as the demand for action, attention to multiple sides, and verticality increased with the instructions. That is, the final three instructional sets would be higher than the first. Also, it was expected that scores would tend to increase with each successive set and the fourth set would result in the highest scores. This task requested a figure with a vertical posture, which in turn would allow for the modeling of additional sides. If incorporated, both of these aspects would produce higher dimensionality scores. As uprightness or upright posture of the figures is part of the overall dimensionality score, it was also expected to increase with the specificity of the instructions. It was hypothesized that scores on the General Dimensionality Scale would increase as a function of age.

On the Sides Modeled Scale (overall and Hard Score), it was hypothesized that the number of sides modeled would be higher for the instructions that included a side or posture (Instructional Sets 2, 3, and 4), compared to the open-ended person task (Instructional Set 1). It was also predicted that the tendency to model more sides would increase with age.

The Figural Differentiation scores (level of detail) were predicted to increase as the instructions became more elaborate with Instructional Sets 2, 3, and 4 producing higher scores than the first set. It was also anticipated that scores would increase from the youngest to the oldest participants. In congruence with the findings of Golomb and McCormick and similar research involving drawn figures (Cherney, Seiwert, Dickey & Flichtbeil, 2006), it was hypothesized that the detail included in the modeled figures of the girls would be higher than that of the boys.

Concerning the Construction Style, it was predicted that the majority of figures would be created by the process of the addition of separately modeled parts. Based on previous findings (i.e., Golomb & McCormick, 1995) it was hypothesized that the most frequent Construction Sequence would be the top-to-bottom approach. As the type of Representational Model employed can be considered related to the use of three-dimensional modeling tactics, it was also expected that two- and three-dimensional representational models would be employed to a greater extent than one-dimensional, stick figure or graphic models.

Regarding the comparison of the modeled and drawn figures, earlier research (i.e., Brown, 1975) examining detail level, has shown a marked difference between the two media. Therefore, the level of detail as measured by the Figural Differentiation Scale was expected to be higher for the drawings. The number of details was also expected to differ between the first task and the following three, as they involved additional objects or figures. An exploratory approach was taken when comparing the two media in terms of style and production sequence, although some preliminary hypotheses were made. While no age trends for construction style have been observed for clay modeling (Golomb & McCormick, 1995), a slightly different pattern has emerged for children's drawings. Generally, differentiation of the figure will occur via the addition process. Once this has been mastered, the child may reorganize the figure by drawing the parts in outline (Cox, 1992; Golomb, 2004). With this in mind, the prevalence of the different styles was expected to occur at different frequencies for the two media. Specifically, the outlined drawn figure would occur to a greater extent than its clay counterpart (the internally subdivided figure). Regarding production sequence, it was expected that the two media would differ in this measure as well. Studies of children's clay figures (i.e., Golomb & McCormick, 1995) have shown that while the head-first strategy is the most common in the attempt to make a standing figure, children may adopt a different strategy, such as feet-first (Golomb, 2002). While the production of drawn figures does not involve the problem of uprightness, the head (being the most salient feature) is usually drawn first (Thomas & Tsalimi, 1988). Therefore, the frequency of head-first or top-to-bottom sequence was expected to be higher for the drawings.

Method

Participants

A total of 30 children, 15 boys and 15 girls, participated in the study (see Table 1). The children constituted three groups: 10 children 4-5 years old (mean age 5.19); 10 children 7-8 years old (mean age 7.83); 10 children 11-12 years old (mean age 11.89). These particular age groups were chosen as they reflect qualitative and quantitative differences in representational, cognitive (see Table 2) and fine motor abilities. Around 4 years of age children's thinking, although preoperational, has achieved a certain stability. They begin to understand relationships between objects and can separate mental from physical reality (Piaget & Inhelder, 1969). They have the fine motor skill and the finger strength needed to manipulate both clay and the drawing implements (Reid, 1991). This age also marks a turning point in the development of representation. Children have moved beyond pre-representational explorations and have already begun to create simple forms that are intended to represent objects (Cox, 1993, Golomb, 2002). This period also coincides with major improvements in children's sculptural abilities (Brown, 1975). Around 7 years of age, children transition to concrete operational thought and can focus on more than one aspect of a problem at a time. Their thinking becomes reversible, flexible and considerably more complex (Piaget & Inhelder, 1969). In addition to increased strength and coordination (Krus, Bruininks, & Robertson, 1981), in the few years following, the use of three-dimensional modeling tactics tends to peak and level off (Golomb, 2002). Age 11 marks the development of formal operational thought, and children are able to solve problems by approaching them systematically and testing all possible combinations of factors (Piaget & Inhelder, 1969). It is also around this time when children move beyond clay representations that are minimally differentiated and they become more concerned with anatomical correctness and the realistic portrayal of figures (Churchill, 1988; Golomb, 2007). By this time, children's dexterity and integration of motor movements approximates that of an adult (Morra, Gobbo, Marini, & Sheese, 2008). As Golomb (2002) points out, while representations such as human figure drawings have been used as indices of general intellectual maturity (e.g., Harris, 1963; Koppitz, 1968, Bensur & Eliot, 1993), an important distinction should be made between general conceptual knowledge and representational skill. The two domains are related but by no means equivalent. To illustrate this point, Golomb (2002) described an inexperienced three-year-old girl who within a 10-minute testing session first produced several oval shapes, created her first human figure complete with a head, facial features, trunk, and finely detailed appendages, then finished the sequence with several tadpole figures. This suggests that one should be hesitant to interpret apparent lags in children's productions (graphic and plastic alike) as indices of general cognitive deficiencies. Cox (1993) also asserted that, for a novice, the tools, techniques and the medium-specific constraints take some getting used to and there is evidence, which suggests that inexperience, and not childhood is the starting point for true representational development. For example, tadpole and open-trunk figures also appear in the work of some normal adults with little or no drawing experience (Alland, 1983).

The participants lived in Montreal and surrounding area and were of varying socio-economic and ethnic backgrounds. Most were bilingual but spoke English as their first language, although a few spoke only French. The children were recruited from five different community organizations. These included two after-school programs at the

Tyndale-Saint Georges Community Centre ($n = 6$) and Saint Columba House ($n = 3$), a Saturday activity program at the Jamaica Association of Montreal ($n = 5$), a Sunday school class at the Unitarian Church of Montreal ($n = 4$), and three extracurricular mixed media and ceramic classes offered by the Dollard Centre for the Arts ($n = 12$). The children at each facility were questioned prior to the onset of the study proceedings to determine their level of experience with clay and other related materials such as Playdough, Plasticine, Sculpy, etc. All of the children had experimented with these media at home, school or extracurricular settings such as art camps or classes. As directed by the Human Research Ethics Committee at Concordia University, informed assent was obtained from the children and informed consent from the parents/guardians.

Materials and Procedure

The sessions took place in a private room equipped with standard tables and chairs. Each child's work in clay was observed and video taped individually to obtain as complete a record as possible while minimizing distractions. To date, few studies examining children's sculpture have utilized video technology and have instead relied on photographs, audio recordings and detailed observations by researchers. This procedure allowed for an in-depth exploration of the physical, verbal and emotional responses involved in the completion of the tasks. Often the children engaged in activities during the production process that were not readily apparent upon post-examination of their work. Photographs of the works were also taken. As art experience and learning are cumulative, in order to examine change in behaviour over time, the same participants were examined once a week over a period of four weeks. Several of the children ($n = 6$) engaged in one sculpture and one drawing per session (see Table 3). Due to time constraints, the remaining participants ($n = 24$) completed only the clay sculptures. Both the drawing and sculpture tasks were conducted using four instructional sets that focused on the representation of the human figure. A previous pilot study had been performed, which investigated clay sculptures of a solitary static figure. The current study extended this research by including additional instructional sets that involved postures that were more complex and two figures interacting with one another. Golomb (2004) addressed the phases in the development of three-dimensional representation in terms of the posture of the figure (upright standing or placed horizontally), the child's attention to the object's multiple sides, and the manner in which the clay is used, for example, by creating both indentations and protrusions. The tasks for the present study were designed with these concepts in mind. The four tasks were characterized by a different instructional set, administered in a fixed order beginning with the least descriptive instructions, and then increased in terms of specificity and the demand for action. Each participant engaged in one session a week for a period of four weeks. In the event of one absence, the sessions were extended by a week. If two or more absences occurred, the participant was dropped from the study and their work was not included in any analyses.

The tasks were designed in consultation with Claire Golomb who suggested, "[B]egin with a single human figure, you might ask for a man, a woman or a child. [The following task ought] to encourage some form of modeling in the round or the notion of uprightness. Next ought to come two tasks that suggest a social relationship and encourage uprightness: 'use the clay to make a person, perhaps a child, who is catching a ball.' You leave unspoken whether or not a second figure ought to be modeled who is throwing the ball. Next, perhaps you might consider a 'child picking a flower,' " (personal communication, December 11, 2008). In their study, Golomb and McCormick also noted that, "the tendency to work horizontally on the figure's frontal side is counteracted on the Person Bending [task]," (p. 47). With the above information in mind, the following instructions were designed: Instructional Set 1 began with a single human figure. The children were asked to "make a person" with the clay. The children were free to interpret these instructions in any manner they saw fit and create whatever type of person they liked, as no particular posture or view was imposed. In order to encourage some form of modeling in the round, Instructional Set 2 requested that the children "make a person who is wearing a backpack". These instructions were designed to encourage the participants to consider multiple sides of the modeled object by placing the focus on the back of the figure in addition to the frontal plane. The following two tasks were intended to suggest a social relationship and involved more locomotive poses. Instructional Set 3 involved using the clay to "make a person who is playing catch with a ball". It was left unspoken whether or not a second figure was to be modeled who was throwing the ball. Since playing catch often involves more than one person, the capacity of these instructions to prompt the creation of at least one additional figure was examined. As this activity usually involves an upright stance (at least in the case of familiar sports such as baseball, football, basketball, etc.), this task was also designed to promote appropriate modifications to the figure's body position that would allow it to stand, either on its own or with some form of support. For this task, the instructions did not directly ask the children to alter the posture so that a comparison could be made to the task that did (i.e., Instructional Set 4). Instructional Set 4 requested the participants to model “a parent bending down to pick up a child”. These instructions involved a different action/body position that required additional consideration of how to balance the standing adult figure. The upright posture would in turn draw attention to the figure’s multiple sides. For this task the children were told explicitly, “Today I am going to ask you to make two people”. The tasks were administered in a fixed order as indicated by the numbering. For each of the modeling tasks, the children were provided with a non-descript lump of air-dry clay approximately 10 cm in diameter. For the children who completed the four drawings in addition to the sculptures, the same instructional sets were used. A sheet of plain white letter paper and a standard pencil with an eraser were also provided. No time limit was imposed on any of the activities. The children were allowed to work until they decided they were finished or their class ended. If there were any questions from the children, these were answered and then the instructions were repeated in case the child had forgotten what was asked. In the event a child expressed concern about the quality of their figures, they were encouraged with comments such as, “I’m sure you can do it, just try”.

Scoring Criteria

The scoring criteria developed by Golomb and McCormick (1995) with slight modifications, were used to assess the clay sculptures. These scales were designed to analyze several aspects of representation including the three-dimensional attributes of the modeled figure, the level of figural differentiation, the method of construction, the construction sequence, and the representational model. With regard to the tasks that involved more than one figure, analyses focused on the figure emphasized by the instructions. For example, Instructional Set 4 requested that the children “make a parent who is bending down to pick up a child" and not "make a child who is being picked up by a parent". The purpose of these instructions was to examine how the participants responded to problems related to the articulation of movement and variations in posture, therefore only the parent figure was scored.

Dimensionality Measures. Two measures were used to assess the three-dimensional aspects of the clay figures: the General Dimensionality Scale and the Sides Modeled Scale (see Appendix A). The General Dimensionality Scale analyzed three-dimensionality in terms of verticality or uprightness, medium-specific strategies such as hollowing out or creation of protrusions (techniques which suggest an inside as well as an outside), and the number of sides modeled. This scale used a checklist to assign a weighted score to each item or feature that specified the use of three-dimensional modeling tactics as opposed to those involving only one- or two-dimensional planes. For instance, the scale allotted 1 to 3 points for uprightness (upright intention—1 point, upright standing with structural support—2 points, upright and freestanding—3 points). If the figure was constructed horizontally on the work surface with no attempt to raise the figure to an erect position, no points were awarded for uprightness. One to 2 points were also assigned for the differential and three-dimensional modeling of facial features. When a child made eyes constructed from balls of clay that protruded from the head in addition to a deep indentation for the mouth, two points toward the overall dimensionality score were assigned to the figure. In addition, the scale gave 1 point each for the presence of features such as a bulky or rounded body, arms that reached forward into space, and a body bent at the legs or torso. A sculpture could receive another 4 points for the presence of additional markers such as clothes that surrounded or enveloped the figure. The highest score possible on this portion of the scale was 19 points. This scale also included the criteria from the Hard Score portion of The Sides Modeled Scale and assigned one point for each of the six sides modeled. Together this produced a possible score range of 0-25.

The Sides Modeled Scale considered a clay figure as analogous to a cubic object with a possible total of six sides (top, bottom, front, back, left side, right side). This scale included both a Hard Score and a Soft Score, which both yielded a maximum of 6 points. The Hard Score, a more specific and stringent set of criteria, awarded a single point for each side of a figure that was carefully attended to and differentially modeled. This required that the child look at a side during its modeling. The Sides Modeled Scale also included a more inclusive measure, the Soft Score, which assigned a point to each side of the figure that had been considered and differentiated even if the side was modeled hastily or lacked particular detail. Thus, if a side was considered but not carefully attended to during modeling, a Soft Score was assigned instead of a Hard Score. As the total number of sides of a figure cannot exceed six, both scales combined yielded a possible total of 6 points/sides.

Figural Differentiation Scale. The sculptures were scored on a quantitative scale that assigned 1 point for each modeled part. Parts made with extra detail were awarded additional points; for example, a hair clip was scored in addition to hair, and pupils were scored in addition to eyes. Points were also given for the construction of any modeled object or accessory that was intended to accompany the figure. For instance, a slab of flattened clay on which a figure sat or stood was given one point for "base".

Construction Style. Each figure was categorized as one of two modeling styles, each with two levels of differentiation (see Appendix B). A distinction was made between figures that were constructed using additive procedures and those that were modeled by internal subdivision and subtractive methods. The two levels of differentiation included High and Low. Figures assigned to the High category possessed all of the major structural elements, which included the head, body, arms, and legs. Those in the Low category were missing one or more of the major structural elements.

Construction Sequence. The sculptures were coded as top-to-bottom, bottom-to-top, body first, and other or random. These categories referred to the spatial and temporal order in which sculptures were constructed.

Representational Model. All sculptures were qualified according to the representational model utilized (see Appendix C). The six categories described various one-, two-, or three-dimensional modeling techniques. Category A included rudimentary, one-dimensional figures constructed from unattached pieces or blobs of clay. Figures assigned to Category B were also one-dimensional in nature but were constructed from lines or rolled snakes of clay, which resembled drawn stick figures. Category C contained two-dimensional graphic models or figures that were outlined with snakes of clay. The figures in Category D were considered two-dimensional as well but were created from flattened slabs of clay, which resembled the products of a cookie cutter. These figures typically had only one side and no indentations or protrusions that extended beyond the two-dimensional plane. Category E included bulky, three-dimensional models with two or more sides usually constructed by holding the figure upright. The completed figure was held in the hand of the child and presented upright. Category F figures were the same as those in category E except for the freestanding position. Each sculpture was examined as a whole and assigned to one of the six categories based on the dominant strategy. For example, a figure with a flattened head, body and arms that stood upright on bulky, three-dimensional feet was placed in Category D. For an example of the aforementioned scoring systems applied to the four instructional sets, see Appendix D.

Results

Each clay figure was scored using a checklist of the children's behaviours during the session (e.g., inspection, labelling of the figure) in addition to an analysis of each sculpture that had been preserved for this purpose. Ten percent of the total 120 sculptures were randomly chosen (using a random number generator) and scored independently by an additional expert judge with extensive experience in the evaluation of representation in two- and three-dimensional media. This judge was trained by the primary researcher and was blind to the nature of the study. Intra-class correlations (ICCs) were used to determine the agreement between the two judges' scores for the General Dimensionality Scale (score range of 0-18), the Sides Modeled Scale (score range of 0-6), and the Figural Differentiation Scale (score range of 4-20). This measurement offers a more conservative estimate of agreement compared to simple percentage agreement as it is more sensitive to systematic difference between observers. It is also suitable when an additional judge scores only a subset of the data. The ICCs for the above measures were 0.92, 0.88 and 0.86 respectively, indicating a fairly high level of agreement (>0.75). Cohen's Kappa coefficient was used as a measure of inter-rater reliability for the categorical measures. The agreement between the scores was as follows: 0.82 (almost perfect agreement) for both Construction Sequence and Construction Style and 0.68 (substantial agreement) for Representational Model.

