

Development of Infant and Toddler Mark Making and Scribbling

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The development of infant and toddler mark making, scribbling, and drawing was examined in 25 studies including 48 samples of participants. The 25 studies included 1675 infants and toddlers (birth to 42 months of age). A multi-level scale of emergent drawing was used to estimate the average age of acquisition of the different types of drawing landmarks, and comparisons of different characteristics of the types of drawing activities were made to identify the conditions under which early drawing abilities were affected. Results showed that there are discernable age-related changes in infant and toddler mark making and scribbling, and that visual and verbal prompts, collaborative drawing, and the visual consequences associated with drawing acts, facilitated and reinforced infant and toddler emergent drawing behavior. Implications for practice are described.

Most infants at about the time of their first birthdays or shortly thereafter demonstrate the ability to mark on paper with a crayon or other writing instrument (Bayley, 2006; Griffiths & Huntley, 1996; Hresko, Miguel, Sherbenou, & Burton, 1994). During the next several years, infants and toddlers show remarkable progress in their ability to engage in controlled mark making, scribbling, and drawing (e.g., Yamagata, 2001). By three years of age, young children are capable of rudimentary graphic representations of people, objects, and events (Lancaster, 2007).

Yamagata (1997, 2007), Levin and Bus (2003) and others (e.g., Lancaster, 2007; Martlew & Sorsby, 1995) have proposed coding systems for categorizing different types of infant, toddler, and preschooler mark making, scribbling, drawing, and writing. Table 1 shows the major types of drawing that emerge between 1 and 5-6 years of age. The multi-level level sequence is based on the above sources as well as descriptions of the development of drawing and writing found elsewhere in the literature (e.g., Akita, Padakannaya, Prathibha, Panah, & Rao, 2007; Di Leo, 1996; Sheridan, 2005). Figure 1 shows examples of the first eight levels of drawing which were the focus of this research synthesis.

The two-fold purpose of this research synthesis is: (1) describe the developmental progression in the emergence of infant and toddler mark making and scribbling and (2) examine the factors associated with variations in the acquisition of emergent drawing skills. The first purpose was achieved by estimating the ages at which infants and toddlers attain

the different levels outlined in Table 1. The second purpose was achieved by investigating the conditions under which variations in mark making and scribbling were displayed by infants and toddlers.

SEARCH STRATEGY

Studies were identified using *infant* or *toddler* and *scribble** or *draw** or *paint** or *crayon** or *pencil** or *trace** or *tracing* or *paint* and *brush** as search terms. The main search was supplemented by a second search using *mark making* or *mark-making* or *drawing instrument* or *drawing material* or *doodle* and *infant* or *toddler* or *preschool** as search terms.

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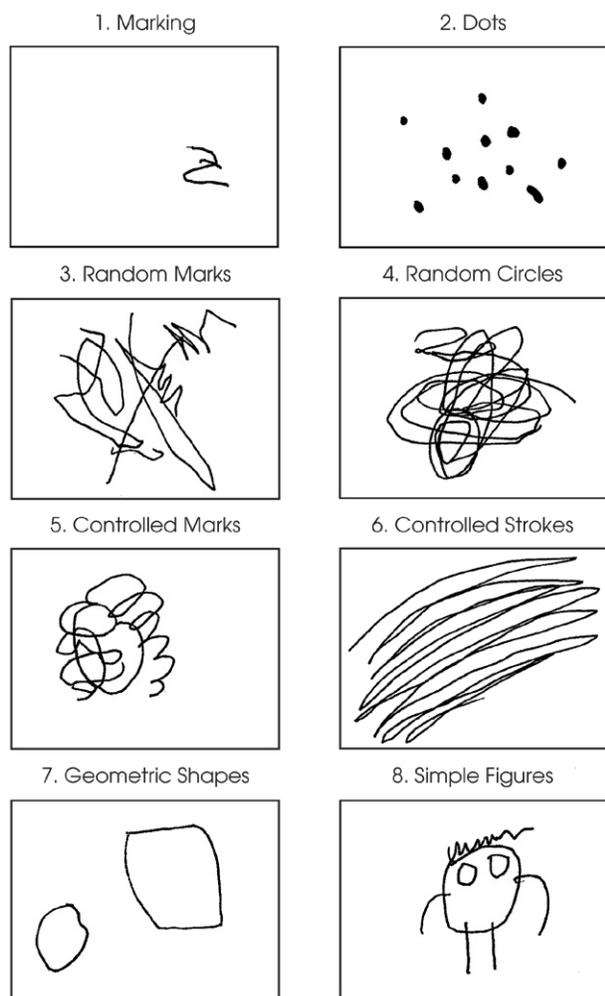


Figure 1. Examples of mark making, scribbling, and drawing at the different levels constituting the focus of the research synthesis.

Psychological Abstracts (PsycInfo), Educational Resource Center (ERIC), MEDLINE, and Academic Search Premier were searched for studies. These were supplemented by a Google Scholar search and a search of an Endnote Library maintained by the Puckett Institute. Hand searches were conducted of the reference sections of all papers, studies, and other relevant sources found through the searches to be sure no studies were missed.

Studies were included if they were investigations of the emergence and development of infant or toddler mark making or scribbling, or a specific type of drawing behavior or skill. Studies were excluded if the ages at which different types of mark making and scribbling were not reported or could not be determined or we were not able to compare and contrast the influences of different person and environmental factors on infant and toddler mark making and scribbling.

Inasmuch as the focus of this research synthesis was the emergence of infant and toddler marking, scribbling, and

drawing, the largest number of study participants in any one study needed to be less than 36 months of age to be included in the synthesis. A separate research synthesis of preschoolers' writing will include studies of children 36 to 72 months of age.

SEARCH RESULTS

Twenty two reports were located that included information on 38 samples of children who differed either by age or drawing task. Three additional sources of normative data were used to ascertain the development of the ability to mark, scribble, and draw using some type of writing instrument (Bayley, 2006; Griffiths & Huntley, 1996; Hresko et al., 1994). These sources included 10 samples of children.

Table 2 includes selected characteristics of the study participants. The total number of study participants was 1675. The ages of the infants and toddlers ranged between birth and 42 months with the majority of the children being 16 to 36 months of age. Six samples included infants (9 to 16 months of age), 38 samples included toddlers (17 to 36 months in age), and four studies included both infants and toddlers or were longitudinal studies of infants followed until they were 24 to 36 months of age. In the studies reporting gender, half of the children were males ($N = 670$) and half females ($N = 673$).

