TABLE 1

ACCOUNT OF A TOUR OF THE CONTINENT:
ORDER OF SECTIONS OF POEM, BY MANUSCRIPT*

MS VIII Draft	MSS IA,† VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
	"Calais" (poem, MS IA)	1-24	Drawing (*Works*, 2:341 n. 1); "Calais" (poem); drawing (*Works*, 2:341 n. 3)		"Calais" (poem; *Works*, 2:341)
	"Calais" (prose, MS IA)	Unnumbered	Drawing (*Works*, 2:341 n. 4); [Calais] (prose); drawing (*Works*, 2:342 n. 2)		[Calais] (prose; *Works*, 2:341-42)
	[Cassel] (poem, MS IA)	25-62	Drawing (*Works*, 2:342 n. 3); "Cassel" (poem); drawing (*Works*, 2:343 n. 1)		"Cassel" (poem; *Works*, 2:342-43)
			Drawing (*Works*, 2:343 n. 2); [Cassel] (prose); drawing (*Works*, 2:344 n. 1)		[Cassel] (prose; *Works*, 2:343-44)
	"Lille" (poem, MS IA)	63-112	Drawing (*Works*, 2:344 n. 2); "Lille" (poem); no drawing at end of poem		"Lille" (poem; *Works*, 2:344-45)

UCP: Child Dev. Mono., JOB: 945, UNIT: 104, PAGE: 88, 03-29-96 14:41:40

REVISED PROOF

sional level and appeared to be missing many of the components of the central numerical structure.

The total sample of 60 was divided into three matched groups on the basis of the children's Number Knowledge pretest scores. A rank-ordering procedure was used to assign children to groups, with the child receiving the lowest ranked score assigned to the Rightstart group (i.e., the treatment group), the child receiving the second lowest ranked score assigned to the traditional math group (i.e., Control Group 1), the child receiving the third lowest ranked score assigned to the reading readiness group (i.e., Control Group 2), etc. This method was adopted in order to provide a conservative rather than a liberal estimate of the effectiveness of the training as well as to give the "neediest" children the benefit of the Rightstart program. The mean chronological ages of the three groups were 5.23, 5.26, and 5.30 years, respectively.

Training

Training was provided by Sharon Griffin and two graduate students in education. Each trainer was assigned to one of the three classrooms and was responsible for the training of all the children it contained in small groups. Since children from each of the three intervention groups were represented in each classroom, each trainer provided training in all three instructional programs. This design permitted us to assess the effectiveness of the Rightstart program not only in relation to the other two training programs but also across classrooms and across trainers. Each child received 40 small-group training sessions, with each session lasting approximately 20 min. The size of each training group was five children. For the most part, training was conducted in a corner of the regular classroom, and visual distractions were minimized by the use of room dividers; however, auditory distractions were quite frequent and could not be controlled.

Assessment Instruments and Procedures

A battery of quantitative tasks was administered individually to all children participating in the study in November (pretest) and in April (posttest) of the same school year. Children were tested in the language with which they were most comfortable (i.e., English or Portuguese); in most cases (93% on the pretest, 100% on the posttest), English was the preferred language. The test battery included the *Number Knowledge* test (which provided a direct measure of the effectiveness of the Rightstart program in teaching the central numerical structure) and five transfer tests drawn from the quantitative

aufme

MS VIII Draft	MSS IA,[†] VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
			Drawing (*Works*, 2:345 n. 2, a drawing heading the prose, not closing the preceding poem, as implied in *Works*); [Lille] (prose); no drawing at end of prose		[Lille] (prose; *Works*, 2:345)
	"Brussels" (poem, MS IA)	113-73	Blank space for drawing; "Brussels" (poem); drawing (*Works*, 2:347 n. 2)		"Brussels" (poem; *Works*, 2:346-47)
"Part of Brussels" (prose, part of first paragraph, "Brussels is a lovely . . . for circumnavigating, for <traversing>"); untitled resumption ("perambulating, Oh woe . . . tread on it softly")		Unnumbered, the two parts sandwiching 810-22	Drawing (*Works*, 2:347 n. 2); [Brussels] (prose); no drawing at end of prose		[Brussels] (prose; *Works*, 2:347-48)
	"The Meuse" (poem, MS IA)	Unnumbered	Blank space for drawing; "The Meuse" (poem); drawing (*Works*, 2:349 n. 1)		"The Meuse" (poem; *Works*, 2:348-49)

UCP: Child Dev. Mono., JOB: 945, UNIT: 104, PAGE: 87, 03-29-96 14:41:40

REVISED PROOF

for following the lessons that were given to teachers always stressed two objectives, namely, (1) helping children acquire the number line structure and (2) helping them realize that numbers can be fun.