The above data represent the reliability estimates for a portion of the total scores and should not be confused with estimates for the entire sample. Establishing inter-rater reliability is a labour intensive and potentially expensive undertaking for small research projects. A standard solution is to use the ratings from one judge for all of the measures and then assign a portion of the data to be judged by an additional rater. This is usually done through random assignment in effort to decrease selection bias. It is common procedure in educational and psychological research to use only a percentage of the data to establish estimates of inter-rater reliability. However, some researchers have taken issue with the validity of such practices (e.g., Fan & Chen, 1999) as incorrect generalizations to the entire sample can lead to unintentional overestimations of agreement.

Effect of Art Classes

A large portion of the participants were recruited from several art classes at the Dollard Centre for the Arts. In order to assess the effect of concurrent art class attendance on the dependent measures, a series of t-tests were used to compare the scores of participants in the classes ($n = 12$) and those not in classes ($n = 18$). There were no differences in scores between those who did and those who did not take art classes on the General Dimensionality Scale, $t(28) = .71, p = .49$, the Sides Modeled Scale (overall scores), $t(28) = .88, p = .39$, Sides Modeled Scale (difference scores), $t(28) = -.28, p = .78$ or the Figural Differentiation Scale, $t(28) = -1.05, p = .30$[1].

An alpha level of 0.05 was adopted for all subsequent statistical analyses, except where otherwise indicated. A 4 (instructional set) x 3 (age) x 2 (sex) ANOVA (analysis of variance) was used to examine the effects of instructional set, age and sex on the dependent measures (General Dimensionality Scale, Sides Modeled Scale, Figural Differentiation Scale). The within subjects factor included the four different instructional

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[1] A non-significant difference between groups should not be interpreted as indicating that art classes do not improve sculpting ability. A number of the children who were not concurrently enrolled in the classes had participated in similar programs on previous occasions.

sets as described above. The first between subjects factor was age and had three levels, 4-5, 7-8 and 11-12 years old. The second between subjects factor was sex.

General Dimensionality Scale

Instructional Set Effects. There was a significant main effect for instructional set, $F(3, 72) = 11.22, p < .001, \eta^2 p = .32$. Follow-up paired samples t-tests using an adjusted alpha level of < .01, indicated that the scores for Instructional Set 1 ($M = 7.37, SD = 4.44$) were significantly lower than those of Instructional Set 2 ($M = 9.93, SD = 4.47; t(29) = 5.96, p < .001$), Instructional Set 3 ($M = 8.97, SD = 4.75; t(29) = 3.89, p = .001$) and for Instructional Set 4 ($M = 9.93, SD = 4.03; t(29) = 4.61, p < .001$) with no other significant differences. The number of three-dimensional modeling tactics was higher for the sets that specified an additional side or a variation in posture/activity (set 2, 3 and 4) compared to the first set although the final three sets did not differ.

Age Effects. There was a significant main effect for age, $F(2, 24) = 8.80, p = .001, \eta^2 p = .42$. Post hoc comparisons between age groups using Tukey's HSD[2] test indicated that the scores of the 11-12 year olds ($M = 12.65, SD = 3.83$) were significantly higher than the scores of the 4-5 year olds ($M = 6.52, SD = 3.25, p = .001$) and the scores for the 7-8 year olds ($M = 7.98, SD = 3.79, p = .014$). There was no significant difference between the two younger groups, $p = .61$. Three-dimensional modeling tactics increased with age but the differences were between the two younger groups and the oldest group.

Sex Effects. The main effect for sex was not significant, $F(1, 24) = .79, p = .38, \eta^2 p = .032$, as the scores for girls ($M = 9.50, SD = 4.90$) did not differ from boys ($M = 8.60, SD$

[2] Golomb and McCormick (1995) used the Fisher Protected LSD post hoc test in their analyses; however, the current study employed Tukey's HSD test as it is a more conservative measure of mean differences. Fisher's is considered the most liberal of post hoc tests for ANOVA as it more easily detects a difference.

= 3.99). The number of three-dimensional modeling strategies did not differ between girls and boys.

Instruction by Age Interaction. The interaction was not significant, $F(6, 72) = 1.00, p = .34, \eta^2 p = .077$. Instructional set did not have a different effect on the three age groups.

Instruction by Sex Interaction. The interaction was not significant, $F(3, 72) = .76, p = .51, \eta^2 p = .031$. Instructional set did not have a different effect for boys and girls.

Instruction by Age by Sex Interaction. The interaction was not significant, $F(6, 72) = .43, p = .86, \eta^2 p = .034$. Instructional set did not have a different effect for boys and girls across the three age groups[3]. The means and standard deviations are presented in Table 4.

Uprightness. To better determine the effects of the instructions on dimensionality, the section related to uprightness (an intention to model a freestanding figure, a figure standing with structural support or a figure held upright) was analysed in isolation. A chi square test of independence to determine the effect of instructional set on uprightness approached significance, $\chi^2(3) = 7.44, p = .059$. Frequencies are presented in Table 5. Results indicated that while the number of these upright figures increased with each task, the difference was only slight.

Sides Modeled Scale

The Sides Modeled Scale is comprised of two subscales, the Hard Score and the Soft Score. The Hard score takes into account the level of assiduity or the care a child applies to each side while the Soft Score assigns points to a side regardless of how carefully it was sculpted. When the two scores are combined, the resulting overall score does not

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[3] The Sides Modeled Scale (Hard Score) is a subscale of the General Dimensionality Scale. As a follow up measure, the General Dimensionality Scale was analyzed without the inclusion of the Hard Score. This yielded an identical pattern of results.

reveal the level of care or detail applied by the child but provides an index of the total number of sides modeled.

Instructional Set Effects. As the assumption of sphericity was violated with this analysis, the Greenhouse-Geisser correction was used for the degrees of freedom. Using the overall scores, there was a significant main effect for instructional set, $F(2.16, 72) = 5.65$, $p = .005$, $\eta^2 p = .19$. Post hoc paired t-test comparisons indicated that the overall scores for Instructional Set 1 ($M = 3.20$, $SD = 2.04$) were significantly lower than those for Instructional Set 2 ($M = 4.00$, $SD = 1.89$), $t(29) = -3.50$, $p < .002$. The difference between Instructional Set 1 and Instructional Set 4 ($M = 4.00$, $SD = 1.78$) approached significance, $t(29) = -2.63$, $p = .014$. The other comparisons did not yield significant results, all *ps* > .01. The total number of sides modeled increased when the instructions specified an additional side or an upright posture, as with the second set ("a person wearing a **back**pack") and the fourth set ("a parent **bending down**").

Age Effects. There was a significant main effect for age, $F(2, 24) = 4.11$, $p = .029$, $\eta^2 p = .26$. Post hoc comparisons between age groups using Tukey's HSD test indicated that the scores of the 11-12 year olds ($M = 4.83$, $SD = 1.56$) were significantly higher than the scores of the 4-5 year olds ($M = 2.68$, $SD = 1.60$, $p = .021$). The comparison between the other age groups did not reach significance, all *ps* >.05. The total number of sides modeled increased with age but the differences were between the oldest and youngest groups.

Sex Effects. The main effect for sex was not significant, $F(1, 24) = .042$, $p = .84$, $\eta^2 p = .002$. There was no difference in the total number of sides modeled for boys and girls.

Instruction by Age Interaction. The interaction was significant, $F(4.31, 72) = 2.65, p = .04, \eta^2p = .18$. The instructional sets had a different effect on the scores of the three age groups. While the total number of sides modeled increased as the age of the participants increased, the instructions had a much more dramatic effect on the scores of the younger groups, especially the 4-5 year-olds. A similar, although less extreme, trend characterized the score of the 7-8 year-olds. Conversely, the scores of the 11-12 year-olds remained relatively constant across the four tasks.

Instruction by Sex Interaction. The interaction was not significant, $F(2.16, 72) = 2.40, p = .097, \eta^2p = .091$. Instructional set did not have a different effect for boys and girls.

Instruction by Age by Sex Interaction. The interaction was not significant, $F(4.31, 72) = .58, p = .69, \eta^2p = .046$. Instructional set did not have a different effect for boys and girls across the three age groups. Means and standard deviations are presented in Table 6.

While both the Hard Score and Soft Score constitute the Sides Modeled Scale, the 1995 publication of Golomb and McCormick refers only to the Hard Score. This is because, "the results for the hard and the soft scales on further analysis were very similar so the report on the Soft Score was omitted" (C. Golomb, personal communication, May 5, 2009). Conversely, upon initial inspection the present study found there to be a marked difference between the two measures. Therefore, difference scores for the Sides Modeled Scale were computed by subtracting the Soft Score from the Hard Score. This allowed for an in depth examination of the discrepancy between the two modeling approaches measured by each scale. Higher difference scores indicated a figure with sides that were carefully attended to and differentially modeled while lower scores indicated a figure with sides that were modeled quickly or crudely yet still demonstrated a consideration for that side.

Instructional Set Effects. Using the difference scores, there was a significant main effect for instructional set, $F(3, 72) = 4.49, p = .006, \eta^2p = .16$. Post hoc paired t-test comparisons indicated that the difference scores for Instructional Set 1 ($M = 2.13, SD = 2.34$) were significantly lower than those for Instructional Set 2 ($M = 3.33, SD = 2.06$), $t(29) = -3.99, p < .001$. The comparison between Instructional Set 2 and Instructional Set 3 (M = 2.47, SD = 2.52) approached significance, $t(29) = 2.64, p = .013$. The other comparisons did not yield significant results, all $ps > .01$. The number of sides modeled with detail and attention only increased when the instructions specified an additional side, as with the second set.

Age Effects. Using the difference scores, there was a significant main effect for age, $F(2, 24) = 4.45, p = .023, \eta^2p = .27$. Post hoc comparisons between age groups using Tukey's HSD test indicated that the scores of the 11-12 year olds ($M = 4.08, SD = 2.30$) were significantly higher than the scores of the 4-5 year olds ($M = 1.73, SD = 1.57, p = .027$). The comparison between the 11-12 year olds and the 7-8 year olds ($M = 2.10, SD = 2.64$) approached significance, $p = .069$[4]. There was no difference between the score of the two younger groups, $p = .90$. The difference scores indicated that the number of sides carefully modeled increased with age but the differences were mainly between the oldest and youngest groups.

Sex Effects. Using the difference scores, the main effect for sex was significant, $F(1, 24) = 4.58, p = .043, \eta^2p = .16$, such that boys ($M = 1.93, SD = 2.51$) scored lower than girls

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[4] Using Fisher's LSD test this comparison was significant, $p = .03$.

($M = 3.33$, $SD = 2.09$). The difference scores for the boys were lower than those of the girls, indicating that when the boys modeled a side it was with less attention and detail.

Instruction by Age Interaction. The interaction was not significant, $F(6, 72) = 0.65$, $p = .69$, $\eta^2 p = .052$. Instructional set did not have a different effect on the three age groups.

Instruction by Sex Interaction. The interaction was not significant, $F(3, 72) = .88$, $p = .46$, $\eta^2 p = .035$. Instructional set did not have a different effect for boys and girls.

Instruction by Age by Sex Interaction. The interaction was not significant, $F(6, 72) = .23$, $p = .10$, $\eta^2 p = .019$. Instructional set did not have a different effect for boys and girls across the three age groups[5]. The means and standard deviations are presented in Table 7.

Figural Differentiation Scale

Instructional Set Effects. There was no main effect for instructional set, $F(3, 72) = 1.09$, $p = .36$. That is, the scores for Instructional Set 1 ($M = 7.83$, $SD = 2.74$), Instructional Set 2 ($M = 8.43$, $SD = 2.51$), Instructional Set 3 ($M = 8.60$, $SD = 2.59$) and Instructional Set 4 ($M = 8.73$, $SD = 2.73$) did not differ significantly. The instructions had no effect on the level of details in the sculptures.

Age Effects. There was no main effect for age, $F(2, 24) = .91$, $p = .42$, $\eta^2 p = .070$, as 4-5 year-olds ($M = 7.80$, $SD = 2.08$), 7-8 year-olds ($M = 8.30$, $SD = 3.09$) and the 11-12 year-olds ($M = 9.10$, $SD = 2.67$) did not differ significantly. The age of the children had no effect on the level of detail in the sculptures.

Sex Effects. There was no main effect for sex, $F(1, 24) = 2.14$, $p = .16$, $\eta^2 p = .082$, such that girls ($M = 8.69$, $SD = 2.69$) did not differ significantly from boys ($M = 7.88$, $SD =$

[5] The scores on the Hard Scale and Soft Scale were also analyzed separately; however, this did not yield any additional information.

2.49). There was no difference between details included in the sculptures by girls and boys.

Instruction by Age Interaction. The interaction was not significant, $F(6, 72) = .38, p = .89, \eta^2 p = .031$. Instructional set did not have a different effect on the three age groups.

Instruction by Sex Interaction. The interaction was not significant, $F(3, 72) = 1.52, \eta^2 p = .060$. Instructional set did not have a different effect for boys and girls, $p = .22$.

Instruction by Age by Sex Interaction. The interaction was not significant, $F(6, 72) = .60$, $p = .73, \eta^2 p = .047$. Instructional set did not have a different effect for boys and girls across the three age groups. The means and standard deviations are presented in Table 8.

In addition to the quantitative scales, the sculptures were also assessed using qualitative measures including Construction Style, Construction Sequence and Representational Model. This allowed for a general examination of modeling strategies and stylistic choices made by the children.

Construction Style. Figures could be modeled either by internal subdivision or by addition of separate parts. There were two levels of differentiation within each of these categories, those containing all necessary parts or those missing at least one major structural component. The majority of participants made complete figures by the addition of separately modeled parts (73.33 %). The next most frequent technique was the additive figure that lacked one or more elements (15.00 %). Then the internally subdivided figure with all parts (11.67 %). None of the children produced internally subdivided figures with low differentiation. The overall frequencies are presented in Table 9.

Instructional Set Effects. The tendency to employ the different construction styles did not appear to vary across the instructions.

Age Effects. Examination of the data indicated a clear pattern for age group. While the most frequent style across all participants was the complete figure created with an additive method, the youngest children tended to omit more parts from their figures. The oldest children also internally subdivided their figure more frequently. The frequencies by age group and sex are presented in Table 10.

Sex Effects. The most frequent technique for both girls and boys was addition. However, none of the girls made figures that were internally subdivided. Girls also omitted body parts five times as often as the boys did.

Construction Sequence

The majority of the figures were modeled in a top-to-bottom sequence (60.00 %). Most of the remaining figures were constructed feet first (18.33 %) or body first (20.00 %). Only two sculptures (1.67 %) were made from random constructions. A similar pattern was observed for construction sequence as with construction style. Overall frequencies are presented in Table 11.

Instructional Set. Instructional set was not related to Construction Sequence.

Age Effects. There was a clear pattern for age group. A head-first construction was the most common sequence for all groups, but the oldest children tended to utilize a body first sequence more often than the younger ages. The 7-8 year-old group also employed a feet-first strategy more often than the other two age groups. The frequencies by age groups and sex are presented in Table 12.

Sex Effects. Girls tended to build their figures in a top-to-bottom sequence almost twice as often as boys did.

Representational Model

The one-dimensional model made from a series of unattached pieces of clay did not appear. Stick figures, two-dimensional graphic models, and figures made of flattened slabs, occurred at per cent frequencies of 10.83, 5.83, and 17.50 respectively. Three-dimensional models with support (27.50 %) or freestanding (38.33 %) were the most common. Overall frequencies are presented in Table 13.

Instructional Set Effects. The frequency of the representational models was not related to the instructions.

Age Effects. There was a pattern for age group as the oldest children did not produce any one-dimensional stick figures or graphic outline models (Category B, C) and made freestanding three-dimensional figures more frequently than the two younger groups. The frequencies by age group are presented in Table 14.

Sex Effects. The boys and girls did not appear to use differing representational models.

Drawings

In addition to the modeling the clay figures, six participants were asked to engage in the drawing tasks. The drawing tasks involved the same four instructional sets as the sculptures. The order of the drawings and sculptures was counter balanced across tasks and participants. These drawings were then compared to the sculptures of the same subject matter. The measures for this comparison included figural differentiation or number of distinctly drawn parts (e.g., facial features, body, clothes, hair, etc.), the construction/production sequence, and style. The production sequence measure used for the drawings was identical to the construction sequence measure used for the sculptures, and consisted of the same four categories. The style measure was adapted slightly.