The types of writing activities, writing instruments, and characteristics of the mark making and scribbling activities in the different studies are shown in Tables 3 and 4. The writing activities included both unstructured tasks ($N = 25$) where the children were provided a writing instrument and writing surface without any guidance, and structured tasks ($N = 20$) where some type of instruction or guidance was used to promote child engagement in drawing. A combination of standard and primary (large or jumbo) writing instruments were used with the different samples of study participants. The writing instruments included crayons ($N = 20$), colored and lead pencils ($N = 17$), magic markers, pens, or felt tip pens ($N = 13$), and digitized computer pens ($N = 3$). Two samples of children were provided nonfunctional pencils to evaluate the influence of lack of marking or scribbling on drawing behavior. The primary writing surface was either white or colored paper ($N = 38$). Eight of these surfaces had preprinted shapes, geometric forms, or pictures on the writing surface to evaluate the elicitation function of these prompts. Three studies used computer screens as writing surfaces.

Six characteristics of the writing activities were coded for the synthesis. The effects of either or both verbal and visual prompts were one characteristic. Verbal prompts ($N = 31$) included either adult guidance or suggestions when the children were writing or *a priori* instructions to engage the children in a specific type of writing (Table 4). Visual prompts ($N = 17$) included either visual models (e.g., pictures of faces or geometric forms) that the children were asked to draw or

preprinted geometric forms, figures, or shapes on the writing surface that the children wrote on.

Eleven studies included adult modeling of the particular type of drawing the children were asked to produce. The writing activities for seven samples involved collaborative drawing between the study participants and either adults or other children. In those studies where adults were collaborative partners, they provide physical as well as verbal guidance to assist children to mark or scribble.

The number of opportunities to mark or scribble varied from only a few times on a single occasion to multiple times per day over extended periods of time. The length of any one writing episode ranged from less than one minute to as many as 20 minutes (per episode).

The focus of analysis in most of the studies, and a primary emphasis in this research synthesis, was the extent to which the production of a mark or scribble functioned as a reinforcement sustaining child engagement in the drawing activity. According to Bereft (1987) and Yamagata (1997), the act of marking and scribbling, and the visual effect produced by the act, is a natural reinforcement evoking and sustaining drawing behavior.

SYNTHESIS FINDINGS

The participants in all the studies and samples demonstrated the ability to mark or scribble when the writing act resulted in a discernable visual effect on a writing surface. In the two studies where the writing instrument was designed not to produce a graphic effect, both the quantity and quality of the children's marking and scribbling were markedly attenuated (Bereft, 1987; Gibson & Yonas, 1967). In all other studies, the more easily a writing instrument produced a visual effect, the larger the quantity and the better the quality of the mark making and scribbling.

Table 5 shows those studies where the type of drawing and the estimated age of demonstrating the different types of marking and scribbling could be determined. Estimated ages could be determined for 1016 infants and toddlers. In those studies where age related changes were reported, there were statistically significant increases in the level and complexity of drawing between 1 and 3 years of age (Adi-Japha, Levin, & Solomon, 1998; Levin & Bus, 2003; Yamagata, 2001). The interested reader is referred to Cox and Parkin (1986) for illustrations of the monthly or every other month changes in six children's transition from scribbling to representational drawing.

The information in Table 5 was used to determine, for the different levels of mark making, scribbling, and drawing shown in Table 1, the estimated average age at which infants and toddlers demonstrate the different types of drawing. (Too few Type 2 mark making examples were available to assign estimated ages.) The results are shown in Figure 2. What are shown are the estimated mean ages of acquisition of the

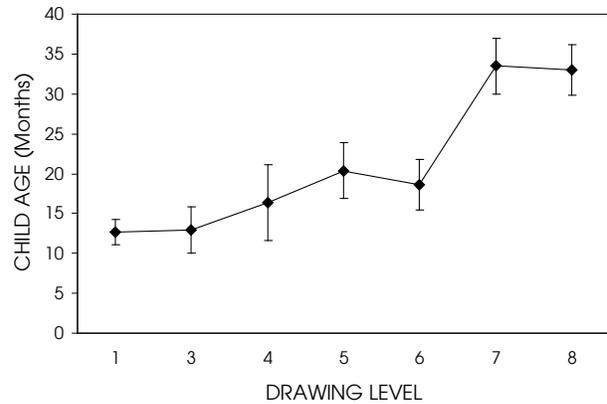


Figure 2. Average ages (and standard deviations) for depicting the pattern of acquisition of different types of mark making, scribbling, and drawing (see Table 1).

different levels of drawing and the standard deviations for these ages. Several things can be discerned from the results.

First, there were discernable age-related changes in the development of the different types of mark making and scribbling. A 7 Between Level of Drawing ANOVA produced a significant age effect, $F(6, 985) = 703.62, p < .0001$. A test for a linear trend (increase) in the age of acquisition of the different levels of drawing was also significant, $F(1, 990) = 864.18, p < .0001$. The Cohen's d effect size for the linear trend was 1.87. These three sets of results indicate that infant and toddler early drawing skills develop in a manner consistent with descriptions in the literature (e.g., Levin & Bus, 2003; Yamagata, 2007).

Second, Level 1 to Level 6 infant mark making and toddler scribbling occurs incrementally between 12 and 18 months of age followed by a delay in the development of representational drawing. The gap between the two types of drawing corresponds to the transition between the sensorimotor and pre-operational periods of development (Fischer, 1980).

Third, the standard deviations for the estimated average age of acquisition of the different types of drawing are very much alike. This indicates that variations in the age of acquisition of mark making and scribbling follow a relatively similar pattern of development. Infants and toddlers therefore can be expected to differ in terms of when they demonstrate early drawing behavior but nonetheless develop mark making and scribbling in a similar manner.

The extent to which mark making and scribbling differed as a function of contrasting drawing conditions was examined in 10 studies. The same study participants were either observed under different conditions (e.g., structured vs. unstructured drawing tasks) or different samples of children were compared to each other to evaluate the effects of contrasting drawing opportunities. Cohen's d effect sizes for the between condition differences were used to identify which characteristics of the drawing activities were associated with

differences on the dependent measures.

The comparisons that could be made, the dependent measures that were the focus of analysis, and the Cohen's *d* effect sizes (ES) for the between contrasting condition differences are shown in Table 6. In those cases where the same comparisons were made in different studies or with different samples of participants, average effect sizes were calculated and used as the best estimate of size of effect of the characteristics constituting the focus of analysis.