Control Program 1: Traditional Math Readiness

The math program developed for the first control group was a traditional one that incorporated some, but not all, of the components of the Rightstart program. The components that were included were forward and backward counting, mapping of numbers onto objects, cardinality, and recognition of numerals (i.e., elements 1, 2, 3, 4, and 9 of the core program). The reason for selecting these components is that they form the backbone of the typical math readiness program found in American schools today.

Control Program 2: Reading Readiness

The second control program was a reading readiness module designed on the hypothesis that a major component of reading readiness is phonemic awareness (Adams, 1990; Bradley & Bryant, 1985). The program that we developed was based loosely on a sound categorization program developed by Bradley and Bryant (1985). It provided systematic training in sound categorization as well as ample opportunity for children to map sounds (e.g., beginning word sounds, final word sounds, rhyming sounds) onto words, letters, and pictorial representations of objects and events in the real world. To ensure comparability across treatments, the three instructional modules were identical in length and comparable in the sort of participation structures employed for the games and other activities (copies of all these programs are available on request from Sharon Griffin).

Subjects

The training programs were implemented in three public kindergarten classes serving middle- to low-income families who had immigrated from rural Portugal to Toronto. Although Portuguese was the dominant language in most of the children's homes, the vast majority had attended prekindergarten and were proficient in English. The few children who lacked minimal oral comprehension of English were excluded from the sample, and the remainder (N = 60) constituted the treatment and control groups. When the Number Knowledge test (Griffin et al., 1995; Chap. II above) was administered to this sample in the middle of the kindergarten year (November), the majority of children performed at or below the predimen-

an/mc

MS VIII Draft	MSS IA,[1] VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
"The Meuse" (prose)		Unnumbered, composed following "The descent," 753-77	[Meuse] (prose); drawing, broadside on whole of recto following prose (*Works*, 2:350 n. 2)		[Meuse] (prose; *Works*, 2:349-50)
"Aix-la-Chapelle" (prose)		Unnumbered, following [Lago Maggiore], 890-920	Blank verso; drawing (*Works*, 2:350 n. 2); "Aix la Chapelle" (prose); blank space for drawing between "Aix la Chapelle" and "Cologne"		"Aix la Chapelle" (prose; *Works*, 2:350-51)
			"Cologne" (poem); drawing (*Works*, 2:351 n. 3)		"Cologne" (poem; *Works*, 2:351)
"Cologne" (prose, first paragraph only)		Unnumbered, composed following "The Meuse," prose	[Cologne] (prose); no drawing at end of prose		[Cologne] (prose; *Works*, 2:351-53
	"Andernacht" (poem, MS IA)	378-403	Blank space for drawing; "Andernacht" (poem)		"Andernacht" (poem; *Works*, 2:354 n.)

REVISED PROOF

5. Increment rule (i.e., knowledge that each number up one in a sequence represents a set that has been incremented by one [+1]; row *e*);

6. Decrement rule (i.e., knowledge that each number down one in a sequence represents a set that has been decremented by one [−1]; row *e*);

7. Mapping of relative numerosity onto number sequence (i.e., since this set [XXX] has more than this set [XX], one can say that 3 is "more" than 2; rows *b* and *d*);

8. Use of information regarding relative numerical magnitude to make dimensional judgments (e.g., A is longer than B since A contains three identical objects and B contains only two identical objects; outer brackets in the figure);

9. Mapping of numbers onto symbolic representations (rows *b* and *a*).

The principles followed in devising materials to teach this content were as follows:

Affective engagement.—Each exercise should be affectively engaging.

Representational congruence.—The visual props for representing numerical change should be congruent with children's internal representation of number. This means that they should indicate numbers of increasing magnitude as lying along a line that increases in length.

Representational diversity.—A variety of external forms of representation should be utilized (e.g., thermometers, board games, "number lines," rows of objects, etc.).