Drawn figures had either high or low differentiation as with the sculptures. The creation of a figure via the addition of separate parts was the same for both media, but a continuous body contour was considered analogous to a clay figure modeled by internal subdivision. This form of comparison, unlike the detail point system, allowed for an examination of the overall appearance of the figures. It differentiated between global units and advanced models with a greater number of essential parts. It also distinguished between the stylistic approach of the child to model either by subdividing the clay mass or by adding parts to form a whole.

A 2 (medium) x 4 (Instructional Set) repeated measures ANOVA with two within-subjects factors was used to examine the effect of the variables on the figural differentiation scores. The first within-subjects factor had two levels, drawing and sculpture. The second within-subjects factor, instructional set, had the same four levels as previously described.

Medium Effects. The main effect for medium was significant such that the figural differentiation scores were significantly higher for the drawing tasks compared to the corresponding sculptures, $F(1, 5) = 13.57, p = .014, \eta^2 p = .73$ (means and standard deviations are reported in Table 15). When children made drawings and sculptures of the same subject matter, the drawings had more detail.

Instructional Set Effects. The main effect for Instructional Set was not significant, $F(3, 15) = 0.17, p = .36, \eta^2 p = .19$. The type of instruction had no effect on the level of detail in either the drawings or the sculptures.

Medium by Instructional Set Interaction. The interaction was not significant, $F(3, 15) = 0.41$, $p = .75$, $\eta^2 p = .076$. The instructions did not affect the detail level of the drawings and sculptures differently.

In terms of style, the majority of the drawings (92.00%) were created by the addition of separately drawn parts. Only 4.00% were drawn without an essential element using the additive technique. The frequencies are presented in Table 16. A comparison of the drawings and sculptures produced by the same participants indicated that a child tended to use the same style across media. Drawings employing a single body contour occurred at the same rate. Although more extreme, this trend paralleled the general pattern for the children who made only the sculptures.

The most common sequence for the drawings was head-first (63.00%), followed by feet-first (20.83%) then body first (16.67%). The overall frequencies for the drawings are reported in Table 17. Again, the children tended to use the same sequence for both media. Overall, these results were quite similar to the modeling trends for the rest of the sample.

Summary of Results.

- Results indicated significant task and age effects on overall levels of dimensionality. Instructions that specified additional sides of the figure or implied a locomotor activity increased scores. Even the younger children were capable of modifying their schematic clay figures to incorporate three-dimensional modeling tactics although this tendency increased with age. The dimensionality scores did not differ between the girls and boys.
- Upright figures (held by the artist, with structural support and freestanding) showed a slight increasing pattern as a function of the instructions.

- The total number of sides modeled increased when the instructions specified an additional side or an upright posture, as with the second and the fourth sets. The oldest participants modeled a greater number of sides than the youngest participants. Across the four tasks, the total number of sides increased as the age of the participants increased but the instructions had the most dramatic effect on the scores of the 4-5 year-olds. A less extreme trend characterized the score of the 7-8 year-olds. Conversely, the scores of the 11-12 year-olds remained relatively constant for the four tasks. Girls and boys did not differ on the total number of sides modeled.
- When the instructions specified an additional side, as with the second task, the number of sides modeled with detail and attention significantly increased. This trend also tended to increase with age. Girls and boys differed in terms of how much care and detail was used when a side was modeled with the girls exhibiting greater attentiveness.
- Figural differentiation scores did not change as a function of instruction, age or sex.
- The majority of figures were made by the addition of separately modeled parts in a top-to-bottom sequence and patterns emerged for age and sex but not instruction.
- Most of the sculptures were three-dimensional Representational Models and the frequency of freestanding figures tended to increase with age.
- The drawn figures had significantly more details than the corresponding sculptures but the two media were similar in terms of style and sequence.

Discussion

Results are discussed in the order that the original hypotheses were presented. I begin with the effects of instructions, age group and sex on the nominal scales (General Dimensionality, Sides Modeled, Figural Differentiation) followed by an examination of the effects on the categorical measures (Construction Style, Construction Sequence, Representational Model). The relationship between the modeled and drawn figures is then explored. A more general research question concerned the cognitive, physical and verbal behaviours of the children as they worked with the clay. The various problem-solving tactics applied to each task, stylistic changes, relative figure size and accompanying talk are addressed. Congruence with previous research is noted and when possible, unexpected results are presented with tentative explanations.

The first hypotheses considered the influence of instruction, age and sex on the overall measures of dimensionality. Results indicated significant task effects on the General Dimensionality Scale. The first task ("make a person") produced lower scores than all subsequent tasks. The results supported the hypothesis that children are capable of adapting their modeling strategies to suit the task. Specifically, the representation of figures in a three-dimensional manner is affected by instructional demands. The significant main effect for instructional set observed in the present study adds support to previous research demonstrating that a child's use of clay as a three-dimensional medium can be increased by altering the meaning of an assignment. Golomb and McCormick (1995) found that scores on the General Dimensionality Scale were higher for the Person Bending task than for the Man and Woman tasks. Thus, even the tendency to consider only one or two spatial dimensions as with a flattened horizontal figure was countered by these simple instructional modifications. This is not surprising given that young children are highly astute and keen observers of their own creative process (Golomb, 2002). In the current study, it was expected that the scores on the General Dimensionality Scale would tend to increase as the demand for action and the specificity of instructions increased with Set 4 yielding the highest scores, however, this was not the case. The scores for Instructional Set 2, 3, and 4 were significantly higher than those for the "make a person" instructions. The means increased from Instructional Set 1 to 2 then remained relatively constant for the remaining tasks although there was a slight (non-significant) decrease for Instructional Set 3. While it could be argued that this increasing trend was due to a practice effect, the slight decrease in the scores for Instructional Set 3 indicated that the difference between scores was largely due to the verbal instructions. This suggests that the contrast created by specifying movement/posture with words such as *playing catch* and *bending* or the inclusion of an additional wearable object in the composition (i.e., *backpack*) was sufficient to significantly increase scores as compared to simply making a person.

It is more difficult to explain why none of the scores for the final three tasks differed significantly from each other. While the instructions changed a great deal semantically, they produced near equivalent levels of three-dimensional modeling tactics. Perhaps these tasks were not different enough from the preceding tasks. It stands to reason that if the specificity of Instructional Sets 2, 3 and 4 were to be increased further, the significant differences would appear. For instance, if the children were asked to make a clay person who is "running and reaching up into the air to catch a ball" rather than one who is "playing catch with a ball". Such an alteration may also increase the saliency of the kinaesthetic and proprioceptive experience of playing catch, making it easier to translate it into the three-dimensional use of clay. Research with children's drawings has shown that expressive activities designed to emphasize movement words yielded a decrease in schematic drawing and exemplified movement of the human figure (Kapsch & Kruger, 2005).

Regarding the effect of age on dimensionality scores and a more general pattern of development, it appears that even the youngest children possessed a basic understanding of three-dimensionality. The clay figures tended to begin with simple forms and progressed to more skilful and complex sculptures. The present findings are generally consistent with the trends observed by Golomb and McCormick (1995) as scores of the oldest participants were significantly higher than those of the two younger groups. These authors also found that the differences were mainly between the youngest and older subjects. The scores for the preschoolers (mean age 4.50) and kindergarteners (mean age 5.20) did not differ from one another, but these groups scored lower than all of the older groups, with the exception of the first and second graders (mean age 7.30) who differed only from the adults (mean age 30.00). While these results included the data from both the human and animal tasks, an inspection of the mean General Dimensionality scores for the three human tasks reported by the authors also showed a steady increase with the age. Given these previous findings, it is not surprising that the two younger groups in the present study did not differ from one another but scored significantly lower than the oldest children. The similarity between the two younger groups is exemplified in the work of a boy, aged 4 years 6 months, and the work of another boy artist, aged 7 years 2 months (see Figure 7). The two younger age groups had comparable scores to their same age counterparts of Golomb and McCormick.

For exploratory purposes, the dimensionality scores of the boys and girls were also included for comparison. No differences were found between the two groups. This finding parallels results of previous studies that examined the production of the human form in clay (Golomb & McCormick, 1995). Both sexes appear to employ an equivalent number of three-dimensional techniques as assessed by the General Dimensionality Scale. It seems however, that this similar use of three-dimensional tactics amongst boys and girls may be specific to clay modeling. Conversely, research investigating children's use of other three-dimensional materials such as building blocks has found marked sex differences (e.g., Casey et al., 2008; Farrell, 1957; Goodfader, 1982). These differences tend to be most pronounced on tasks that require the mental rotation of an object. While both clay and blocks are three-dimensional materials, there are a number of medium specific constraints that may influence production. The texture and malleability of clay lends itself to the creation of organic forms. Blocks are rigid and geometric, allowing for the construction of simple and complex structures in space. This exemplifies the difficulty of transposing developmental models from one domain to another, even if some cursory characteristics are shared.

The second series of hypotheses concerned the effect of the independent variables on the Sides Modeled Scale. Analysis of the total number of sculpted sides indicated that Instructional Set 2 yielded significantly higher scores than Instructional Set 1. A comparison between the first set and the fourth showed a similar but less pronounced increasing pattern. These results demonstrated that the overall number of sides of a modeled figure tends to increase when a particular side (i.e., back) or posture (i.e., bending down) is described. The findings for the third task did not follow this predicted increase, most likely because the instructions included the activity of playing catch but did not reference a specific side or upright stance. Also, it is possible that the act of playing catch drew more attention to the frontal plane of the figure than to the other sides, as a ball is caught with the hands in front of the body. Requesting the creation of a figure wearing a backpack made the reverse side of the figure particularly salient. Fashioning a backpack required special consideration of how to attach the accessory. It also drew attention to the long sides and frontal plane of the figure as often straps were incorporated that wrapped around the figure. The backpack was a component that even the youngest children were capable of incorporating with great skill. Making a parent bending down to pick up a child also drew attention to multiple sides. The arms/long sides were engaged in the act of reaching out into space for the child, making their placement and adhesion important. However, the inclusion of outstretched arms on a forward bending standing figure created additional difficulties when it came to balance. To create a more stable structure, occasionally the legs and feet were not included. Instead, they were swapped for solid dress-like structures that could better support the figure (see Figure 8). Without these appendages, usually a point cannot be assigned for the figure's bottom side (see Appendix A). With this task a number of standing parent figures were made. This particular posture exposed the back side, making its modeling more likely; however, as this plane was not specified, attention to it was not an essential component to the successful completion of the task. Combined, these aspects could have accounted for the slightly less than significant findings for the fourth task.

Differences between the total number of sides modeled were also noted between the age groups with the 11-12 year-olds constructing a greater number of sides than the 4-5 year-olds. This indicated that while a child as young as 4 years is capable of modeling more than just the frontal side of a figure, older children are more likely to consider a greater number of sides. The lower scores for the younger children should not be interpreted as a lack of knowledge of the existing sides of an object. The significant interaction between age and instructional set showed that for the younger children the total number of sides modeled was more susceptible to task demands. While the scores of the 11-12 year-olds hovered at approximately five sides for each of the tasks, the scores of the 4-5 year-olds almost doubled for the second and fourth task. This suggests that a very young child is capable of modeling the multiple sides of a figure, but with less specific instructions the more likely they are to create a canonical sculpture.

In addition to the total number of sides modeled, the difference scores between the Hard and Soft Scores were computed. Analysis of these scores on the four tasks yielded significantly higher scores for Instructional Set 2 compared to the first set, indicating that the presence of a backpack produced figures with sides that were treated with greater care and attention. This was not the case for subsequent tasks as there was a non-significant change in the difference scores. This finding was inconsistent with the original predictions and while Golomb and McCormick (1995) did not include identical tasks in their study, they did note a significant effect of the tasks (humans and animals) on the Hard Scores. Since the children had been prompted to examine sides other than the frontal plane with Set 2, it was thought that this experience may influence subsequent tasks. This suggests that unless the instructions specify additional sides (i.e., "backpack"), simply describing an upright posture or activity, (i.e., "bending", "playing catch") does not guarantee that a greater number of sides will be modeled with attention and detail. In light of the current findings, it appears that careful attention to multiple sides is largely dependent on the specificity of the task demands.

As described earlier, the points from the Sides Modeled Scale (Hard Score) and the level of uprightness contribute to the overall dimensionality scores. The upright posture of the figures increased marginally as a function of the instructions and the number of sides modeled only increased significantly for the second task. Taken together these findings suggest that what changed the most for the third and fourth tasks in terms of dimensionality was the way in which the clay was used, such as the creation of a bulkier figure or the modeling of more protrusions and envelopments that would indicate an awareness of a third spatial dimension. For example, these tasks did prompt the creation of figures with forward reaching arms/hands and articles of clothing such as ball caps, all of which would have contributed to the higher overall dimensionality scores.

Age was also found to affect the number of sides modeled with detail and attention. While the difference between the 11-12 group and the 7-8 group did not reach statistical significance, it was in the predicted direction. The difference mainly occurred between the youngest and oldest participants, which was generally consistent with expectations and comparable to the results of Golomb and McCormick (1995). Although they did not compute a difference score, these researchers found that even the youngest children in their study were inclined to model carefully more than a single side of an object and this tendency increased with age.

While overall dimensionality scores were similar for girls and boys, a significant difference between the two groups appeared on the difference scores for the Sides Modeled Scale. This outcome was unexpected, as no studies on clay modeling have noticed a difference between the sexes on their level of attentiveness to a given side of an object. Results indicated that girls were more likely to meticulously model a side. This should not be interpreted as indicating that boys had diminished three-dimensional conceptions, but that they simply did not carefully attend to the sides that they did model. Generally, the boys took considerably less time to create their figures, some as little as only 3 minutes. In sharp contrast, several of the girls would routinely spend upwards of 45 minutes on a single figure. This would have undoubtedly influenced the attention allocated to the modeling each side of a figure. Research on drawing has shown that the time engaged in a task has a positive effect on the complexity of the art product (Hanline, Milton & Phelps, 2007). It is quite possible that the same is true for modeling. As the total number of sides modeled relates to the three-dimensional sculpting of an object, including this aspect in a measurement system for dimensionality is warranted. While the scale system designed by Golomb and McCormick (1995) provided an excellent foundation for the measurement of three-dimensional modeling, the current finding on sex differences calls into question the division of the Sides Modeled Scale into two levels. Rather than reflecting a greater competence in the three-dimensional domain, the Hard Scale criteria appeared to reflect the level of detail or persistence exhibited by a child. For example, in order to receive one Hard Score point for the top side a child had to attach the head to the figure by paying attention to the shoulders/top part of the torso (e.g., smoothing). If it was simply stuck on top of the figure or pulled out of the global mass, a Soft Score was credited.

Contrary to my predictions and the research of Golomb and McCormick (1995), the scores on the Figural Differentiation Scale did not change with the instructions. One possible source of the significant results of the previous study may have been the nature of the tasks employed. Golomb and McCormick compared a broader range of tasks than the current study including three animals (Dog, Cow, and Turtle). Their results are not particularly surprising given that these animals were chosen because of their lower levels of complexity (number and arrangement of differentiated elements) and familiarity (knowledge of the object and/or its representation) relative to the human tasks. A related factor is the presence of clothing and accessories, which are typically more common for people than for animals. Either of these aspects could have contributed to the observed significant main effect for the level of detail. As Golomb and McCormick did not provide descriptive statistics or post hoc analyses for this measure, it cannot be determined which tasks differed from one another in terms of the level of differentiation, only that there was an overall significant effect.

An alternative explanation to the consistent Figural Differentiation scores across tasks observed in the present study could be explained by the first set of instructions. The children were asked to make a person; however, no restrictions were stipulated regarding what type of person this had to be or what action they were to perform. A closer examination of the sculptures produced from the first instructional set indicated that much of them already had a very high level of detail and included a number of additional accessories or objects. This can be seen in examples such as the "Chicken man with 'mini me' chicken man" (Figure 9A) or the "Dude with a mohawk on a skateboard holding a stick" (Figure 9B). This could have created a ceiling effect for the figural differentiation scores. The final three instructional sets did not lead to a significant change in scores as the figures were already very highly detailed to begin with. In addition, the detailed representation of the human figures could have conflicted with the need to alter the figure in other ways. For example, creating a parent bending down to pick up a child required the consideration of how to alter the posture as well as bending and balancing the figure. These constraints could have interfered with the creation of additional details on the parent figure.