Several things can be gleaned from the effect size differences as well as the descriptive findings in other studies. First, the use of a writing instrument that produced a visual effect of any kind (compared to nonfunctional writing instrument) resulted in more complex and longer durations of drawing (ES > 2.50). Second, drawing surfaces of any kind that had some type of image or figure as a background (compared to blank pages or surfaces) elicited more frequent and complex drawing (ES = 1.81). Third, the particular backgrounds that elicited the most frequent and the most complex drawings were ones of human figures or faces, or pictures of animals (ES = .46).

Several other notable patterns of results could be detected. Slanted writing surfaces made it easier for the children to engage in drawing when using crayons or magic marker (ES = .34) but not pencils (ES = .08). Crayons and magic markers (as well as digitized pens) were also associated with more complex and mature drawing compared to the use of pencils (ES = 1.32). Contrary to common wisdom, standard size crayons and magic markers were associated with more complex and mature drawing compared to primary writing instruments (ES = .34).

The influences of structured and unstructured drawing activities varied depending on the child behavior that was the focus of analysis. Structured activities were more likely to elicit child imitations of an adult's drawing or drawing in response to an adult's request (ES = .26). The proportion of time a child stayed engaged in a drawing activity was also greater in structured compared to unstructured activities (ES = 1.21). In contrast, unstructured activities were more likely to be associated with child-initiated drawing (ES = .65) and longer durations of collaborative drawing episodes with an adult (ES = .62).

Collaborative drawing between a child and adult was not only associated with more complex drawing, but the roles of the child and adult in the drawing episodes showed a shift in *balance of power* between the child and adult in a manner consistent with Bronfenbrenner's (1979) descriptions of this developmental phenomenon. In those studies where both child and adult behavior was investigated, adults played a more active role engaging younger children in drawing activities, but as the children became more capable of mark making or scribbling, the adults "backed off" and let the children initiate collaborative drawing episodes. This was demonstrated quite nicely by Yamagata (1997) in a

study of two infants followed longitudinally between 12 and 30 months of age. The patterns of child and adult initiated drawing episodes in this study are shown in Figure 3. The shift in balance of power is clearly apparent in the patterns of child and adult behavior.

Finally, the more often a child was provided the opportunity to mark or scribble, the more a child engaged in drawing and the more complex was the child's drawing behavior. This was found in those studies where participants were provided considerable time within any one drawing episode and where drawing episodes occurred frequently over time (Cox & Parkin, 1986; Readdick, 1994; Yamagata, 1988, 1997).

DISCUSSION

Findings showed that the development of infant and toddler mark making and scribbling emerged in a predictable sequence, and that the transition from simple mark making to line drawings and pre-representational drawing occurs between 12-14 and 15-24 months of age. Findings also showed the conditions under which mark making and scribbling were prompted, facilitated, and reinforced. The more pronounced the visual effect produced by a writing instrument, the larger the quantity and the more advanced the pre-drawing behavior. Drawing surfaces that had images of persons or animals printed or drawn on them elicited more mark making and scribbling compared to blank pages. Collaborative drawing activities were associated with more child engagement in mark making and drawing, and more complex pre-drawing behavior. Furthermore, the more drawing opportunities study participants were afforded, the more the children marked and scribbled, and the faster the children made a transition to higher level pre-representational drawing.

Several other findings also highlight the conditions that are associated with the quantity and quality of mark making

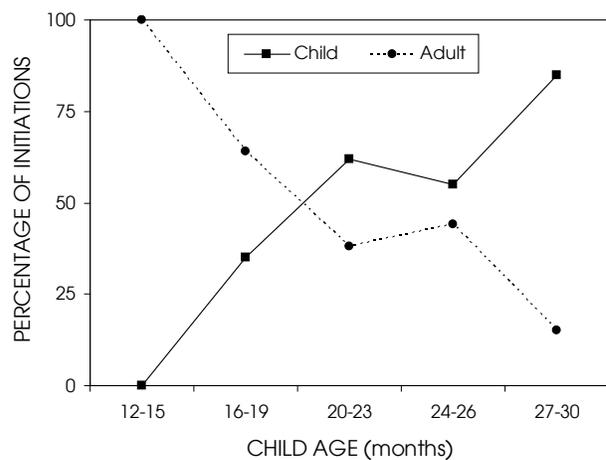


Figure 3. Percentage of drawing activity initiations (suggestions) made by two children and mothers at different ages. (Adapted from Yamagata [1997] with permission.)

and scribbling. Drawing on a slanted surface rather than a flat surface made it easier for infants and toddlers to mark or scribble. Magic markers and crayons proved the best writing instruments for encouraging and supporting infant and toddler pre-drawing. Collaborative drawing activities evoked infant and toddler mark making and scribbling, where adults who provided assistance as needed, reinforced child engagement in pre-drawing.

The implications of this research synthesis for intervention are straight forward. Engaging infants and toddlers in mark making and scribbling is most likely to occur when nontoxic crayons or magic markers are used as writing instruments; writing surfaces have background pictures or images of people or animals; and collaborative drawing is used as the context for mark making and scribbling. These kinds of activities are most likely to be effective when a child shows interest in drawing and the mark making and scribbling opportunities occur frequently enough to reinforce previous behavior and result in drawing artifacts that function as reinforcers sustaining child engagement in the activities.