Developmental sequencing.—The concepts to be covered should be sequenced in their normal order of developmental acquisition.

Multiple levels of learning.—Wherever possible, multiple levels of understanding and learning should be facilitated. Thus, in the early exercises where the explicit activity is counting, the props and general context should be such as to permit some implicit learning of the higher-order concepts by the more capable children; in the later exercises, children who are still consolidating their counting should have the opportunity to do so, and they should be able to get some fun and knowledge out of the exercise.

The materials that were developed to help children acquire each of the elements of knowledge listed above and integrate them into a coherent structure were assembled into a set of 20 lessons that teachers were asked to follow. To maximize affective engagement, the majority of the activities included in these lessons were set in a game format, and the majority of the games were designed to be played by small groups of children under the teacher's guidance (for a sample lesson, see App. D). The instructions

ay/mc

MS VIII Draft	MSS IA,[†] VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
"Andernacht" (prose)		Unnumbered, composed following [Arve at Chamouni], 520-64	Drawing (*Works*, 2:354 n. 2); [Andernacht] (prose); no drawing at end of prose		[Andernacht] (prose; *Works*, 2:354-55)
"Ehrenbreitstein" (poem, Ruskin's title in MS IX, untitled in MS VIII)		973-1081	Drawing (*Works*, 2:356 opp.); "Ehrenbreitstein" (poem); drawing (*Works*, 2:358 n. 1)		"Ehrenbreitstein" (poem; *Works*, 2:355-58)
[Ehrenbreitstein] (prose)		Unnumbered, between 1160-82 and [Heidelberg] (prose)	Space for drawing; [Ehrenbreitstein] (prose); no drawing at end of prose		[Ehrenbreitstein] (prose; *Works*, 2:358)
	"St. Goar" (poem, MS IA)	404-29	Space for drawing; [St. Goar] (poem); no drawing at end of poem (*Works*, 2:360 n. 1 in error)		[St. Goar] (poem; *Works*, 2:359 n. 1)
[St. Goar] (prose)		Unnumbered, composed following "Andernacht" (prose)	Space for drawing; [St. Goar] (prose); no drawing at end of prose		[St. Goar] (prose; *Works*, 2:360-61)

UCP: Child Dev. Mono., JOB: 945, UNIT: 104, PAGE: 85, 03-29-96 14:41:39

carry more of this core meaning than others and thus contribute more to development in other areas?

STUDY 1

The first training study was designed to provide an initial answer to each of the questions posed above. To address the question of whether central numerical knowledge can be trained (question 1), a set of measurable learning objectives was constructed for each component of the central numerical structure, and a curriculum ("Rightstart") was developed to teach each of these. To address the question of transfer (question 2), the battery of quantitative tasks that was described in the previous chapter, as well as in Griffin, Case, and Capodilupo (1995), was administered both before and after training. To address the question of whether certain components in the structure are more important for transfer than others (question 4), a mathematical "control" program was developed and administered to another group of children. This program was designed to teach a partial set, but not all, of the components specified in Figure 16. A second control program that taught none of these components but engaged children in a set of games and activities that were similar in their general form to those used in the treatment program was also developed. Finally, to address the question of transfer to school learning (question 3), children in all three training interventions were presented with several standard school "mini-curricula" immediately following the transfer tests; the extent of their learning was then evaluated.

Methods

Training Interventions

Core training: The number knowledge program ("Rightstart").—The content covered in the main training program consisted of the set of nodes and relations that were postulated to compose the central numerical structure illustrated in Figure 16. These were partitioned into instructional units as follows:

1. Number sequence going up from 1 to 10 (row *b*);
2. Number sequence going down from 10 to 1 (row *b*);
3. One-to-one mapping of numbers onto objects when counting in either direction (rows *b* and *c*);
4. Mapping of each number onto a canonical set of appropriate size (rows *b* and *d*);

a/ mc

MS VIII Draft	MSS IA,[†] VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
[Heidelberg] (poem, untitled lines 19-48, corrected numbering; see Part 1, MS VIII, "Content," b) "Continuation Heidelberg" (poem, from variant lines in *Works* 2:362 n. 1, to end of poem as printed)		939-68 1083-1155	Drawing (*Works*, 2:360 n. 1, erroneously cited as following [St. Goar] poem); [Heidelberg] (poem); space for drawing on two-page spread, each page half-filled with poem; no drawing at end of poem		[Heidelberg] (poem; *Works*, 2:361-64)