The non-significant effect of age on Figural Differentiation scores was another unexpected outcome. Golomb and McCormick (1995) found that although the scores of the preschoolers and the kindergarteners did not differ from one another, their performance differed significantly from all of the other age groups. In addition, the scores for the groups composed of grades one and two and of grades three and four differed significantly from the group comprised of grades five and seven. In her study of children's clay sculptures Brown (1975), who used a modified version of Harris' Draw-a-Man Test to analyze her participants' "man" sculptures, also found that the percentage of features tended to show a steady progression of growth as the ages of the children increased. For example, 6.00 % of the four-year-olds gave their clay men necks while 72.00 % of the eleven-year-olds included this characteristic. In the current study, although the trend was not strong, some of the children, especially the younger ones, made their first and second figures flattened and horizontal. It was not until subsequent sessions that these children made bulkier or freestanding figures. It is considerably easier to add detail to a sculpture when it is stuck flat to the table top and does not need to support its own weight. Moreover, although many of the younger children's figures were less refined or distinct than those of the older children, many of them contained much of the necessary body parts. Clay tadpole figures with only a head, facial features and legs were made by only one of the youngest children.

Another reason for the discrepancy could stem from the measurement system itself. While the Figural Differentiation Scale awards points based on the details in the figure, it also gives points to any other additional item modeled by the child that is directly related to the figure (e.g., a base, a ball, pets, furniture). As many of the younger children in the present study created a great deal of additional components for their sculptures, this could have inflated their scores. Although the Figural Differentiation Scale used in the present study was not designed to determine children's level of intellectual maturity, other measures that use the increasing number of details in figure drawings as evidence of cognitive development have received some criticism. One such scale is the Goodenough-Harris Draw-A-Man Test. Opponents argue that the linear progression from undifferentiated figures to the more complex and detailed drawings of older children is an overly simplified explanation that discounts a number of contextual and social influences (e.g., Kindler, 1999). While it was clear that the processes and products differed across the various age groups, perhaps the Figural Differentiation Scale was unsuited to measuring developmental changes that occurred under the conditions of the current investigation. It is possible that what took place was a qualitative reorganization of features rather than a quantitative accumulation of detail.

Contrary to predictions, the sex of the child did not influence the level of figural differentiation in their sculptures. This is especially perplexing because the Sides Modeled Scale (Hard Score) and the Figural Differentiation Scale are somewhat related. While all additional details contribute to the overall level of differentiation, if details are added that indicate attention to the side of a figure such as a shirtsleeve or a hat, they contribute to the number of sides modeled. This suggests that while girls may have used detailing that was related to the construction of a side, when the boys added details it was more likely to be an additional object (e.g., stick, skateboard, etc.) or items like buttons and pockets. Golomb and McCormick found that amongst the younger participants (mean age 4.50 years), the girls tended to create more detailed sculptures. It could be that sex effects on the overall level of differentiation is confined to somewhat younger children, as the youngest age group in the current study was slightly older (mean age 5.19 years). Sex related trends on detailing tend to be much stronger for studies of children's figure drawings. Koppitz (1968) found that girls tended to include more body parts and clothing in their figures than boys did. Cherney, Seiwert, Dickey and Flichtbeil (2006) noted a significant difference between girls and boys on a number of details depicted in drawings of their families. Girls were more likely to depict clothing and include stereotyped details (e.g., fingernails, hairstyles, jewellery). Brown (1975) in her study of clay productions also noted that girls made figures that were more detailed. However, participants in this study were given a sharpened wooden dowel to use with the clay. Brown reported that the details were predominantly "drawn" into the clay with this tool. It is therefore conceivable that a large difference in figural differentiation between girls and boys is primarily confined to the domain of drawing.

The general patterns observed for Construction Style, Construction Sequence, and Representational Model were similar to those noted by Golomb and McCormick (1995) with most of the sculptures created using an additive method in a top-to-bottom sequence, however some other trends emerged. The most common sculptures were those that were three-dimensional and stood upright on their own. The use of this Representational Model increased with age. Regarding Construction Style, the younger children tended to omit more parts and this tendency was higher amongst the girls. The oldest children internally subdivided their figures more frequently, especially the boys. Although Lowenfeld (1982) refers to the analytical or subtractive method of construction (the pulling out of an object from a lump of clay) as an important means of expression used by children in their clay products, he did not discuss any sex differences. In terms of the Construction Sequence, the oldest boys tended to make the body of the figure first, while girls in all age groups preferred the head-first strategy. As previous research did not note any sex or age related trends on these measures, it is difficult to determine why it occurred here. In order to understand this phenomenon better, further research in this domain is warranted.

While only a very small number of drawings were collected in the present study and the conclusions that can be made from such a sample are quite limited, some similarities and differences were noted between the sculptures and their graphic counterparts. The Figural Differentiation Scale used to compare the sculptures and the drawings produced by the same children showed that detail was higher for the drawings. This finding was consistent with previous research (i.e., Brown, 1975). While it was expected that the drawings and sculptures would differ in terms of production sequence and style, the two media were very similar. It is conceivable that if a greater number of drawings had been collected, the predicted trends may have emerged.

There were however, a number of other noteworthy points not covered by these scales. Previous research has found that under certain conditions the two art forms appear related, as cross-media transfer can occur. For example, Golomb (2002) has noted that some children use clay in a manner similar to the drawn line. Although it is less obvious, experiences with clay may also affect subsequent encounters with drawing. After completing his sculpture of a person wearing a backpack, one boy (aged 4 years, 6 months) was faced with the problem of representing this same subject on paper. He drew his person first and then stopped, unsure of how to make him "wear" the backpack. He then said, "I can flip it over and draw on the back [of the page]" (Figure 10). This technique was very similar to the one he used to make his clay person and offered an ingenious solution to the representational problem. This exemplified the child's willingness to freely experiment with a material regardless of pre-existing representational conventions. Such behaviours did not appear to take place because the children confused the techniques used in drawing with those used in clay sculpture or vice versa. The following quotes illustrate this point: referring to his clay person one boy asked, "Do you want me to make it like in drawing?". Another child enquired, "Does it have to be three-dimensional?...I'm three-dimensional". This suggests that the children tended to select the most efficient representational solution and based their choices on prior knowledge and experiences.

A comparison of the drawings from each task, revealed a number of changes made to the figures. The first drawings showed a predominance of canonical views of the human figure. Subsequent drawings showed the use of profile views and other indices of movement such as bent legs/torso and arms "drawn at different angles to the body axis" (Golomb, 1994). Some changes were more typical such as the placement of both arms on the same side of the body to depict "catching" or "picking up". This created a *mixed view* where the head was drawn frontally while other parts of the body were drawn showing the side view. A number of other researchers have found that this sideways orientation is often used by children to convey locomotion (e.g., Ives & Rovet, 1979; Golomb, 2002; Smith, 1993). Some of the other alterations were more unusual. When asked to draw "a person catching a ball", one child (boy aged 8 years, 7 months) drew the figure's arms reaching into the air and three separate legs (see Figure 11). He stated that the extra leg was to show the person was "running" to catch the ball. Smith (1993) noted that some children employed similar *cartoon cues* (p. 113) to represent movement in their drawings of a person walking. Techniques such as multiple images and trailing lines were not frequent and tended to occur mostly amongst older children (9-10 years). This method illustrates not only the difficulty of representing movement in drawing but the range of solutions children can employ on a given problem solving task.

Overall, the clay was a more involving activity for the children. This was especially true for some of the younger ones. Blobs of clay were often sources of fantasy play and would become cars to be "driven" around the tabletop. More often, the clay figures would become animated and these basketball players or ninjas would jump through the air and across the table. The physical properties of the clay that allowed for this movement also provided exciting tactile sensations. Many of the children would carefully inspect the material as they repeatedly squished it through their fingers. Simple manipulations seemed to bring great pleasure. One young girl (age 5 years, 8 months) would roll the clay into long snakes each session, marvelling at their length and thickness. When I inquired as to why she routinely repeated this action, she replied simply, "Because it makes me happy!".

A more general question of this research concerned the physical and verbal behaviours of the children as they engaged in the clay activities and what this revealed about their cognitive processes. While the measurement scales did not capture all aspects of the children's behaviour, the use of the video footage (approximately 36 hours in total) and a detailed post-examination of the sculptures revealed the imagination and problem-solving tactics applied during their encounters with the material. Although Instructional Set 2 did not consistently produce a standing figure, as expected the majority of children did consider the back of the figure even if it was constructed from two-dimensional, flattened clay. In the case of the horizontal figures, this was usually accomplished by removing the sculpture from the work surface after its completion and flipping it over. If the figure was upright, either it would be turned 180 degrees or the child would simply look over the head and around to the back in order to attach the backpack. The most common construction technique for adding the backpack was to form it around the figure. However, occasionally a backpack would be completed separately. The child would then attempt to make the figure wear it by poking the arms, one at a time, through the holes made by the straps, in a manner similar to how they would dress a doll. Often, this did not work, as the holes were too small, so one side of the strap was unstuck and reattached after the arm was inserted. However, after trying this technique one artist, a boy (aged 5 years 1 month), stuck the backpack onto his person backwards, with the straps pointing out behind. Two of the younger children did not attach their separately made backpack to the figure at all. The boy (aged 5 years 9 months), placed it gently on top on his bulky horizontal figure. The girl (aged 4 years 7 months), created a global figure with a head, facial features and legs. She then proceeded to create a much larger outline of a backpack with strips of clay and placed the figure in its centre. The few children who produced one- or two- dimensional sculptures tended to indicate the presence of a backpack by placing straps on the front side of the arms but overlooking the figure's back. With one exception, the standing figures had backpacks on their backs. For this participant, a boy aged 12 years 4 months; the task of creating this accessory seemed daunting. However, this omission did not appear to be due to neglect, as after sticking the straps to its front, he carefully turned the figure so that the head could be attached all the way around the neck.

The final three instructional sets were designed to suggest alterations to the figures, such as a change in posture; however, often the participants utilized other three-dimensional tactics. For instance, Instructional Set 3 was intended to produce an upright figure with some alteration of the body sufficient to make it stand, such as creating a more solid construction that would not topple over. Some children did make vertical sculptures but for those unable to raise their horizontal figures, the arms/hands were often repositioned so that they reached forward into space to grasp the ball. Less frequently, the ball was placed in one hand outstretched to the side or it was positioned beside its intended target. Although forward reaching arms do not demonstrate as high a level of technical competence as a full-fledged standing figure (as measured by the Dimensionality Scale), they do indicate a consideration of the third dimensional plane.

Prior to being placed in the hands of the figure, there was often some indication that the ball was being thrown and moving through space toward the awaiting catcher. This involved the ball being held by the child as they moved their hand through the air or pushing the ball across the work surface. It could be argued that this occurred because balls are recognized playthings and even clay balls elicit playful behaviours. This action may also provide an explanation as to why none of the children created an additional clay figure who was throwing the ball: the child became the other ball player. This suggests that they also recognized that the instructions signified a social act.

Of the four tasks, Instructional Set 4 yielded some of the most interesting compositions. For some of the younger children, the problem of representing a parent figure engaged in the act of "bending down" proved to be too difficult. Instead, these children depicted the interaction between the two figures by other subtler means. Several showed the child "being picked up" by sticking one sculpture on top of the other. One girl (aged 4 years, 7 months), made the two figures holding hands. This finding is consistent with other similar studies of this subject. While younger children are capable of making alterations to depict motion or posture, they tend to employ fewer and less obvious alterations than their older counterparts (Smith, 1993).

One of the most striking findings was that for the fourth task, almost one third of the children made a child figure that was the same size or larger than the adult figure. While similar accounts of this behaviour in clay are absent from the literature, one of the most frequently considered aspects of children's drawings is the exaggeration or minimization of an object relative to the rest of the composition. Several authors have suggested that size of an object or feature may be due to the importance it holds for the child (e.g., Arnheim, 1974). While "importance" is difficult to operationalize, Thomas and Jolley (1998) proposed three possible definitions: contextual importance, externally or socially defined importance and personal importance. If a child places contextual importance on an object, it may be drawn larger than other objects to highlight its significance in a scene. For example, the hands of a figure catching a ball may be oversized. A figure with socially assigned authority or importance may also be drawn larger. Aronsson and Andersson (1996) found that the size of teachers was exaggerated in children's drawings of a schoolroom. If a person holds personal importance for a child, such as a best friend, that particular individual may be drawn larger in a picture that also includes other classmates.

Thomas and Tsalimi (1988) also point out that there may be procedural elements that affect the relative size of figures. The point on the page where the drawing is started or the sequence in which parts are drawn exert considerable influence on the relative size of objects. Drawings are confined by the borders of the page; however, sculptures are not. They can be picked up and moved around on the work surface. A similar planning problem may arise if a participant first made the child figure with most of the allocated clay, leaving very little with which to construct the parent figure. This would be plausible had most of the size anomalies not occurred with sculptures that were quite small and produced with a sizable blob of left over clay. However, it is possible that if the parent figure was made first but was rather small, creating an equally well-differentiated child figure that was even smaller was too difficult. In this instance, the child sculpture would most likely be made the same size as the parent. Nevertheless, this would not explain why some of the participants made child figures that were larger than the parent. One plausible explanation for the size discrepancies is that the concept of "child" held considerable personal significance for some of the participants. As the large child sculptures tended to be made by younger children, perhaps the idea of a "child being picked up by a parent" was particularly salient for them. This common social act could have been something that they experienced recently. Even so, without further research examining this issue in depth, it is difficult to determine the exact source of the size anomalies.

Although it was unintentional, Instructional Set 4 also elicited the concept of a family with multiple members. Despite the instructions specifying the creation of two figures, following the completion of the parent and the child, five of the children proceeded to construct an entire family of three or more individuals and the occasional pet. Some children designated the group as their own family, while others simply referred to the composition as a non-specific "mother and father with a brother and a sister". Occasionally, other items such as furniture, a house or a car were created to complete the familial scene. It was interesting that Instructional Set 4 and not 3 prompted the creation of figures beyond those that were stipulated. The act of playing catch, as with a baseball, can be done alone but usually involves at least two people. Therefore, it could be expected that depictions of this activity would often include a person who is throwing the ball in addition to one who is catching it. Nonetheless, it appears that this association was not made by the participants or not considered essential to the completion of the task. It is possible that additional figures were created for the fourth task because the concepts of parent and child are closely related to ideas about family. The children may have been more likely to make extra figures because of their own personal experience with the subject matter and the emotional significance it carried.

The figures produced from the four tasks ranged from very small (3cm) to quite large (30 cm). The majority of the children remained relatively consistent in their personal style across all four tasks. However, a few children demonstrated a radical stylistic evolution (see Figure 12). Often large or expansive horizontal sculptures would shrink to become tiny stout upright clay people. While the nature of the task often demanded radical structural alterations, at times there were additional contributing factors. Wolf and Perry (1988) argued that the world of representation is broad and that often children are capable of constructing and using a range of representational "styles" within the period of a single "stage". They go on to suggest that during the development of symbolism children "construct a range of visual languages with which to portray their experiences or ideas", (p. 31). For some of the children in the current study this seemed to be true as often their sculptures changed due to an interaction of contextual and experiential influences. One girl who had produced a larger bulky figure during an earlier session proceeded to make a small, flattened cut-out of a person. After flattening the clay, she traced the outline of various body parts and clothing onto the surface and carefully removed the excess clay from the perimeter of her marks. She then indicated that she had helped her grandmother make a hand-sewn outfit on the weekend. Without an examination of her utterances and relevant experiences, use of this flattening technique may have been wrongfully interpreted as a regression to stereotyped and less complex modeling. The importance of parallel talk has been emphasized by Kress (1997), who suggested that interpretation of an art product in isolation disregards utterances that promote a greater awareness. Although the resulting clay products were something that could be examined and analyzed by others than those present, what the finished sculptures could not convey was the thoughts, speech and social experiences that formed an integral part of the creative process (Coates and Coates, 2006).

As the above example illustrated, while working with the clay, many of the children would discuss a range of topics that informed the task at hand. Initially, some children were shy and seldom spoke, as it was my first time meeting many of them. This behaviour was often replaced by a more open dialogue as the sessions progressed. The children frequently criticized their work saying, "It doesn't look like a person" or "It's not right…I don't like it". This self-criticism seemed to occur regardless of age and after expressing their dissatisfaction they would rework or modify their sculpture often several times, "I squished him…I'm starting over". Some children also considered the tasks to be challenging assignments as was revealed by their remarks: "I can't do it, I can't make him stand", "I can't make a person catching a ball, I don't know how" and "I suck at it". At times, other practiced alternatives would be suggested hoping that these objects could be substituted for the clay figure. Some options were similar, "I can make a snowman", while others seemed unrelated "I know, how bout I make a boat [instead]…how bout I make a volcano?". Despite initial misgivings, most of the children were determined and adventurous with the clay. After a little experimentation, doubt was replaced by excitement and satisfaction. One 5 year-old boy who, after becoming quite frustrated with his clay people falling apart, adopted a new construction technique and said, "I'm just squeezing them out [referring to ears and arms]. [Now] they can't fall off. Okay let me see if it stands. It stands! It stands! See you have to push it down". Unplanned discoveries were made as the children tested the physical properties of the clay through processes of squeezing, flattening, rolling and stacking. These actions were then integrated into careful systematic experimentation that often involved construction, destruction and then reconstruction. Together these behaviours pointed to an awareness and reflectivity indicative of active problem solving, creativity and learning.