REFERENCES

- Adi-Japha, E., Levin, I., & Solomon, S. (1998). Emergence of representation in drawing: The relation between kinematic and referential aspects. *Cognitive Development, 13*, 25-51.
- Akita, K., Padakannaya, P., Prathibha, B., Panah, M. A., & Rao, C. (2007). Drawing and emergent writing in young children. *Psychological Studies, 52*, 216-222.
- Bayley, N. (2006). *Bayley Scales of Infant and Toddler Development* (3rd ed.). San Antonio, TX: Psychological Corporation.
- Berefelt, G. (1987). Sex differences in scribbles of toddlers: Graphic activity of 18-month-old children. *Scandinavian Journal of Educational Research, 31*(1), 23-30.
- Braswell, G. S. (2001). Collaborative drawing during early mother-child interactions. *Visual Arts Research, 27*, 27-39.
- Braswell, G. S., & Rosengren, K. S. (2005). Children and mothers drawing together: Encountering graphic conventions during social interactions. *British Journal of Developmental Psychology, 23*, 299-315.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Cox, M. V., & Parkin, C. E. (1986). Young children's human figure drawing: Cross-sectional and longitudinal studies. *Educational Psychology, 6*, 353-368.
- Di Leo, J. H. (1996). *Young children and their drawings*. Philadelphia, PA: Brunner/Mazel.
- Fischer, K. W. (1980). A theory of cognitive development: The control and construction of hierarchies of skills. *Psychological Review, 87*, 477-531.
- Gibson, J. J., & Yonas, P. (1967, September). *The development of graphic activity in the child: A theory and a first experiment* (BR-5-1213-1). Ithaca, NY: Cornell University. (ERIC Document Reproduction Service No. ED013717).
- Griffiths, R., & Huntley, M. (1996). *Griffiths Mental Development Scales-Revised: Birth to 2 years*. Oxford, UK: Hogrefe.
- Hresko, W., Miguel, S., Sherbenou, R., & Burton, S. (1994). *Developmental Observation Checklist System: A systems approach to assessing very young children: Examiner's manual*. Austin, TX: Pro-Ed.
- Lancaster, L. (2007). Representing the ways of the world: How children under three start to use syntax in graphic signs. *Journal of Early Childhood Literacy, 7*, 123-154.
- Levin, I., & Bus, A. G. (2003). How is emergent writing based on drawing? Analyses of children's products and their sorting by children and mothers. *Developmental Psychology, 39*, 891-905.
- Martlew, M., & Sorsby, A. (1995). The precursors of writing: Graphic representation in preschool children. *Learning and Instruction, 5*, 1-19.
- Matthews, J., & Jessel, J. (1993). Very young children use electronic paint: A study of the beginnings of drawing with traditional media and computer paintbox. *Visual Arts Research, 19*(1), 47-62.
- Readdick, C. A. (1989). *A descriptive study of toddlers and preschoolers drawing with primary and standard markers, pencils and crayons*. Tallahassee, FL: Florida State University. (ERIC Document Reproduction Service No. ED325240).
- Readdick, C. A. (1994). Toddlers and preschoolers drawing with primary and standard markers, pencils, and crayons. *Journal of Research in Childhood Education, 9*, 68-74.
- Rosenbloom, L., & Horton, M. E. (1971). The maturation of fine prehension in young children. *Developmental Medicine and Child Neurology, 13*, 3-8.
- Saida, Y., & Miyashita, M. (1979). Development of fine motor skill in children: Manipulation of a pencil in young children aged 2 to 6 years old. *Journal of Human Movement Studies, 5*, 104-113.
- Sheridan, S. R. (2005). A theory of marks and mind: The effect of notational systems on hominid brain evolution and child development with an emphasis on exchanges between mothers and children. *Medical Hypotheses, 64*, 417-427.
- Tseng, M. H. (1998). Development of pencil grip position in preschool children. *Occupational Therapy Journal of Research, 18*, 207-224.
- Yakimishyn, J. E., & Magill-Evans, J. (2002). Comparisons among tools, surface orientation, and pencil grasp for children 23 months of age. *American Journal of Occupational Therapy, 56*, 564-572.
- Yamagata, K. (1988). Representational activity in a scrib-

- bling stage of drawing. *Japanese Journal of Educational Psychology*, 36, 201-209.
- Yamagata, K. (1991). A study of scribbles on picture books by 1- and 2-year-old children. *Japanese Journal of Educational Psychology*, 39, 102-110.
- Yamagata, K. (1993). The development of representational activity on drawing by 1- and 2-year-old children. *Advances in Japanese Cognitive Science*, 6, 119-141.
- Yamagata, K. (1997). Representational activity during mother-child interaction: The scribbling stage of drawing. *British Journal of Developmental Psychology*, 15, 355-366.
- Yamagata, K. (2001). Emergence of representational activity during the early drawing stage: Process analysis. *Japanese Psychological Research*, 43(3), 130-140.
- Yamagata, K. (2007). Differential emergence of representational systems: Drawings, letters, and numerals. *Cognitive Development*, 22, 244-257.
- Yamagata, K., & Shimizu, M. (1997). Development of constructive activity in early drawing. *Japanese Journal of Educational Psychology*, 45, 22-30.

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Table 1
Descriptions of Different Types of Mark Making, Scribbling, Drawing, and Writing

Type	Level	Description
Marks	1	Marks on a piece of paper or other writing surface
	2	Makes discernable dots
Scribbling	3	Random mark making without discernable form
	4	Random circular mark making
	5	Controlled mark making
Line Drawing	6	Controlled strokes and straight lines (vertical, horizontal, zig-zags, etc.)
	7	Geometric shapes (circles, squares, ovals, etc.)
Representational Drawing	8	Draws figures of objects or people with discernable features
	9	Invented drawing
	10	Conventional drawing (pictures, faces, etc.)
Symbolic	11	Conventional symbols/letters
	12	Invented spelling
	13	Conventional name writing/spelling