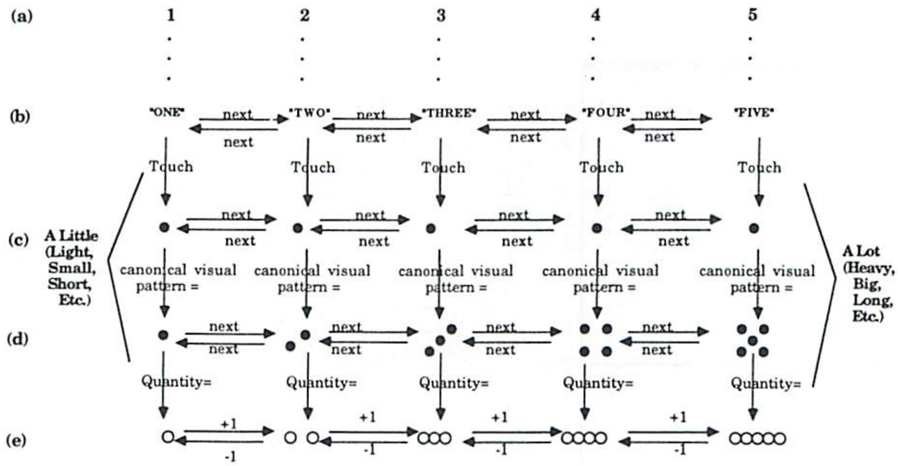

FIG. 16.—The expanded representation of the number line used for instructional purposes. The top row indicates knowledge of written numerals. The second row indicates knowledge of number-word sequence. The third row indicates knowledge of appropriate motor routine for counting physical objects. The fourth row indicates knowledge of canonical visual patterns for small sets of numbers as they appear, e.g., on dice. The fifth row indicates knowledge of the cardinal values of these sets and the "increment/decrement" rule that connects them.

vailed when elements of the central narrative structure were taught to children in the same age range (4–5 years). There are a number of problems with these early studies, however, and the authors themselves have urged caution in interpreting their findings. These problems include (*a*) small sample size, (*b*) interventions that were impromptu in many respects and only partially documented, (*c*) the absence of controls that would permit the locus of the effects to be identified, and (*d*) transfer effects that were demonstrated only in the laboratory (if central conceptual structures really are central, some sort of effect should be found in children's everyday learning as well).

The current studies were designed to eliminate the foregoing difficulties. The set of questions that they were designed to address can be summarized as follows: (1) Can the knowledge specified in the 6-year-old central numerical structure and illustrated in Figure 16 be taught to children who are at an age when they should have acquired it but for some reason have not? (2) If so, will this knowledge have an effect on children's performance on a broad range of developmental tasks for which no specific training has been provided? (3) If so, will this knowledge also have an effect on children's learning outside the laboratory—for example, in school mathematics? (4) Is the current specification of the 6-year-old central numerical structure adequate to capture its core meaning, or do some elements of this structure

afpma

MS VIII Draft	MSS IA,' VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
[Heidelberg] (prose)		Unnumbered, following 1160-82 and [Ehrenbreitstein] prose	Blank page; new recto with space for drawing; [Heidelberg] (prose), incomplete ("Most beautiful . . . granite, sometimes")		[Heidelberg] (prose; *Works*, 2:364-65)
"Cont. Heidelberg" (prose)		Unnumbered, following poems for John James's May 1834 birthday and "The foam globes round come riding fast" (see Part 1, MS VIII, "Content," b)			
			Blank verso; drawing (*Works*, 2:364 n. 1 [no. 1])		
			Blank verso; drawing (*Works*, 2:364 n. 1 [no. 2])		

REVISED PROOF

IV. EVALUATING THE BREADTH AND DEPTH OF TRAINING EFFECTS WHEN CENTRAL CONCEPTUAL STRUCTURES ARE TAUGHT

Sharon Griffin and Robbie Case

Since the central conceptual structure hypothesis was first proposed (Case & Griffin, 1990; Case & Sandieson, 1987, 1988), a great deal of work has been devoted to increasing the precision of the theoretical framework and testing its core components. Thus, for example, several studies have focused on showing that children's central conceptual structures for representing number have the content that had been originally suggested and that they emerge at the postulated point in development (Chap. II). Other studies have been devoted to showing that children's quantitative and social-cognitive competencies form two coherent factors and that the Number Knowledge test is one of the principal tests to define the quantitative factor (Chap. III).