Overall, results suggested that very young children exhibit a basic three-dimensional conception, as demonstrated by the creation of rounded heads/bodies and the consideration of multiple dimensional planes. These tendencies tended to increase with age as the children gained experience with the medium and experimented with configurations that were more complex. That being said, a particular developmental stage as expressed by a given artwork is largely determined by the task demands. Therefore, it is important to include multiple examples when examining children's artistic development (Barrett, 1983; Kapsch & Kruger, 2005). Earlier research showed that children, especially younger ones, characteristically use inflexible formulas when depicting the human figure (e.g., Harris, 1963; Karmiloff-Smith, 1990). More recently, experimental studies have shown this rigidity can be diminished by guidance and the manipulation of specific environmental or instructional variables (e.g., Morra, 2005; Smith, 1993). With appropriate contextual support, children's optimal level of artistic performance typically exceeds that which is exhibited under spontaneous or minimally structured conditions (Boyatzis, 2000). In an attempt to provide contextual support, the present study employed specific instructions that were designed to draw attention to various features. Such exercises are useful as they engage a child's imagination and promote an awareness of dimensionality.

This should not be taken as an indication that open-ended clay activities are not also highly valuable learning tools. The current study utilized instructions that were intended to investigate how children coped with specific problems of representation. This somewhat narrowly defined and structured approach yielded valuable information regarding the general effect of the designated contextual factors. However, it could be considered limiting in terms of gaining insight into the child's broader creative processes. The spontaneous productions of children can reveal a child's personal experience and identify what is important to them (Szabad-Smith, 1988). Task-oriented research can be somewhat removed from many of the child's natural processes of exploration and expression. As Sherman, Landau, and Pechter (1977) point out "the creative act is most evident in the choosing of the subject and finding one's own meaning within and through the medium…[T]he act of making is itself the subject and object of artistic endeavour", (p. 69). In addition, studies of artistic development based on psychological research methods are primarily concerned with the generalizability of results to larger populations. As a result, the individual style, preferences, mannerisms and idiosyncrasies of the participants that may in fact exert considerable influence on their productions, remain largely unexplored aspects of the experience. An area for future research could be to address a broader range of clay activities and measurement techniques, in an effort to provide a more encompassing description of modeling development.

Beyond documenting the subtleties of modeling development, the present study revealed important implications for more general practices within art education. Art educators face a number of choices related to teaching methods, lesson design, and materials. The use of clay in the classroom offers the opportunity for children to develop a spatial awareness and understanding of their surroundings, which is "linked to the development of imagination and the creation of original creative content", (Matthews & Geist, 2002, p. 322). Outside of specialized schools such as Montessori or Reggio Emilia, this form of knowledge is often a neglected aspect in early education. As two-dimensional modes of communication dominate the media and permeate modern life, it becomes increasingly important to expose children to activities that engage the third spatial dimension as well as the tactile sense.

The incorporation of clay activities involving the human form can provide an excellent starting point for the development of three-dimensional representational skills. Teaching modeling of the human figure may be encouraged by including activities that emphasize multiple sides and locomotor activity. Although instructional support may facilitate three-dimensional modeling at any age, younger children may actually benefit more when it comes to particular aspects of modeling such as the creation of multiple sides. Students are stimulated by medium levels of complexity and optimal learning occurs with activities that promote multiple thought processes (Freedman, 1997). Teachers could consider moderately involved sculpture tasks when assigning projects to their students. As long as instructions are presented in a clear and relevant manner, such tasks can encourage more intricate modeling while exercising problem-solving skills. Guided learning experiences can give children the confidence to continue with artistic endeavours and nurture their potential for expression.

Figure 1. April Mandrona, *Bricolage*, 2008. Still photograph from the stop-motion animation including an articulated doll hand-sculpted from polymer clay and fabric. Figure stands 25 cm.

Figure 2. April Mandrona, *Ice Floe*, 2009. Detail of self-contained miniature mixed media sculpture. Figure stands 2.50 cm high.

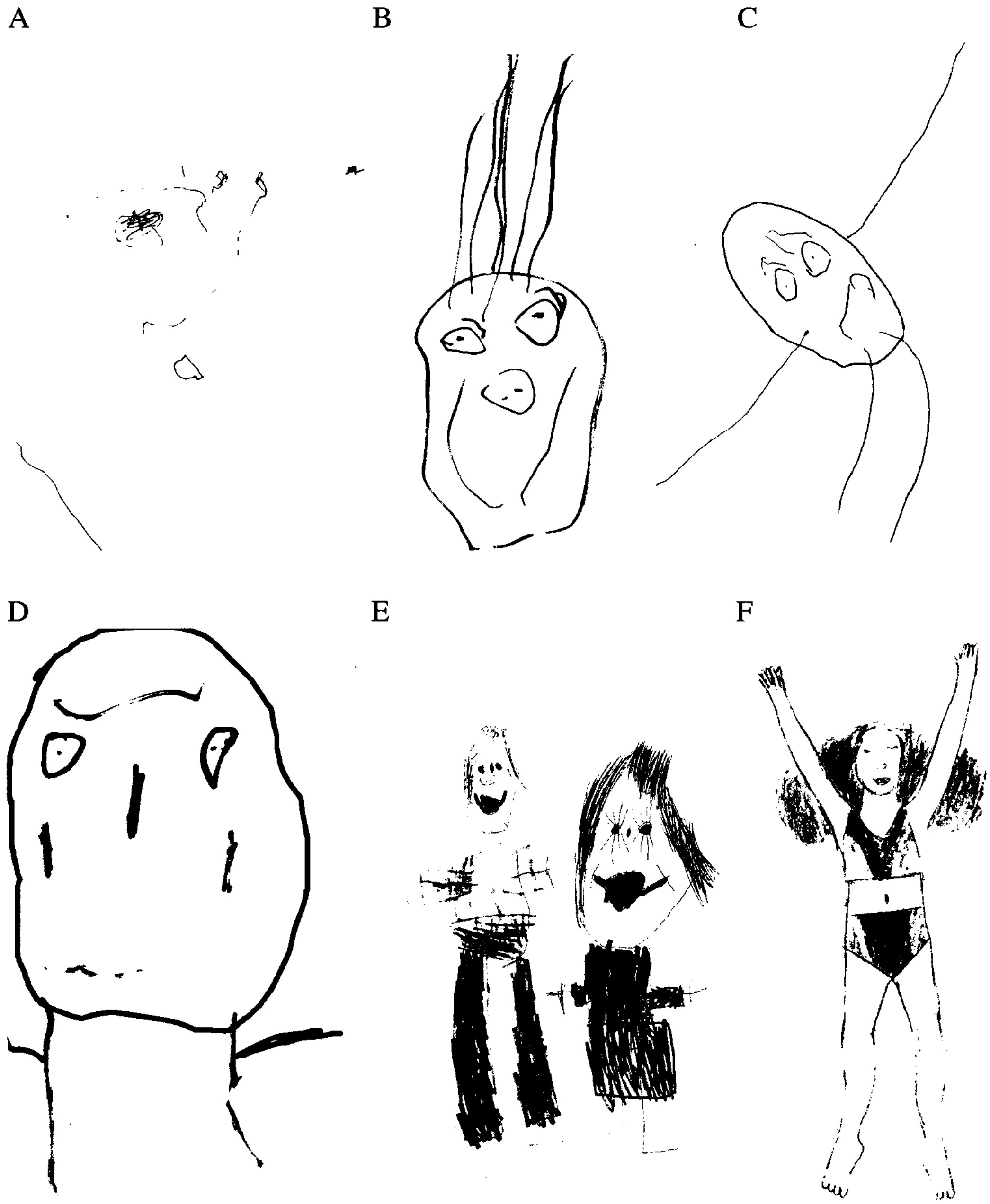

Figure 3. Development of the human figure in drawing.
A. Scribble. Shows use of lines, dots, curves and enclosed forms.
B. Global human form
C. Tadpole figure
D. Open-trunk figure
E. Conventional figures
F. Contoured figure

Note. Drawings form the personal collection of April Mandrona.

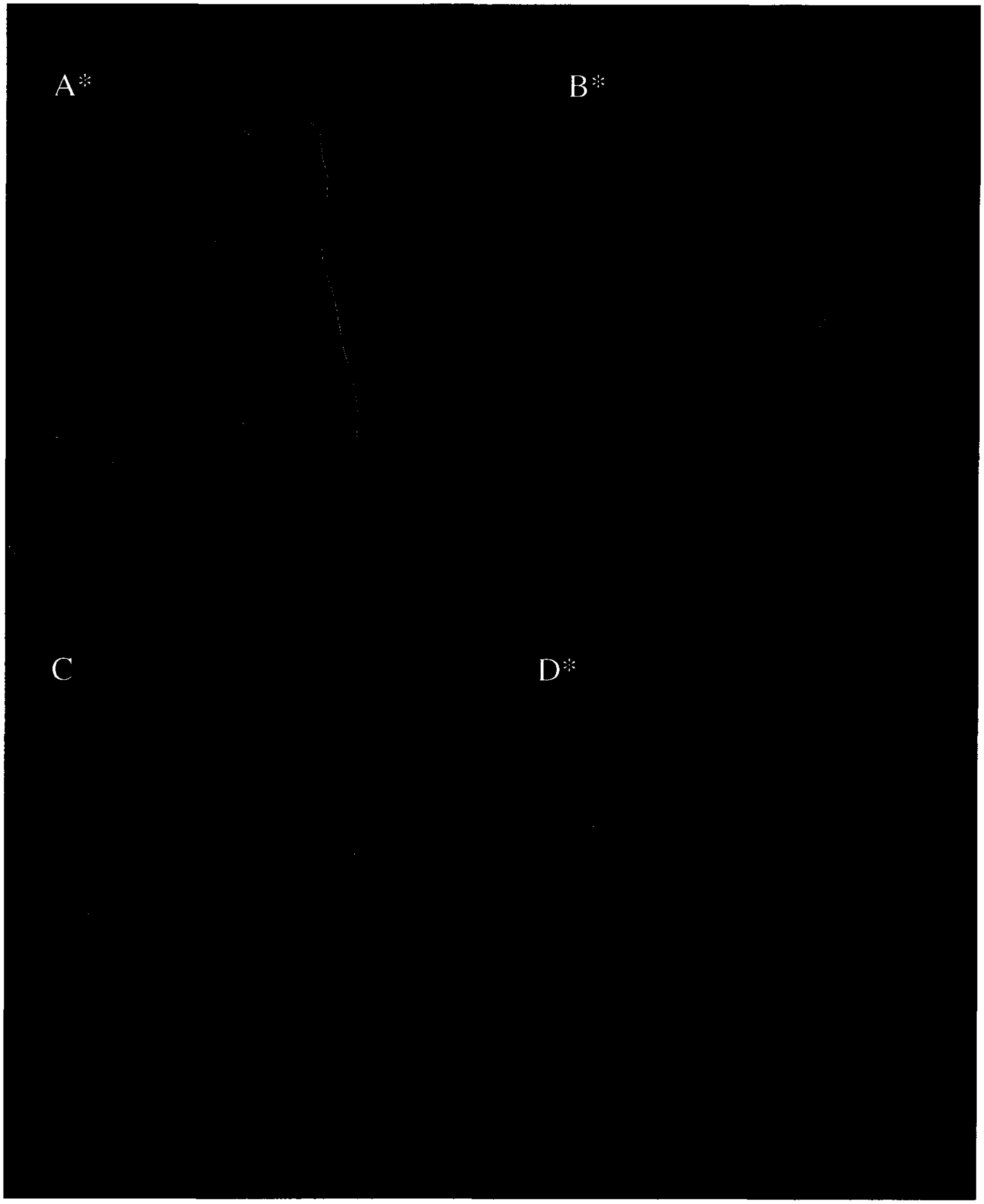

Figure 4. Development of the lengthened column figure in clay.
A. Lengthened column
B. Minimally modeled figure with internal subdivision
C. Figure with pinched out appendages
D. Upright standing figure composed of solid, separately modeled parts

Note. Sculptures from the personal collection of April Mandrona.
*Clay models illustrating possible constructions based on the research of C. Golomb.

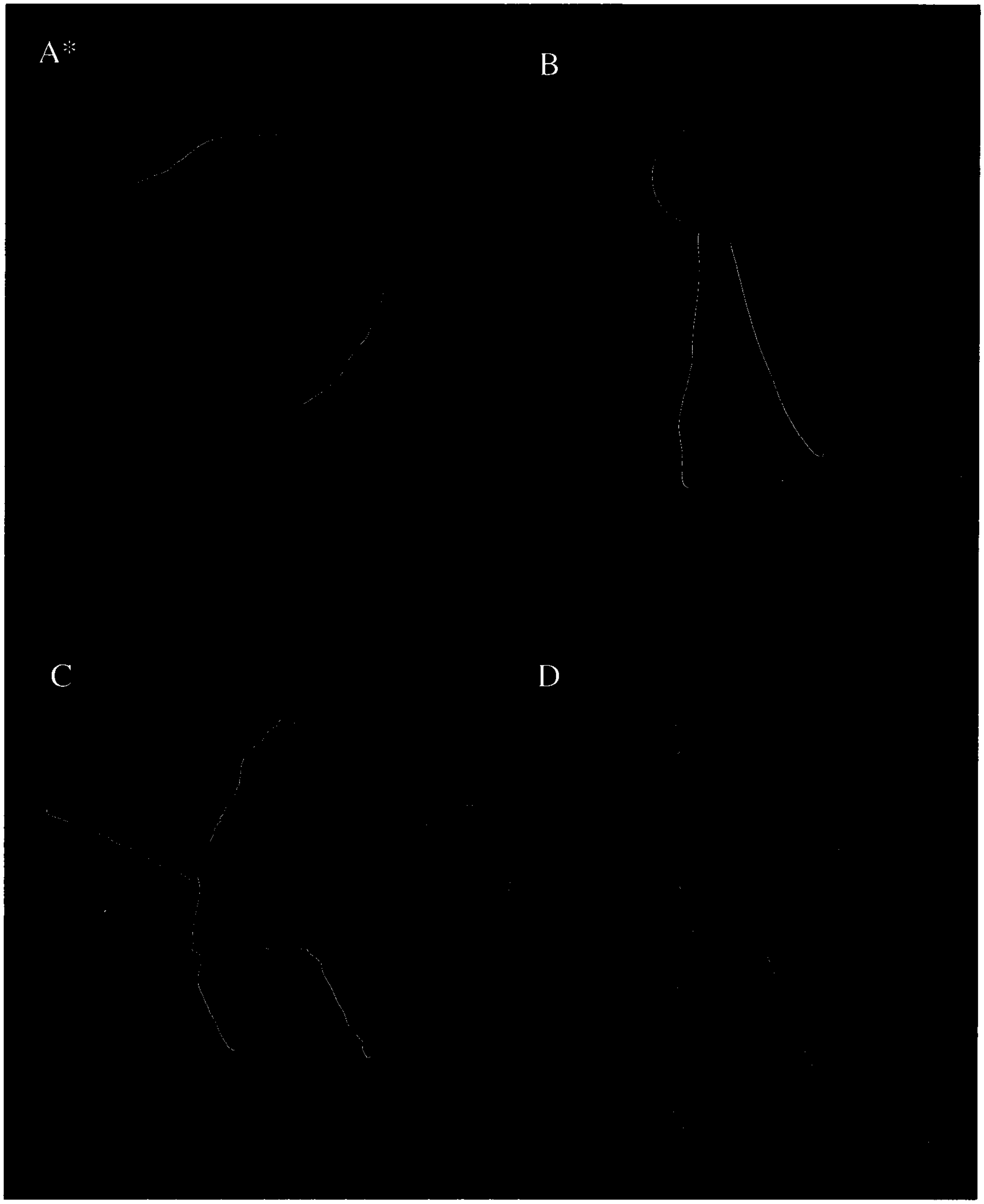

Figure 5. Development of the tadpole figure in clay.
A. Global form with facial features
B. Tadpole figure
C. Differentiated horizontal figure
D. Horizontal figure with two-part body

Note. Sculptures from the personal collection of April Mandrona.
*Clay model illustrating possible construction based on the research of C. Golomb.