Table 2
Characteristics of the Study Participants

Study	Number	Age (Months)	Gender		Participants
			Male	Female	
Adi-Japha et al. (1998) (Study 1)	6	30–35	3	3	Toddlers
Adi-Japha et al. (1998) (Study 2, Group 1)	28	27–36	12	16	Toddlers
Adi-Japha et al. (1998) (Study 2, Group 2)	20	25–36	9	11	Toddlers
Bayley (2006) (Samples 1 & 2)	100	11–13	50	50	Infants
Bayley (2006) (Samples 3)	100	16	50	50	Infants
Berefelt (1987) (Study 1)	100	18	50	50	Toddlers
Berefelt (1987) (Study 2, Group 1)	64	18	31	33	Toddlers
Berefelt (1987) (Study 2, Group 2)	64	18	34	30	Toddlers
Braswell (2001) Braswell & Rosengren (2005) (Task 1)	16	16–20	8	8	Toddlers
Braswell (2001) Braswell & Rosengren (2005) (Task 2)	16	29–33	7	9	Toddlers
Cox & Parkin (1986) (Study 1)	27	24–41	NR ^a	NR	Toddlers
Cox & Parkin (1986) (Study 2)	6	31–33	4	2	Toddlers
Gibson & Yonas (1967)	14	15–38	NR	NR	Toddlers
Griffiths & Huntley (1996) (Sample 1)	57	11–12	NR	NR	Infants
Griffiths & Huntley (1996) (Sample 2)	67	15–16	NR	NR	Infants
Griffiths & Huntley (1996) (Sample 3)	73	19–20	NR	NR	Toddlers
Griffiths & Huntley (1996) (Sample 4)	59	23–24	NR	NR	Toddlers
Hresko et al. (1994) (Sample 1)	128	0–12	63	65	Infants
Hresko et al. (1994) (Sample 2)	151	13–24	74	77	Infants & Toddlers
Hresko et al. (1994) (Sample 3)	173	25–36	85	88	Toddlers
Lancaster (2007) (Child 1)	1	32	0	1	Toddlers
Lancaster (2007) (Child 2)	1	30	1	0	Toddlers
Levin & Bus (2003) (Group 1, Israeli)	16	28–36	8	8	Toddlers
Levin & Bus (2003) (Group 1, Dutch)	16	28–36	8	8	Toddlers
Matthews & Jessel (1993) (Group 1)	3	22–27	1	2	Toddlers
Readdick (1989, 1994) (Group 1)	6	24–31	NR	NR	Toddlers
Rosenbloom & Horton (1971) (Group 1)	28	18–42	NR	NR	Toddlers
Saida & Miyashita (1979)	33	27–36	13	20	Toddlers
Tseng (1998) (Group 1)	33	30–35	19	14	Toddlers
Yakimishyn & Magill-Evans (2002)	51	23–24	29	22	Toddlers
Yamagata (1988)	1	0–36 (longitudinal)	0	1	Infant to Toddler
Yamagata (1991)	17	12–24	9	6	Infants & Toddlers
Yamagata (1997)	2	12–30 (longitudinal)	1	1	Infant to Toddler
Yamagata (2001) (Group 1, Task 1)	10	18–23	7	3	Toddlers
Yamagata (2001) (Group 1, Task 2)	6	18–23	3	3	Toddlers
Yamagata (2001) (Group 2, Task 1)	12	24–29	6	6	Toddlers
Yamagata (2001) (Group 2, Task 2)	11	24–29	6	5	Toddlers
Yamagata (2001) (Group 3, Task 1)	12	30–35	4	8	Toddlers
Yamagata (2001) (Group 3, Task 2)	15	30–35	7	8	Toddlers
Yamagata (2007) (Group 1)	9	22	5	4	Toddlers
Yamagata (2007) (Group 2)	15	27	11	4	Toddlers
Yamagata (2007) (Group 3)	14	32	8	6	Toddlers
Yamagata (2007) (Group 4)	14	38	6	8	Toddlers
Yamagata & Shimizu (1997) (Group 1)	14	18	4	10	Toddlers
Yamagata & Shimizu (1997) (Group 2)	21	24	8	13	Toddlers
Yamagata & Shimizu (1997) (Group 3)	26	30	16	10	Toddlers
Yamagata & Shimizu (1997) (Group 4)	19	36	9	10	Toddlers

^a Not reported.

Table 3
Types of Marking and Scribbling Activities, Writing Instruments, and Child Behavior

Study	Type of Activity	Type of Instrument	Type of Surface	Child Behavior
Adi-Japha et al. (1998) (Study 1)	Free drawing task	Computer stylus pen	Paper on digitized tray Computer screen	Child allowed to produce multiple scribbles without instructions
Adi-Japha et al. (1998) (Study 2, Group 1)	Free drawing task	Computer stylus pen	Paper on digitized tray Computer screen	Child allowed to draw without instructions Questioned about completed drawing
Adi-Japha et al. (1998) (Study 2, Group 2)	Free drawing task	Standard pencil	White (?) Paper	Child allowed to draw without instructions Questioned about completed drawing
Bayley (2006) (Samples 1 & 2)	Free drawing task	Crayon	White paper	Child allowed to draw without instructions
Bayley (2006) (Sample 3)	Structured drawing task	Crayon	White paper	Child asked to imitate stroke
Berefelt (1987) (Study 1)	Free drawing task	Pencil	Sheet of paper with preprinted circle in the middle	Child allowed to draw without instructions
Berefelt (1987) (Study 2, Group 1)	Free drawing task	Non-functioning pencil	Double sheets of paper with carbon paper in between	Child allowed to scribble with no observable results
Berefelt (1987) (Study 2, Group 2)	Free drawing task	Pen	White (?) Paper	Child allowed to scribble with observable results
Braswell (2001) Braswell & Rosengren (2005) (Task 1)	Free drawing task	Colored markers	White paper	Child allowed to draw for allotted time with mother's prompting and help
Braswell (2001) Braswell & Rosengren (2005) (Task 2)	Structured copying task	Crayons	White paper	Child draws two or more shapes with mother's prompting
Cox & Parkin (1986) (Study 1, Task 1)	Structured drawing task	Crayon	White paper	Child asked to draw a person
Cox & Parkin (1986) (Study 1, Task 2)	Structured drawing task	Crayon	White paper	Child asked to copy a picture of a person
Cox & Parkin (1986) (Study 1, Task 4)	Structured drawing task	Crayon	White paper	Child prompted to draw a person with body parts dictated
Cox & Parkin (1986) (Study 2)	Structured drawing task	Crayon	White paper	Child asked to draw a person
Gibson & Yonas (1967) (Task 1)	Free drawing task (Younger participants were provided a brief demonstration)	Primary pencil	Double sheets of white paper with embedded ink mounted on a masonite board	Child allowed to draw until finished, asked for another paper or stopped scribbling
Gibson & Yonas (1967) (Task 2)	Free drawing task (Younger participants were provided a brief demonstration)	Non-tracing tool (wooden dowel made to look exactly like a pencil)	Double sheets of white paper with embedded ink mounted on a masonite board	Child allowed to draw until finished, asked for another paper or stopped scribbling
Griffiths & Huntley (1996) (Sample 1 & 2)	Free drawing task	Pencil	White paper	Child allowed to draw without instructions
Griffiths & Huntley (1996) (Sample 3)	Structured drawing task	Pencil	White paper	Child asked to imitate scribbling
Griffiths & Huntley (1996) (Sample 4)	Free drawing task	Pencil	White paper	Child allowed to draw without instructions
Hresko et al. (1994) (Sample 1)	Free drawing task	Crayon Pencil	White paper	Child allowed to draw without instructions
Hresko et al. (1994) (Sample 2)	Structured drawing task	Crayon Pencil	White paper	Child asked to imitate scribbling