The studies reported in the present chapter were designed to test a stronger hypothesis, namely, that children's central numerical structures play a causal role in the development of competencies in other areas. In order to test this hypothesis, it is not enough to demonstrate that a wide range of developmental tests correlate with tests of children's central numerical knowledge, nor is it sufficient to show that children's number knowledge loads on the same factor as such tests as the Balance Beam, Time Telling, and Money. In addition, one must demonstrate that, when children's central numerical structures are changed, these other competencies will change as well.

Some previous work does indicate that this may be the case. Case and Sandieson (1992) found that exposure to a training program designed to teach elements of the central numerical structure led to substantial gains on the Number Knowledge test as well as transfer to a range of other quantitative measures. McKeough (1992b) found that a similar pattern pre-

ay/mc

MS VIII Draft	MSS IA,' VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
			Blank verso; drawing (*Works*, 2:364 n. 1 [no. 3])		
			Blank verso; drawing (*Works*, 2:364 n. 1 [no. 4])		
			Blank verso; two drawings (*Works*, 2:364 n. 1 [nos. 5a-b])		
			Blank verso; drawing (*Works*, 2:364 n. 1 [no. 6])		
			Blank verso; drawing (*Works*, 2:364 n. 1 [no. 7])		
["Oh are there spirits, can there be"] (poem)		506-19			["Oh, are there spirits, can there be"] (poem; *Works*, 2:384 n. 1)
"The Source of the Arveron" (prose)		Unnumbered			[The Source of the Arveron, incorrectly indicated to be an editorial title] (prose; *Works*, 2:386-87)

UCP: Child Dev. Mono., JOB: 945, UNIT: 103, PAGE: 82, 03-29-96 14:36:01

REVISED PROOF

proaching Inhelder and Piaget's (1958) Shadows task. There is one task, however, on which a finding emerged that was similar to the one reported by Anderson and his colleagues. On the Conservation of Number task, children appeared to be using a bivariate rule (Rule 2) at the age of 5 or 6, a good 2 years before they used the corresponding rule on most other tasks. Once again, it is important to point out that Siegler was not trying to assess the presence of a central numerical structure. He was trying to determine the age at which children used a formally similar rule in several different perceptual and conceptual contexts. As we pointed out in earlier work, the conservation of number problem can be solved by applying a single mental number line (Case, 1972, 1977). By contrast, Rule 2 usage on the Balance Beam, the Shadows, or the Conservation of Liquid task cannot be attained until children have assembled a bivariate numerical structure. When data obtained in these tasks are recoded for the level of numerical reasoning that needs to be applied, the level of understanding that children demonstrate turns out to be quite similar across these various situations.[3]

CONCLUDING COMMENTS

In contrast to the data from the previous chapter, the present data were not intended to provide a more detailed look at the internal workings of children's central conceptual structures for number. Rather, they were intended to demonstrate, both analytically and empirically, that the operation of these structures can be identified on quite a wide range of tasks and contexts, including those that have been interpreted in the literature as indexing competencies that are quite disparate, such as scientific reasoning and social competence. A second goal of the present chapter was to demonstrate that a similar general pattern can be observed in the domain of children's narrative.

In and of itself, correlational data such as those reported in the present chapter do not allow one to conclude that the development of children's central conceptual structures plays a causal role in determining the pattern of reasoning that they display on the various specific tasks that have been studied. Nor do they allow one to conclude with any certainty that children's central conceptual development across different domains is subject to the same limitations. They do add a certain degree of intuitive plausibility to both these suggestions, however, and they provide an extremely important general context within which experiments aimed at drawing causal inferences must be interpreted. It is to studies of this latter sort that we turn in the next chapter.