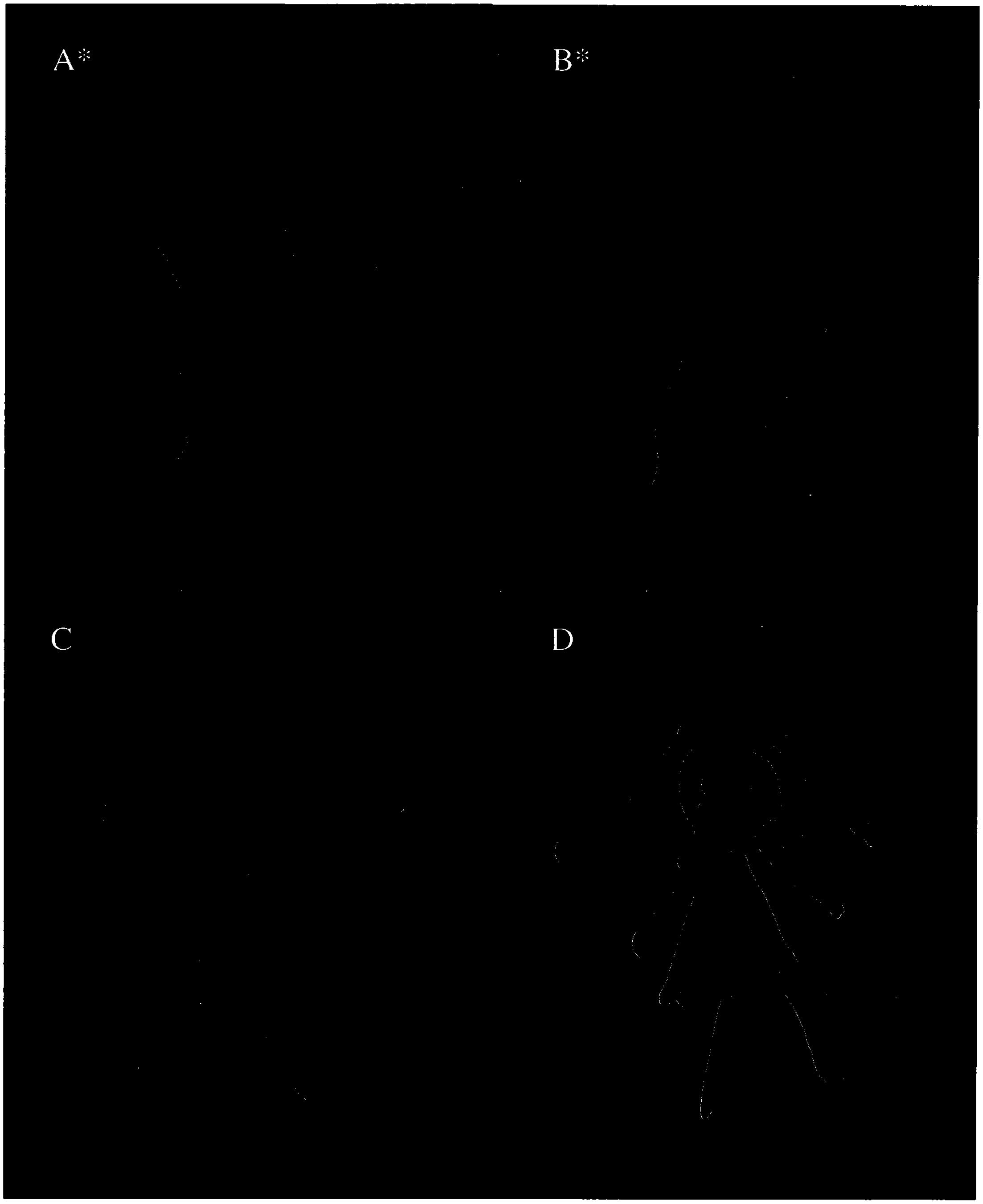

Figure 6. Development of the layout model, stick figure and graphic tadpole in clay.

A. Layout model
B. Graphic tadpole figure
C. Stick figure
D. Full-fledged graphic figure

Note. Sculptures from the personal collection of April Mandrona.
*Clay models illustrating possible constructions based on the research of C. Golomb.

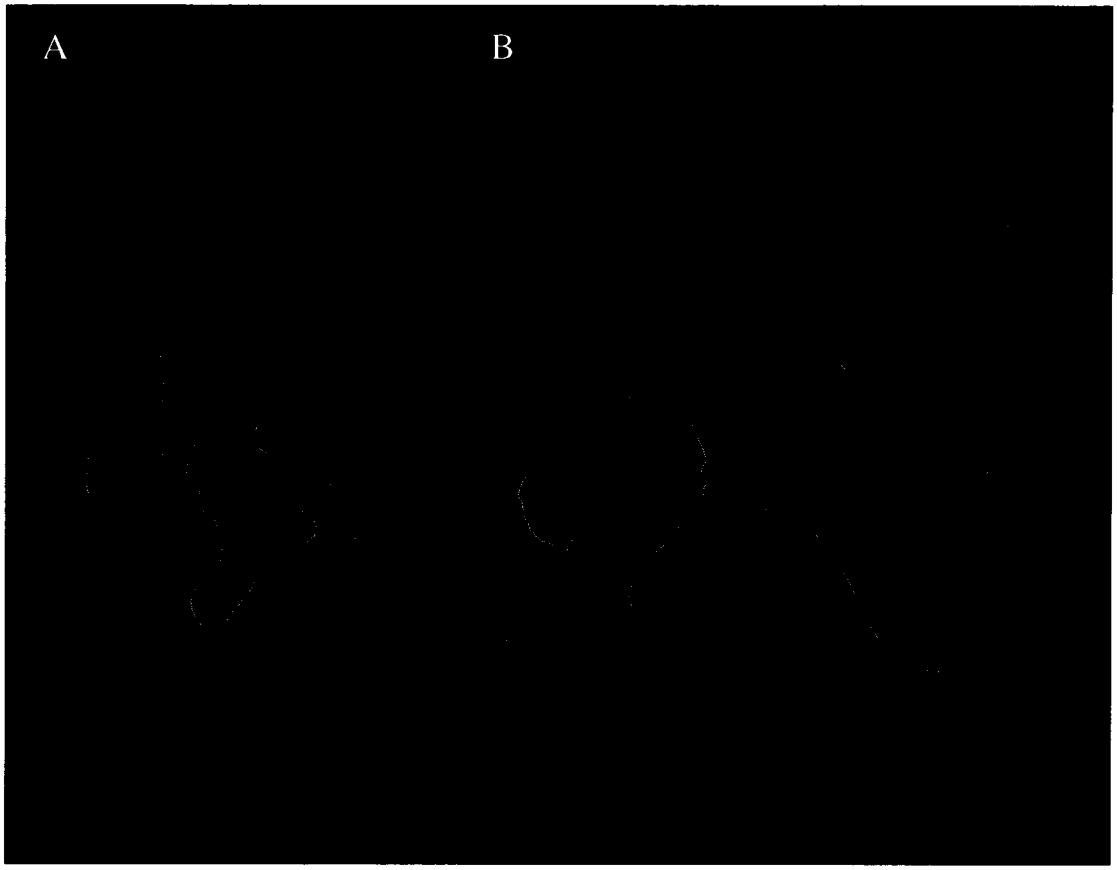

Figure 7. Creation of similar sculptures across younger age groups. Depicts a person playing catch with a ball. A. Created by boy aged 4 years, 6 months B. Created by boy aged 7 years 2 months.

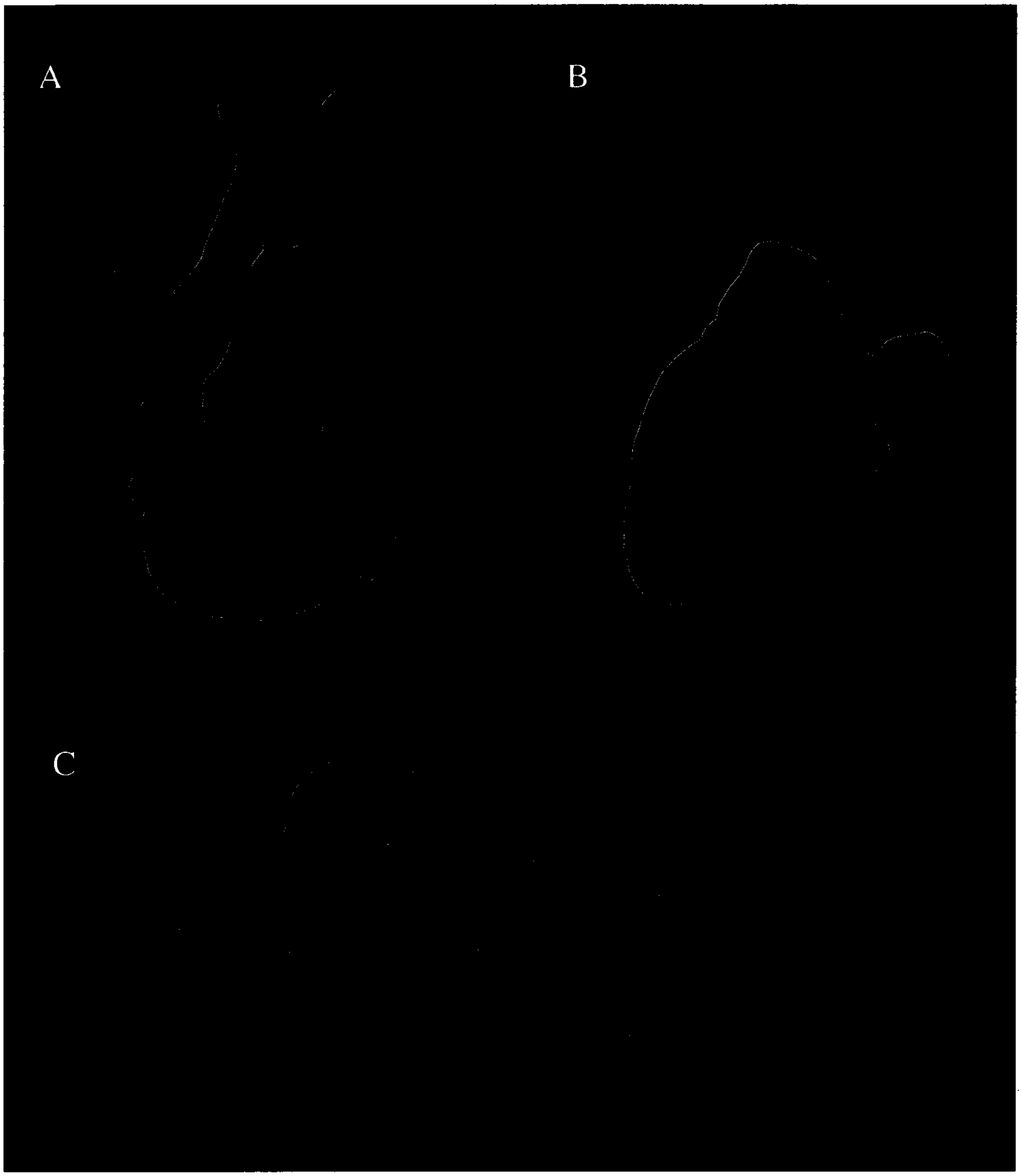

Figure 8. Standing sculptures with a dress instead of legs/feet for support. A. Created by girl age, 11 years, 10 months B. Created by boy age 7 years, 1 month. C. Created by girl age, 12 years, 4 months.

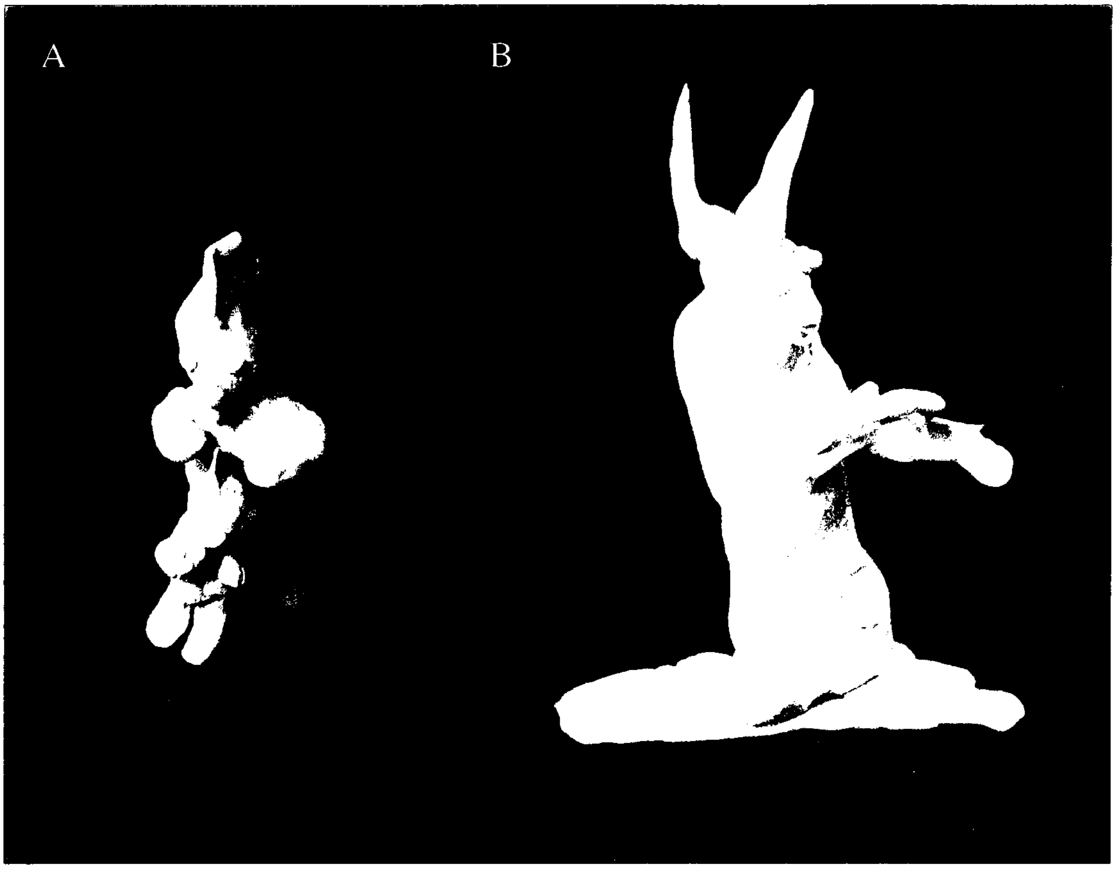

Figure 9. Sculptures of a person with a high level of detail. A. Created by a girl age 11 years, 5 months. B. Created by a boy age 12 years, 2 months.

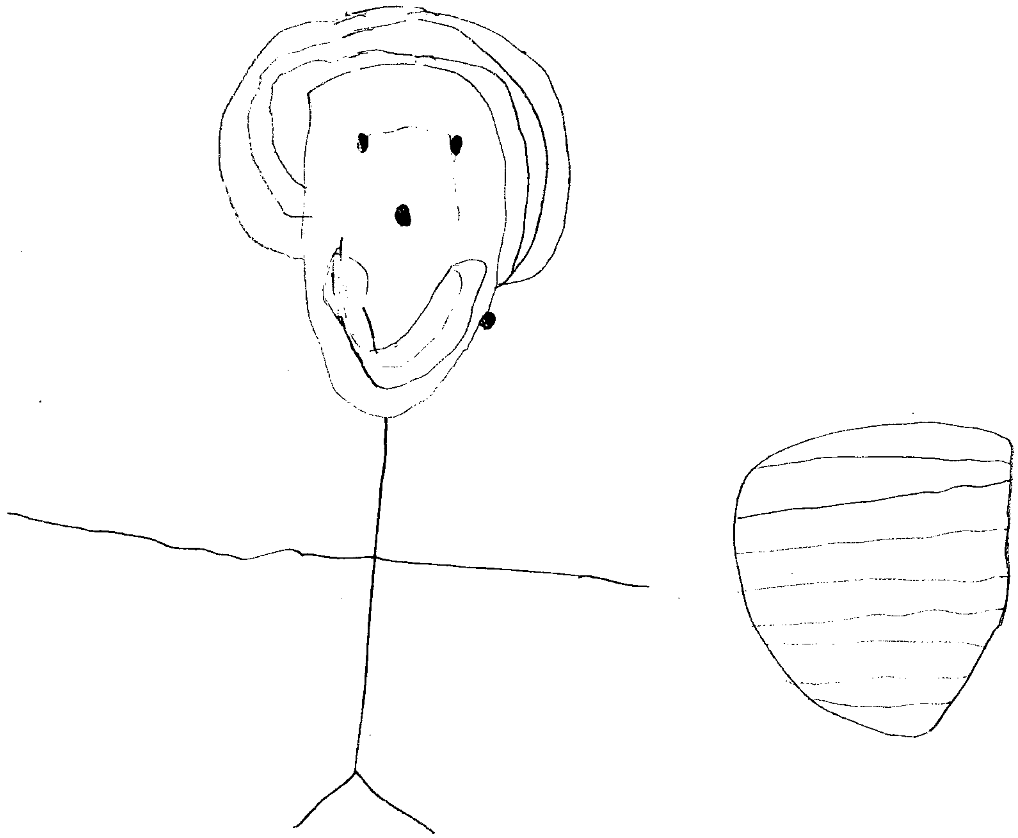

Figure 10. Drawing of a person wearing a backpack. Person was drawn on one side of the page while backpack was drawn on the reverse. Artist was a boy aged 4 years, 6 months.