Table 3, continued

Study	Type of Activity	Type of Instrument	Type of Surface	Child Behavior
Hresko et al. (1994) (Sample 3)	Structured drawing task	Crayon Pencil	White paper	Child asked to imitate vertical line
Lancaster (2007) (Child 1)	Free drawing task	Felt-tipped pen	Pink paper	Child draws pictures with mother sitting with her discussing or suggesting what's being drawn
Lancaster (2007) (Child 2)	Free drawing task	Pen	Orange paper	Child draws pictures with father sitting with him discussing or suggesting what's being drawn
Levin & Bus (2003) (Task 1)	Free drawing task	Colored felt-tipped pens	Not reported	Child allowed to draw without instructions
Levin & Bus (2003) (Task 2)	Structured drawing task	Colored felt-tipped pens	Not reported	Child instructed to draw eight referents: grass, sun, mother, baby, flower, three flowers, father, bird
Levin & Bus (2003) (Task 3)	Structured writing task	Colored felt-tipped pens	Not reported	Child instructed to write his/her name and the eight referents.
Matthews & Jessel (1993) (Task 1)	Free drawing task	Pencils Colored felt-tipped pens Crayons	White (?) paper	Child allowed to draw without instructions
Matthews & Jessel (1993) (Task 2)	Free drawing task	Computer mouse	Computer paintbox	Children allowed to discover how the paintbox worked
Readdick (1989, 1994) (Task 1)	Free drawing task	Standard and primary sizes of color markers, pencils, and crayons	Manila paper	Child allowed to draw without instructions when presented with two baskets, one with primary size and one with standard size drawing tools
Readdick (1989, 1994) (Task 2)	Structured drawing task	Standard and primary size marker	Test booklet for the Riley Preschool Developmental Screening Inventory	Child asked to copy geometric forms and draw a girl or boy
Rosenbloom & Horton (1971) (Task 1)	Free drawing task	Primary crayon (Pencil for older children)	Manila (?) construction paper	Child encouraged to draw a picture
Rosenbloom & Horton (1971) (Task 2)	Structured writing task	Primary crayon (Pencil for older children)	Manila (?) construction paper	Child asked to write his/her name or draw eyes (small circles) in a face
Saida & Miyashita (1979)	Structured writing task	Colored pencils	Paper with printed shapes	Child asked to write his/her name and then to trace the shape on the paper
Tseng (1998)	Structured drawing task	Standard pencil	Grid paper	Child asked to draw geometric figures like circle, square etc.
Yakimishyn & Magill-Evans (2002)	Free drawing task	Primary marker Colored pencil Small piece of regular-sized crayon	White paper taped to horizontal table top and table top easel at 75° angle	Each child drew on both table tops with each writing tool.
Yamagata (1988)	Unstructured drawing task	Not reported	Not reported	Child drew with mother or others
Yamagata (1991)	Structured drawing task	Not reported	Picture book	Child drew on picture stimuli of a person, animal and vehicle
Yamagata (1997)	Unstructured mother-child drawing activities	Crayons Colored pencils	White paper	Child-mother dyads participated in different drawing activities over several months
Yamagata (2001) (Task 1)	Structured coloring task	Crayons	Paper with pictures drawn on them	Child asked to color picture of mother's face, father's face, police car, generic car, rabbit and cat.

Table 3, continued

Study	Type of Activity	Type of Instrument	Type of Surface	Child Behavior
Yamagata (2001) (Task 2)	Structured drawing task	Crayons	Paper with outline of shapes	Child given paper, one after the other, with an outline of a circle to draw the 2 human or 2 animal faces and the outline of a car to draw the 2 different cars
Yamagata (2007)	Structured drawing and writing task	Crayons	White (?) paper	Children were asked to draw a human figure (drawing task) and then to write their name in hiragana letters and produce the numeral one
Yamagata & Shimizu (1997) (Task 1)	Unstructured drawing task	Not reported	Paper without contours	Children drew without a contour
Yamagata & Shimizu (1997) (Task 2)	Structured drawing task	Not reported	Paper with facial contour with human theme (mother) and animal theme (rabbit)	Children drew with contours on the paper

Table 4
Characteristics of the Mark Making and Scribbling Activities

Study	Types of Prompt		Adult Behavior		Number of Opportunities/ Allotted Time	Reinforcement
	Verbal Prompt	Visual Prompt	Modeling	Joint Activity (Collaborative Drawing)		
Adi-Japha et al. (1998) (Study 1)	None	None	Child shown how to use the stylus	No	As many as the child requested, up to about 15 minutes	Marks on paper and computer screen
Adi-Japha et al. (1998) (Study 2, Group 1)	Child told to request another sheet of paper upon finishing a drawing	None	Child shown how to use the stylus	No	1–8 drawings each. Completed when child wanted to stop or after 20 minutes	Marks on paper and computer screen
Adi-Japha et al. (1998) (Study 2, Group 2)	Child told to request another sheet of paper upon finishing a drawing	None	No	No	1–8 drawings each. Completed when child wanted to stop or after 20 minutes	Marks on paper
Bayley (2006) (Sample 1)	None	None	No	No	1	Marks on paper
Bayley (2006) (Sample 2)	None	Yes	Yes	No	1	Marks on paper
Bayley (2006) (Sample 3)	None	None	No	No	1	Marks on paper
Berefelt (1987) (Study 1)	Children asked if they'd like to draw something	Circle on the middle of the paper	No	No	Not reported	Marks on paper
Berefelt (1987) (Study 2, Group 1)	Not reported	None	No	No	Not reported	None
Berefelt (1987) (Study 2, Group 2)	Not reported	None	No	No	Not reported	Marks on paper
Braswell (2001) Braswell & Rosengren (2005) (Task 1)	Mother could make suggestions about what to draw	None	Mother could help child if she wanted to or felt help was necessary	Yes	6 minutes (18 month olds) 8 minutes (30 month olds)	Marks on paper and mother's praise
Braswell (2001) Braswell & Rosengren (2005) (Task 2)	Mother requested to get child to draw at least 2 shapes, more if possible	Laminated stimulus sheet with various shapes on it	Mother could help child if she wanted to or felt help was necessary	Yes	6 minutes (18 month olds) 8 minutes (30 month olds)	Marks on paper and mother's praise
Cox & Parkin (1986) (Study 1, Task 1)	Child asked to draw a person	None	No	No	1	Marks on paper
Cox & Parkin (1986) (Study 1, Task 2)	Child asked to draw a person like a pre-drawn sample	Yes	No	No	1	Marks on paper
Cox & Parkin (1986) (Study 1, Task 4)	Child asked to draw a person when prompted with body parts	None	No	No	1	Marks on paper
Cox & Parkin (1986) (Study 2)	Child asked to draw a person	None	No	No	6 times over one year	Marks on paper
Gibson & Yonas (1967) (Task 1)	Child told it was a very nice pencil but received no other instruction	None	Some younger children needed a short demonstration of scribbling	No	Not reported	Marks on paper

Table 4, continued

Study	Types of Prompt		Adult Behavior		Number of Opportunities/ Allotted Time	Reinforcement
	Verbal Prompt	Visual Prompt	Modeling	Joint Activity (Collaborative Drawing)		
Gibson & Yonas (1967) (Task 2)	Child told it was a very nice "pencil" but received no other instruction	None	Some younger children needed a short demonstration of scribbling	No	Not reported	None
Griffiths & Huntley (1996) (Sample 1)	None	None	No	No	1	Marks on paper
Griffiths & Huntley (1996) (Sample 2)	None	None	No	No	1	Marks on paper
Griffiths & Huntley (1996) (Sample 3)	None	None	No	No	1	Marks on paper
Griffiths & Huntley (1996) (Sample 4)	None	None	No	No	1	Marks on paper
Hresko et al. (1994) (Sample 1)	None	None	No	No	1	Marks on paper
Hresko et al. (1994) (Sample 2)	None	None	Yes	No	1	Marks on paper
Hresko et al. (1994) (Sample 3)	Yes	None	Yes	No	1	Marks on paper
Lancaster (2007) (Child 1)	Mother discusses drawing with child, commenting on what's drawn or making suggestions about what to do	None	No	Yes (mother doesn't draw but sits with child and discusses child's work)	2	Marks on paper and mother's comments
Lancaster (2007) (Child 2)	Father discusses drawing with child, commenting on what's drawn or making suggestions about what to do	None	No	Yes (father doesn't draw but sits with child and discusses child's work)	1	Marks on paper and father's comments
Levin & Bus (2003) (Task 1)	Child asked to draw	None	No	No	1	Marks on writing surface
Levin & Bus (2003) (Task 2)	Child instructed to draw a particular item (8 referents)	None	No	No	1	Marks on writing surface
Levin & Bus (2003) (Task 3)	Child instructed to write a particular word (name plus 8 referents)	None	No	No	1	Marks on writing surface
Matthews & Jessel (1993) (Task 1)	Children were invited to draw	None	No	Some children worked in pairs	Several sessions	Marks on paper
Matthews & Jessel (1993) (Task 2)	Not reported	None	No	Some children worked in pairs	Several sessions	Marks on computer screen
Readdick (1989, 1994) (Task 1)	Children invited to draw a picture, encouraged to draw whatever they liked, asked which tool they wanted to use first	None	No	No	Children could draw for as long as they liked on as many pieces of paper as they wanted	Marks on paper and positive feedback from experimenter

Table 4, continued

Study	Types of Prompt		Adult Behavior		Number of Opportunities/ Allotted Time	Reinforcement
	Verbal Prompt	Visual Prompt	Modeling	Joint Activity (Collaborative Drawing)		
Readdick (1989, 1994) (Task 2, Part 1)	Child told to draw a shape just like the experimenter traced	Pictures of shapes	Experimenter traced shape with a finger and then traced the same shape on blank page	No	3 chances	Marks on paper
Readdick (1989, 1994) (Task 2, Part 2)	Child told to "make a boy (girl)"	None	No	No	1	Marks on paper
Rosenbloom & Horton (1971) (Task 1)	Children encouraged to make a drawing of some sort	None	No	No	5 minutes (included writing activity)	Marks on paper
Rosenbloom & Horton (1971) (Task 2)	Children asked to draw eyes in a face or write their name	None	No	No	5 minutes (included drawing activity)	Marks on paper
Saida & Miyashita (1979)	Children asked to write their name and trace shapes printed on paper	Shapes on paper	No	No	6	Marks on paper
Tseng (1998)	Child asked to draw various figures, circles or make a drawing of some sort	Grids on paper Geometric forms	No	No	3 minutes	Marks on paper
Yakimishyn & Magill-Evans (2002)	Not reported	None	No	No	14 trials	Marks on paper
Yamagata (1988)	Not reported	Not reported	Not reported	Yes	Multiple opportunities over 36 months	Marks on paper
Yamagata (1991)	Not reported	Pictures in picture book	Not reported	Not reported	Not reported	Marks on pictures
Yamagata (1997)	Mother might suggest drawing activity and drawing theme	Child might make marks on mother's drawing	Mother might begin drawing	Yes	Multiple opportunities over 18-21 months Varied according to mother and child interest in activity	Making marks on child's own drawing or on mother's drawing
Yamagata (2001) (Task 1)	Children asked to color the picture	Pictures on the page	No	No	Given 6 pictures to color, one at a time	Coloring marks on picture
Yamagata (2001) (Task 2)	Children asked to finish drawing a picture when given an outline	Contour (outline) of a picture	No	No	Given 6 contours to complete	Marks on paper/contour
Yamagata (2007)	Children asked to draw a human figure, write their name and the numeral one	None	No	No	1	Marks on paper
Yamagata & Shimizu (1997) (Task 1)	Children asked to draw a picture	None	No	No	Not reported	Marks on paper
Yamagata & Shimizu (1997) (Task 2)	Children asked to draw on the contour picture	Contour (outline) of a mother or rabbit	No	No	Not reported	Marks on pictures

Table 5
Level and Age of Acquisition of the Different Types of Mark Making and Scribbling