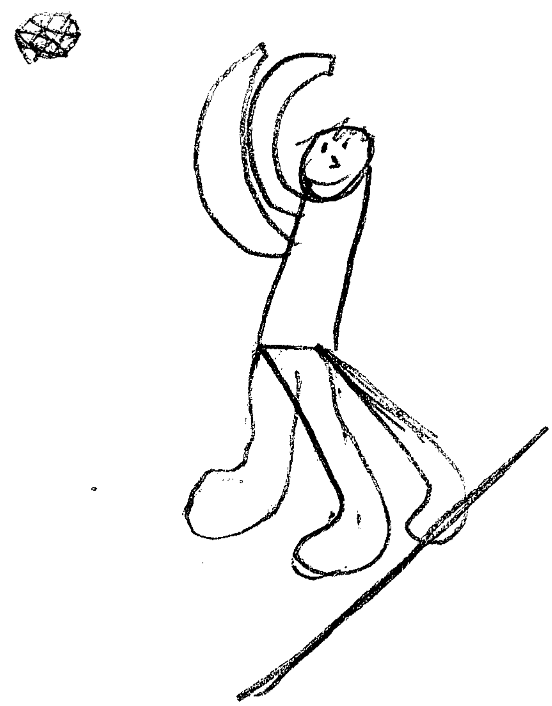

Figure 11. Drawing of a person with three legs. Person was drawn with an extra leg to show the act of running to catch the ball. Artist was a boy aged, 8 years, 7 months.

Figure 12. Stylistic change across tasks. The first figure is large and is modeled flattened and lying down. The second and third figures are smaller and rounded but still horizontal. The fourth task produced two figures that were very small and rounded but standing. Created by boy aged 5 years, 9 months.

Table 1

Distribution of Age and Sex for Groups

	Sex			
Group	Girls	Boys	Age Range	Mean Age
4-5 yrs	6	4	4.50-5.92	5.19
7-8 yrs	4	6	7.08-8.42	7.83
11-12 yrs	5	5	11.25-12.42	11.89

Table 2

Piaget's Stages of Cognitive Development

Stage	Period	Description
Preoperational	2-3 to 7-8 yrs	Young children form concepts and the development of language and make-believe play takes place. Thinking may lack the logic of the two proceeding stages. They can understand multiple points of view, although in an incomplete way. Comparison of arrangements by size, numbers and spatial classification is also incomplete.
Concrete Operational	7-8 to 11-12 yrs	Children begin to think logically, classify on several dimensions and understand mathematical concepts, provided they can apply these operations to concrete objects or events. Can evaluate cause and effect relationships. Children include the process of transformation in their thinking. Thinking is also flexible, reversible and not limited to the here-and-now.
Formal Operational	11-12 yrs and beyond	Children explore logical solutions to concrete and abstract concepts. They can think systematically about all possibilities, project into the future, recall the past, and reason by analogy/metaphor. They have the ability to formulate, test and evaluate hypotheses and can think about their own thoughts.

Note. Summarized from: Piaget, J. & Inhelder, B. (1969). *The psychology of the child* (H. Weaver, Trans.). London: Routledge & Kegan Paul. (Original work published 1966).

Table 3

Distribution of Age and Sex for the Drawing Tasks

	Sex			
Age	Girls	Boys	Age Range	Mean Age
4-5 yrs	1	2	4.50-5.67	5.31
7-8 yrs	0	2	8.33-8.58	8.46
11-12 yrs.	1	0		11.42

Table 4

Means and Standard Deviations for General Dimensionality Scores Across Instructional Sets and All Groups

	Girls			Boys		
	4-5 yrs	7-8 yrs	11-12 yrs	4-5 yrs	7-8 yrs	11-12 yrs
Set	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
1	5.50 (4.09)	7.50 (4.80)	12.00 (3.94)	3.75 (1.26)	4.83 (1.72)	10.80 (3.90)
2	7.17 (3.31)	9.50 (4.80)	13.80 (3.49)	8.00 (1.41)	8.33 (4.76)	13.20 (4.60)
3	6.17 (4.40)	8.25 (4.35)	14.20 (4.76)	5.25 (1.26)	7.83 (3.43)	12.00 (3.67)
4	8.33 (4.25)	9.75 (4.99)	13.40 (3.91)	7.50 (3.32)	8.83 (2.99)	11.80 (3.35)

Note. Set refers to Instructional Sets including 1 (person), 2 (person wearing a back pack), 3 (person playing catch with a ball), and 4 (parent bending to pick up a child).

Table 5

Contingency Table for 2 (uprightness) x 4 (instructional set) Chi Square

	Set				
	1	2	3	4	Total
Upright	Count (%)	Count (%)	Count (%)	Count (%)	Count (%)
Yes	17 (14.17)	23 (19.17)	23 (19.17)	26 (21.17)	89 (74.17)
No	13 (10.83)	7 (5.83)	7 (5.83)	4 (3.33)	31 (25.83)
Total	30 (25.00)	30 (25.00)	30 (25.00)	30 (25.00)	120 (100.00)

Note. Set refers to Instructional Sets including 1 (person), 2 (person wearing a backpack), 3 (person playing catch with a ball), and 4 (parent bending to pick up a child). Upright refers to the verticality of the figure including held in the hand, standing with structural support and freestanding.

Table 6

Means and Standard Deviations for Sides Modeled Scale (Overall Scores) Across Instructional Sets and All Groups

	Girls			Boys		
	4-5 yrs	7-8 yrs	11-12 yrs	4-5 yrs	7-8 yrs	11-12 yrs
Set	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
1	2.17 (1.60)	3.75 (2.06)	5.00 (1.22)	1.00 (0.00)	2.67 (2.16)	4.60 (1.67)
2	3.00 (1.67)	4.00 (2.45)	4.80 (1.79)	3.75 (1.50)	3.67 (2.25)	5.00 (1.73)
3	2.33 (1.86)	3.50 (2.38)	5.00 (2.24)	2.25 (0.50)	3.67 (2.07)	4.80 (1.64)
4	3.17 (1.94)	3.75 (2.06)	4.80 (1.64)	3.75 (2.22)	4.00 (2.00)	4.60 (1.14)

Note. Higher scores indicate a greater number of sides modeled. Set refers to Instructional Sets including 1 (person), 2 (person wearing a back pack), 3 (person playing catch with a ball), and 4 (parent bending to pick up a child).

Table 7

Means and Standard Deviations for Sides Modeled Scale (Difference Scores) Across Instructional Sets and All Groups

	Girls			Boys		
	4-5 yrs	7-8 yrs	11-12 yrs	4-5 yrs	7-8 yrs	11-12 yrs
Set	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
1	1.83 (2.04)	2.75 (2.22)	4.60 (1.52)	1.00 (0.00)	0.00 (1.41)	3.00 (3.00)
2	2.67 (1.63)	4.00 (2.45)	4.80 (1.79)	2.25 (0.96)	2.33 (2.42)	4.20 (2.05)
3	2.00 (2.10)	3.00 (2.16)	4.60 (2.19)	0.75 (0.96)	1.33 (3.08)	3.20 (2.77)
4	2.17 (1.17)	3.75 (2.06)	4.80 (1.64)	0.25 (1.50)	1.33 (3.50)	3.40 (3.21)

Note. Higher difference scores indicate the number of sides modeled with more detail and attention. Set refers to Instructional Sets including 1 (person), 2 (person wearing a back pack), 3 (person playing catch with a ball), and 4 (parent bending to pick up a child).

Table 8

Means and Standard Deviations for Figural Differentiation Scores Across Instructional Sets and All Groups

	Girls			Boys		
	4-5 yrs	7-8 yrs	11-12 yrs	4-5 yrs	7-8 yrs	11-12 yrs
Set	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
1	6.83 (2.14)	9.25 (3.20)	9.00 (1.87)	8.00 (3.46)	6.17 (3.06)	8.60 (2.61)
2	7.00 (2.19)	9.25 (3.40)	9.60 (3.05)	8.50 (0.58)	8.00 (2.83)	8.80 (2.39)
3	8.00 (1.41)	9.25 (2.22)	10.60 (3.36)	7.25 (1.71)	8.17 (3.37)	8.40 (2.61)
4	8.83 (2.64)	10.75 (3.10)	10.20 (3.27)	8.25 (2.22)	7.33 (2.66)	7.60 (1.82)

Note. Set refers to Instructional Sets including 1 (person), 2 (person wearing a back pack), 3 (person playing catch with a ball), and 4 (parent bending to pick up a child).

Table 9

Frequency of Modeled Figure Construction Style

Style	Count	%
IA	0	0
IB	14	11.67
IIA	18	15.00
IIB	88	73.33

Note. Style refers to Construction Style including IA (modeled by internal subdivision and missing at least one major part), IB (modeled by internal subdivided with all major parts), IIA (modeled by addition and missing at least one major part) and IIB (modeled by addition with all major parts).

Table 10

Frequency of Modeled Figure Construction Style by Age and Sex

	Style			
	IA	IB	IIA	IIB
Group	Count (%)	Count (%)	Count (%)	Count (%)
4-5 yrs				
Girls	0 (0)	0 (0)	9 (7.50)	15 (12.50)
Boys	0 (0)	1 (0.83)	2 (1.67)	13 (10.83)
7-8 yrs				
Girls	0 (0)	0 (0)	0 (0)	16 (13.33)
Boys	0 (0)	3 (2.50)	1 (0.83)	20 (16.67)
11-12 yrs				
Girls	0 (0)	1 (0.83)	5 (4.17)	10 (8.33)
Boys	0 (0)	10 (8.33)	0 (0)	14 (11.67)

Note. Style refers to Construction Style including IA (modeled by internal subdivision and missing at least one major part), IB (modeled by internal subdivided with all major parts), IIA (modeled by addition and missing at least one major part) and IIB (modeled by addition with all major parts).

Table 11

Frequency of Modeled Figure Construction Sequence

Sequence	Count	%
Head First	72	60.00
Feet First	22	18.33
Body First	24	20.00
Other	2	1.67

Table 12

Frequency of Modeled Figure Construction Sequence by Age and Sex

	Sequence			
	Head First	Feet First	Body First	Other
Group	Count (%)	Count (%)	Count (%)	Count (%)
4-5 yrs				
Girls	17 (14.17)	4 (3.33)	2 (1.67)	1 (0.83)
Boys	11 (9.17)	1 (0.83)	3 (2.50)	1 (0.83)
7-8 yrs				
Girls	16 (13.33)	0 (0)	0 (0)	0 (0)
Boys	10 (8.33)	10 (8.33)	4 (3.33)	0 (0)
11-12 yrs				
Girls	14 (11.67)	3 (2.50)	3 (2.50)	0 (0)
Boys	4 (3.33)	4 (3.33)	12 (10.00)	14 (11.67)

Table 13

Frequency of Representational Model

Model	Count	%
A	0	0
B	13	10.83
C	7	5.85
D	21	17.50
E	33	27.50
F	46	38.33

Note. Model refers to one of the Representational Models including:

A. One-dimensional model; parts of figure are unattached.

B. One-dimensional stick figure. Figure composed of snake-like strips.

C. Two dimensional graphic model. Figure is "outlined" with strips of clay.

D. Two-dimensional model. Figure constructed from solid but flattened slabs of clay place horizontally on the work surface.

E. Three-dimensional model. Figure is constructed from solid parts. Figure is held upright by artist or physical support.

F. Three-dimensional model. Figure is freestanding.

Table 14

Frequency of Representational Model by Age Group

	Age		
	4-5 yrs	7-8 yrs	11-12 yrs
Model	Count (%)	Count (%)	Count (%)
A	0 (0)	0 (0)	0 (0)
B	4 (3.33)	9 (7.50)	0 (0)
C	5 (4.17)	2 (1.67)	0 (0)
D	9 (7.50)	4 (3.33)	8 (6.67)
E	15 (12.50)	11 (9.17)	7 (5.83)
F	7 (5.83)	14 (11.67)	25 (20.83)

Note. Model refers to one of the Representational Models including:

A. One-dimensional model; parts of figure are unattached.

B. One-dimensional stick figure. Figure composed of snake-like strips.

C. Two dimensional graphic model. Figure is "outlined" with strips of clay.

D. Two-dimensional model. Figure constructed from solid but flattened slabs of clay place horizontally on the work surface.

E. Three-dimensional model. Figure is constructed from solid parts. Figure is held upright by artist or physical support.

F. Three-dimensional model. Figure is freestanding.

Table 15

Means and Standard Deviations for Figural Differentiation Scores Across Instructional Sets and Media

	Drawings	Sculptures
Set	M (SD)	M (SD)
1	16.00 (5.25)	10.83 (2.14)
2	15.17 (3.31)	10.67 (1.51)
3	16.00 (6.90)	9.83 (2.48)
4	14.83 (6.11)	8.67 (2.07)
Overall	15.50 (5.39)	10.00 (3.58)

Note. Set refers to Instructional Sets including 1 (person), 2 (person wearing a back pack), 3 (person playing catch with a ball), and 4 (parent bending to pick up a child).

Table 16

Frequency of Drawn Figure Style

Style	Count	%
IA	1	4.17
IB	1	4.17
IIA	0	0
IIB	22	91.67

Note. Style refers to Production Style including IA (countered figure missing at least one major part), IB (contoured figure with all major parts), IIA (drawn by addition and missing at least one major part) and IIB (drawn by addition with all major parts).

Table 17

Frequency of Drawn Figure Production Sequence

Sequence	Count	%
Head First	15	62.50
Feet First	5	20.83
Body First	4	16.67
Other	0	0

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Appendix A

General Dimensionality Scale

General Dimensionality Scale (15 Points)
Scoring points for the 3D modeling of the human figure

Position/Posture (1-3 points) Points

Upright intention (figure cannot stand on its own, but figure is presented in an upright manner the researcher) 1

Upright seated 2

Upright, standing with support 2

Upright, freestanding without support 3

Head (1 point)

Rolled like a ball, rounded 1

Facial Features (1-2 points)

Scratched or inscribed features 0

"Line-like" features that are deeply inscribed (>6cm) with identical treatment of features 1

Indentations or protrusions applied uniformly to eyes, nose and mouth 1

When eyes and nose are differentiated (poked out eyes, protruding nose) a full point score is given to each part:
Eyes 1

Nose/Mouth.. 1

Ears (1 point)

Three-dimensionally modeled ears on sides of the head 1

Hair (1 point)

Deliberately folded over the back of the head as well as the top/forehead; pigtails placed on both sides of the head (considering "sides" in terms of "view" rather than graphic convention) 1

Relief type work of hair 1

Hat (1 point)

Shaped three-dimensionally and placed over 3D head/scalp 1

Body (1 point)

Rounded or bulky (>6cm) 1

Belt (1 point)

Provided modeling procedures are used 1

Limbs (4 points)

Arms reaching forward and out into space (e.g., to reach for the child) 1

Hands/fingers protruding, curved, reaching into space 1

Upright standing or held figure with bent legs/torso 1

Feet of upright figure at right angle to legs 1

Feet of lying down figure that protrude upwards, with some modeling of sole of foot 1

Sides Modeled Scale (6 Points)

Sides are scored in terms of "hard" score or "soft" score criteria. They differ in terms of the stringency with which behavioural criteria apply.

A primitive 3D representation that does not privilege any side is scored under "bulky" and receives a score of 0.

Even a nicely modeled stick figure or its equivalent, horizontally placed or standing upright, without facial features that does not single out any side receives a score of 0.

Top (1 point)

Head attached to upright held figure:
If attention is paid to the shoulders and top part of the torso (e.g., smoothing) 1HS

If the head is merely attached to the body while figure is held upright 1SS

If the head is pulled out of the global mass (in analogy to limbs) 1SS

Hat 1HS

Hair:
If the area is singled out as a "side", which is most clearly seen when additional sides are constructed 1HS

If only top side is considered it may qualify as a soft score 1SS

If location seems to be the likely cue 0

Bottom/Underside (1 point)

Legs attached to/pulled out from the underside of the body provided figure is held up during leg attachment can be scored as either hard or soft score. If the behaviour indicates attention to the underside either by looking or intentional manipulation of parts 1HS

Otherwise 1SS

Feet or shoes at right angles to legs 1HS

Long Sides (2 points)

1-2 sides are credited if the limbs are attached or pulled out of an upright standing or held upright and is relatively bulky

If attention is paid to side 1-2HS

If there is merely pulling and not much modeling 1-2SS

Deliberate modeling of sleeves 1-2HS

If limbs are placed in the centre of quite bulky body (sign of intentionality), sides are credited 1-2HS

If braids/ponytails extend distinctly from sides of head 2HS

If a belt surrounds all sides of the figure.. 4HS

Back (1 point)

Turning the figure and attending to the back 1HS

Hair draped over back of the head/shoulders; clothing 1HS

If the figure is bent (curved back) without further modeling of back..... 1SS

Physical support for the figure 1HS

Front (1 point)

Facial features, clothing 1HS

Frontality in bent but faceless figure is credited with a Soft Score
if "bent" indicates directionality 1SS

Additional Markers (4 points)

Inspection of the figure (e.g., turning, rotating, checking sides,
labelling) 1

Clothes that have protrusions or layers that indicate a spatial
dimension 1

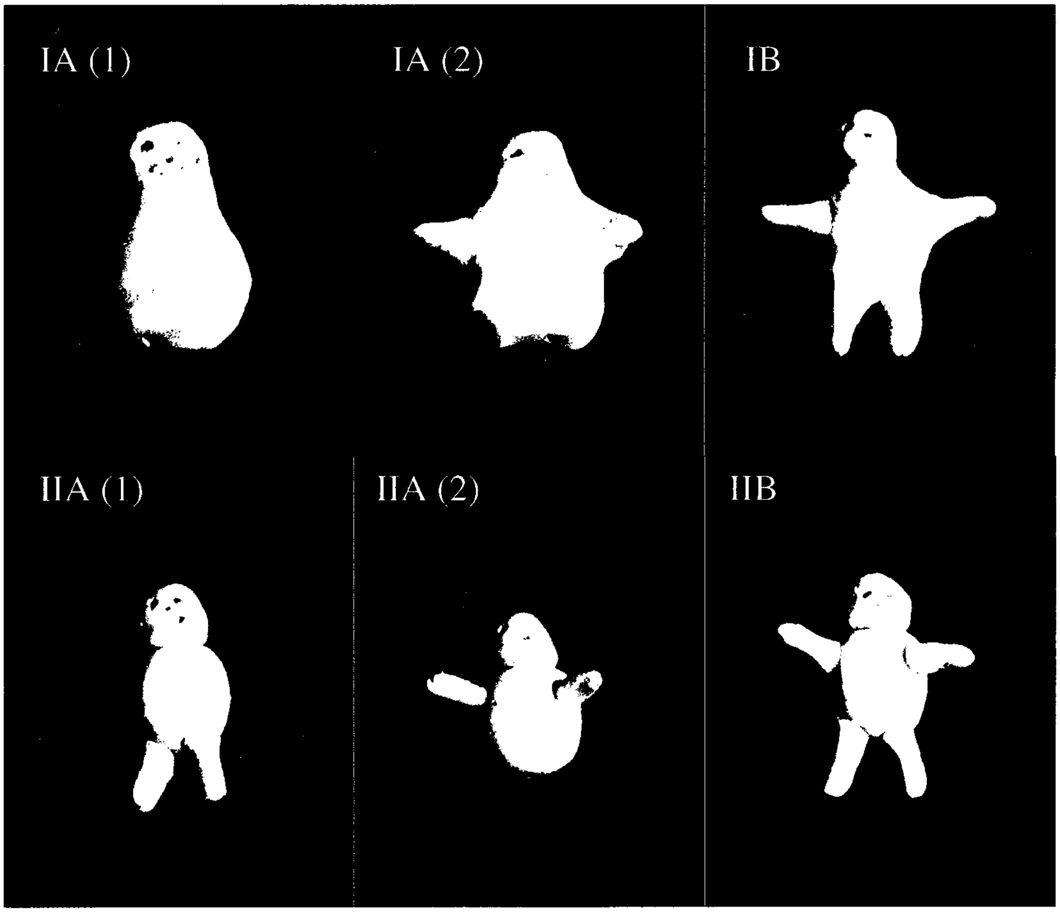
Body insides/enveloped by clothes (>2 sides) 1

Inside (open mouth, tongue) 1

Note. From "Sculpture: The Development of Three-dimensional Representation in Clay", by C. Golomb and M. McCormick, 1995, *Visual Arts Research, 21*, 40. Adapted with permission.

Appendix B

Construction Style for Clay Modeling Tasks

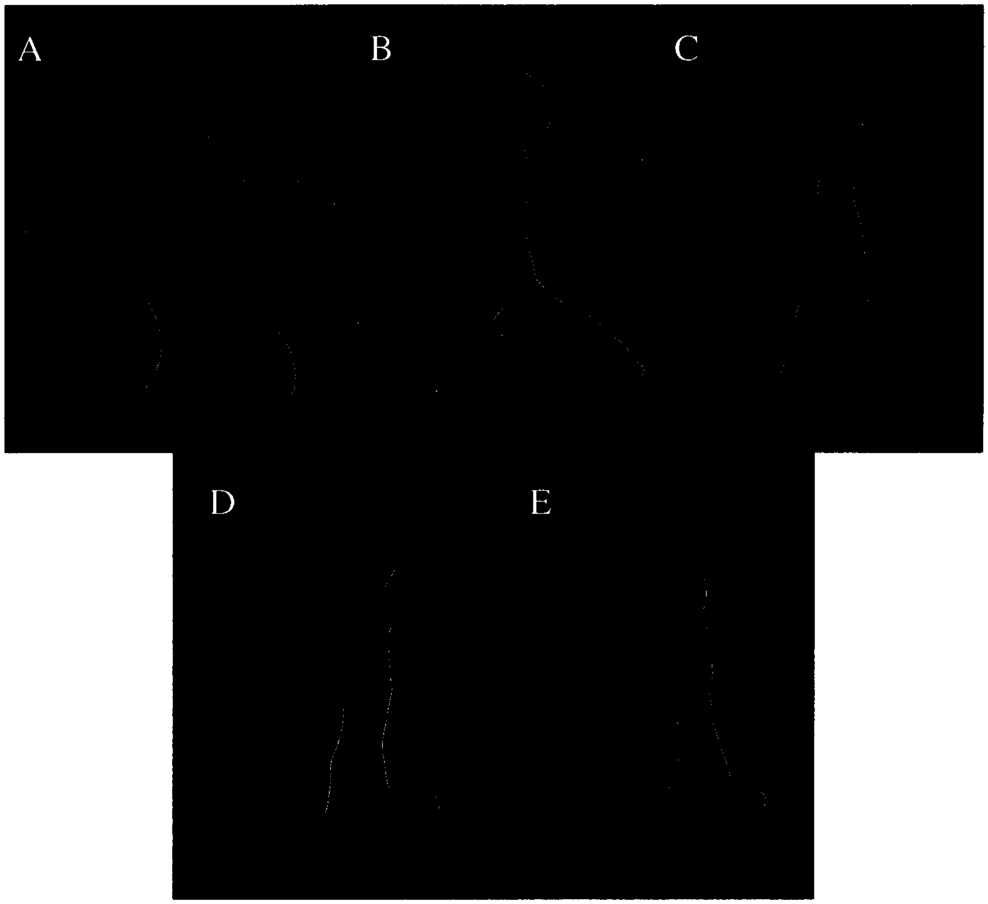


A distinction was made between figures that were constructed using additive procedures (IIA and IIB) and those that were modeled by internal subdivision and subtractive methods (IA and IB). The two levels of differentiation included High and Low. Figures assigned to the High category possessed all of the major structural elements, which included the head, body, arms, and legs (IB and IIB). Those in the Low category were missing one or more of the major structural elements (IA and IIA).

Note. From "Sculpture: The Development of Three-dimensional Representation in Clay", by C. Golomb and M. McCormick, 1995, *Visual Arts Research, 21*, 40. Adapted with permission.

Appendix C

Representational Models for Clay Tasks

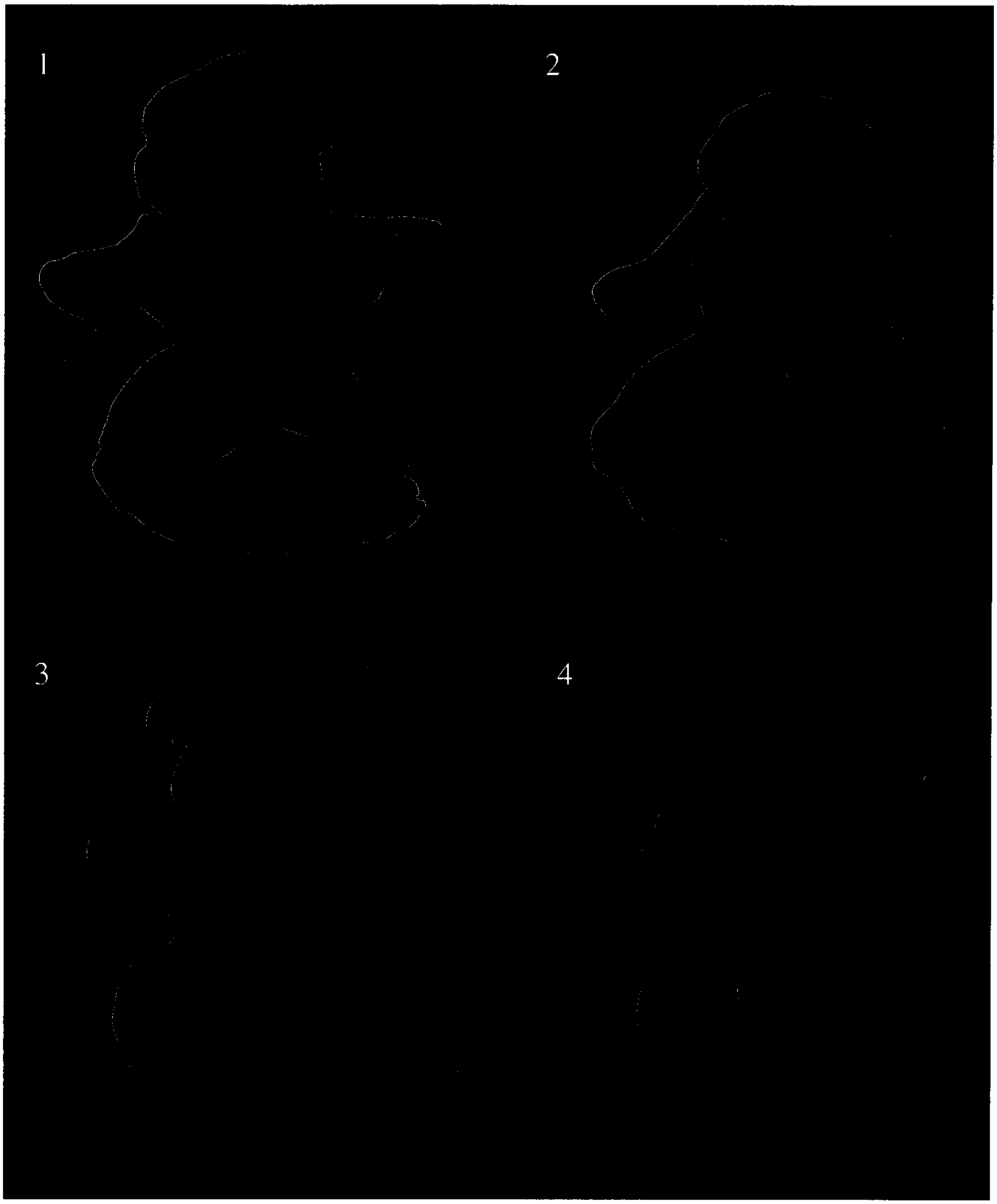


The categories represent various one-, two- or three-dimensional representational models.
A. Rudimentary one-dimensional representation; parts of human are unattached.
B. Stick figure as a one-dimensional model of humans. Figure is composed of one-dimensional snake-like parts.
C. Graphic model. Figure is "outlined" with strips of clay to create a distinctly two-dimensional representation.
D. Two-dimensional model. Figure is constructed from solid but flattened slabs of clay, placed horizontally on the work surface.
E. Three-dimensional model. Figure is constructed from solid parts, most commonly by holding the figure upright during its construction. Upon its completion, the figure is presented in a vertically upright posture, supported by the artist.
F. Three-dimensional model, free standing figure. Same as figure E except for its independently upright stance.

Note. From "Sculpture: The Development of Three-dimensional Representation in Clay", by C. Golomb and M. McCormick, 1995, *Visual Arts Research, 21*, 40. Adapted with permission.

Appendix D

Example of the Scoring Systems Used on Clay Figures for the Four Instructional Sets



Note. Sculptures were produced from the four Instructional Sets including 1 (person), 2 (person wearing a back pack), 3 (person playing catch with a ball), and 4 (parent bending to pick up a child). Sculpture scores follow on proceeding page. Artist was a boy aged 12 years, 5 months.

Dimensionality Score

	TASK 1 (P)	TASK 2 (P/BP)	TASK 3 (P/B)	TASK 4 (P/C)
General Dimensionality Scale				
Position/Posture: 1-3	3	3	3	3
Head: 1	1	1	1	1
Facial Features: 1-2				
Undifferentiated Eyes, Nose, Mouth: 1	1	1	1	1
Differentiated				
Eyes: 1	0	0	0	0
Nose/Mouth: 1	0	0	0	0
Ears: 1	0	0	0	0
Hair: 1	1	0	1	1
Hat: 1	0	1	0	0
Body (bulky): 1	1	1	1	1
Belt: 1	0	1	1	0
Arms, reaching into space: 1	0	0	0	1
Hands/fingers curved, protruding: 1	0	0	0	0
Legs/Torso bent: 1	0	0	0	1
Feet protruding, at right angles to legs: 1	0	1	0	0
Total (/15)	**7**	**9**	**8**	**9**
Additional markers: 4 pts				
Inspection/turning/labelling: 1	1	1	1	1
Clothes (hollows, protrusions): 1	0	1	1	0
Body inside clothes (>2 sides): 1	1	1	0	0
Inside (e.g., mouth, tongue): 1	0	0	0	0
Total (/4)	**2**	**3**	**2**	**1**
Sides Modeled Scale (HS/SS): 6 pts				
Top: 1	1HS	1HS	1HS	1HS
Bottom/underside: 1	1HS	1HS	1HS	1HS
Long Sides: 2	2HS	2HS	2HS	2HS
Back: 1	1HS	1HS	1HS	1HS
Front: 1	1HS	1HS	1HS	1HS
Total HS (/6)	**6**	**6**	**6**	**6**
Total SS (/6)	**0**	**0**	**0**	**0**
Grand Total (/25)	**15**	**18**	**16**	**16**

Figural Differentiation Score

	TASK 1 (P)	TASK 2 (P/BP)	TASK 3 (P/B)	TASK 4 (P/C)
Head	1	1	1	1
Facial Features				
Eyes (pupils, eyebrows +1)	1	1	1	1
Nose (nostrils +1)	0	0	0	0
Mouth (tongue +1)	0	0	0	0
Neck	0	0	0	0
Ears	1	0	0	0
Hair (ribbon, ponytail, hairpin +1)	1	0	1	1
Hat	0	3	0	0
Body (torso)	1	1	1	1
Arms	1	1	1	1
Hands	0	0	0	0
Fingers	0	0	0	0
Legs	1	1	1	1
Feet/Shoes (heels, socks, laces +1)	0	1	1	0
Toes	0	0	0	0
Dress/Skirt/Pants/2 part body	2	1	0	0
Belt	0	1	1	0
Buttons	0	0	0	0
Stripes	0	0	0	0
Tie	0	0	0	0
Book bag/purse	0	2	0	0
Ball	0	0	1	0
Base	1	1	1	1
Child	0	0	0	1
Other	0	0	0	0
Total	**10**	**14**	**10**	**8**

Construction Style

TASK	IA	IB	IIA	IIB
1	☐	☒	☐	☐
2	☐	☒	☐	☐
3	☐	☒	☐	☐
4	☐	☒	☐	☐

Construction Sequence

TASK	A	B	C	D
1	☐	☐	☒	☐
2	☐	☐	☒	☐
3	☐	☐	☒	☐
4	☐	☐	☒	☐

Representational Model

TASK	A	B	C	D	E	F
1	☐	☐	☐	☐	☐	☒
2	☐	☐	☐	☐	☐	☒
3	☐	☐	☐	☐	☐	☒
4	☐	☐	☐	☐	☐	☒