Study	Number of Children	Type of Drawing	Level ^a	Age (Months)
Adi-Japha et al. (1998) (Study 1)	6	Random circles	4	33
Adi-Japha et al. (1998) (Study 2)	1	Random marks	3	34
	1	Random circles	4	28
	1	Random circles	4	32
	1	Lines	6	33
	1	Geometric forms	7	35
Bayley (2006)	100	Random marks	3	11
	100	Random circles	4	13
	100	Lines	6	17
	100	Geometric forms	7	33
Berefelt (1987) (Study 1)	5	Random marks	3	18
	8	Controlled marks	5	18
	3	Lines	6	18
	1	Geometric forms	7	18
Berefelt (1987) (Study 2, Group 2)	4	Random marks	3	18
	2	Lines	6	18
Braswell (2001) Braswell & Rosengren (2005)	16	Lines	6	18
	16	Geometric forms	7	29
Cox & Parkin (1986)	10	Controlled marks	5	30
	11	Lines	6	36
	6	Figures	8	37
Gibson & Yonas (1967)	1	Random marks	3	16
Griffiths & Huntley (1996)	3	Marks	1	7.5
	5	Marks	1	9.5
	32	Marks	1	11.5
	17	Marks	1	13.5
	5	Random marks	3	11.5
	19	Random marks	3	13.5
	37	Random marks	3	15.5
	6	Random marks	3	17.5
	15	Random circles	4	15.5
	20	Random circles	4	17.5
	33	Random circles	4	19.5
	5	Random circles	4	21.5
	2	Controlled marks	5	17.5
	5	Controlled marks	5	19.5
	19	Controlled marks	5	21.5
	35	Controlled marks	5	23.5
	3	Lines	6	19.5
2	Lines	6	21.5	
13	Lines	6	23.5	
Hresko et al. (1994)	45	Marks	1	14
	45	Controlled marks	5	17
	45	Lines	6	18
	45	Geometric forms	7	38
Lancaster (2007)	1	Lines	6	30
	1	Geometric forms	7	32
Levin & Bus (2003)	1	Random circles	4	29
	1	Lines	6	28
	1	Geometric forms	7	30
	1	Geometric forms	7	35
Matthews & Jessel (1993)	1	Lines	6	22
	1	Geometric forms	7	24
Yamagata (1991)	1	Marks	1	12
	1	Lines	6	24
Yamagata (1997)	2	Marks	1	13
	1	Lines	6	17
	1	Lines	6	22

Table 5, continued

Study	Number of Children	Type of Drawing	Level ^a	Age (Months)
Yamagata (2001)	1	Controlled marks	5	18
	2	Controlled marks	5	21
	1	Controlled marks	5	22
	1	Controlled marks	5	29
	1	Lines	6	31
	1	Geometric forms	7	27
	1	Geometric forms	7	28
	1	Geometric forms	7	34
Yamagata (2007)	3	Random marks	3	18
	5	Random marks	3	24
	1	Random marks	3	30
	2	Random circles	4	18
	5	Random circles	4	24
	2	Random circles	4	30
	1	Random circles	4	36
	4	Geometric forms	7	24
	3	Geometric forms	7	30
	1	Geometric forms	7	36
	1	Figures	8	24
	8	Figures	8	30
	12	Figures	8	36
Yamagata & Shimizu (1997)	1	Random circles	4	18
	1	Geometric forms	7	18

^a See Table 1.

Table 6

Cohen's d Effect Sizes for the Characteristics of the Drawing Activities Influencing Mark Making and Scribbling

Study	Comparison ^a	Dependant Measure	Effect Size
Adi-Japha et al. (1998)	Broken Line vs. Smooth Background (Elicited)	Child Attributions About Drawing	6.18
	Broken Line vs. Smooth Background (Spontaneous)	Child Attributions About Drawing	7.57
	Pencil vs. Digitizer (Elicited)	Child Attributions About Drawing	0.06
	Pencil vs. Digitizer (Spontaneous)	Child Attributions About Drawing	0.35
Berefelt (1987)	Nonfunctioning vs. Functioning Pencil	Scribble Complexity	2.06
		Scribble Duration	11.34
Braswell (2001)	Unstructured vs. Structured (18 month olds)	Proportion of Collaborative Episodes	1.34
	Unstructured vs. Structured (30 month olds)	Proportion of Collaborative Episodes	1.09
	Structured vs. Unstructured (18 month olds)	Duration of Collaborative Episode	0.81
	Structured vs. Unstructured (30 month olds)	Duration of Collaborative Episode	0.42
Braswell & Rosengren (2005)	Unstructured vs. Structured (18 month olds)	Child Imitation of Mother's Drawing	0.08
	Unstructured vs. Structured (30 month olds)	Child Imitation of Mother's Drawing	0.46
	Unstructured vs. Structured (18 month olds)	Drawing in Response to Mother Request	0.13
	Unstructured vs. Structured (30 month olds)	Drawing in Response to Mother Request	0.27
	Structured vs. Unstructured (18 month olds)	Independent Drawing	0.92
	Structured vs. Unstructured (30 month olds)	Independent Drawing	0.48
Gibson & Yonas (1967)	Nonfunctioning vs. Functioning Pencil	Scribble Duration	1.80
Readdick (1994)	Primary vs. Standard Pencil	Drawing Level	0.10
	Primary vs. Standard Marker	Drawing Level	0.40
	Primary vs. Standard Crayon	Drawing Level	0.28
	Blank Paper vs. Geometric Forms (Standard)	Drawing Level	1.44
	Blank Paper vs. Geometric Forms (Primary)	Drawing Level	1.14
Yakimishym & Magill-Evans (2002)	Flat vs. Slanted Surface (Crayon)	Grasp Maturity	1.35
	Flat vs. Slanted Surface (Marker)	Grasp Maturity	0.41
	Flat vs. Slanted Surface (Pencil)	Grasp Maturity	0.08
	Pencil vs. Crayon (Flat Surface)	Grasp Maturity	1.00
	Pencil vs. Crayon (Slanted Surface)	Grasp Maturity	2.61
	Marker vs. Pencil (Flat Surface)	Grasp Maturity	0.19
	Marker vs. Pencil (Slanted Surface)	Grasp Maturity	0.49
Yamagata (1991)	Inanimate (Vehicle) vs. Animate (Face) Background	Scribbling Frequency	0.35
	Inanimate (Ball) vs. Animate (Person) Background	Scribbling Frequency	0.41
	Inanimate (House) vs. Animate (Animal) Background	Scribbling Frequency	0.48
	Drawing of a Person vs. Human Face Background	Scribbling Frequency	0.17
	Human Hand vs. Human Eyes Background	Scribbling Frequency	0.34
Yamagata (1997)	Free vs. Collaborative Drawing	Drawing Complexity	1.48
	Child vs. Adult Initiated (12-19 months)	Child Initiations	2.75
	Adult vs. Child Initiated (24-30 months)	Child Initiations	1.67
Yamagata (2001)	Circle vs. Human Face Background (18 month olds)	Drawing Complexity	0.55
	Circle vs. Human Face Background (24 month olds)	Drawing Complexity	0.70
	Circle vs. Human Face Background (30 month olds)	Drawing Complexity	0.60
	Circle vs. Human Face Background (36 month olds)	Drawing Complexity	0.10

^aThe condition to the right of *versus* is the one associated with a higher score on the dependent measure.