[3] We are grateful to Robert Siegler for making his data available to us for the purpose of this analysis.

aug/mc

MS VIII Draft	MSS IA,[†] VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
[The Arve at Chamouni] (poem)		520-64			[The Arve at Chamouni] (poem; *Works*, 2:384-85)
[The Alps from Schaffhausen] (poem)		565-614, following unnumbered Andernacht and St. Goar (prose)			[The Alps from Schaffhausen] (poem, incorrectly indicated as Ruskin's title; *Works* 2:366-67)
"Viamala"		615-46			"Via Mala" (poem; *Works* 2:369)
"Splugen"		647-95			"Splügen" (poem; *Works* 2:370-71)
"The <descent> Summit"		696-752			"The Summit" (poem; *Works* 2:371-72)
"The descent"		753-77			"The Descent" (poem; *Works* 2:372-73)
[The Black Forest], poem		778-809			[The Black Forest] (poem; *Works* 2:365-66)
"It was a wide stretchy sweep," untitled prose, connected with St. Goar in Library Edition but more likely belonging to [The Black Forest] (poem)		Unnumbered, following 778-809			"It was a wide and stretchy sweep" (prose; *Works* 2:360 n. 1)

UCP: Child Dev. Mono., JOB: 945, UNIT: 103, PAGE: 81, 03-29-96 14:36:00

REVISED PROOF

or structure to the next. This is perhaps the most important reason that our findings differ from those reported by others. If one examines the mean scores in Table 11 carefully, one will see that there is still a substantial amount of variability from one task to the next, notwithstanding our attempt to control extraneous factors. What is equally clear, however, is that this variability is present in both test batteries to the same degree. Since both test batteries also have the same central tendency, the general pattern that is observed is one where children find it considerably easier to apply their central conceptual structures in certain task situations than in others but where the overall pattern of their development looks very similar in both the numerical and the narrative domains.

In the past few years, studies have begun to appear in which the above distinction has been made and an effort has also been made to disentangle specific from more general structural variance. By and large, these studies have shown results that are quite like those reported here (Demetriou, Shayer, & Pervez, 1988; DeRibaupierre & Pascual-Leone, 1979; Lautrey, DeRibaupierre, & Rieben, 1985; Marini & Case, 1993). The present study thus joins these studies in suggesting that development often proceeds across different conceptual domains at a relatively constant rate.

Before concluding, we would like to mention two sets of data that we believe are compatible with the foregoing conclusion but that might be taken to be incompatible with it were they not scrutinized quite closely.

1. In research conducted on a variety of tasks—including the Balance Beam, Estimation of Time, and Estimation of Area—it has been reported that children are capable of integrating information about two separate dimensions in making quantity judgments by the age of 5 years (Anderson & Cuneo, 1978; Wilkening, 1981). By contrast, we repeatedly found them *incapable* of doing so until the age of 9 or 10. The important point to note here is that Anderson and his colleagues were not trying to assess the presence of a central numerical structure: they were merely trying to assess children's ability to utilize information from two different quantitative dimensions. As a consequence, most of the judgments that they asked children to make could be made by simple visual inspection and did not require careful enumeration. In our terms, then, they did not require a level of numerical sophistication beyond the predimensional level. On several tasks that we have designed for preschoolers ourselves, we have predicted and found similar findings (Bruchkowsky, 1992; Marini & Case, 1993).

2. Consider next a set of data reported by Siegler (1981). These data are congruent with ours in showing that, in general, bidimensional thought does not emerge until the age of 7–10. They are also consistent in showing considerable evidence of cross-task consistency in development; thus, for example, approximately 70% of the children studied by Siegler used the same-level rule in approaching the Balance Beam task as they did in ap-

au/mc

MS VIII Draft	MSS IA,' VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
[Chiavenna] (poem)		810-22			[Chiavenna, incorrectly indicated as Ruskin's title] (poem, *Works* 2:373)
"Lago di Como" (poem)		823-63			"Lago di Como" (poem, *Works* 2:373-74)
[Genoa] (poem, untitled lines 19-44 as printed) "Genoa" (poem, titled by Ruskin, remainder of poem as printed; see Part 1, MS VIII, "Content," b)		864-89 1376-97			"Genoa" (poem, *Works* 2:378-79)
[Lago Maggiore] (poem, untitled lines 1-31 as printed) [Lago Maggiore] (poem, untitled lines 32-39 as printed, not certainly associated with lines 1-31)		890-920 1369-76, embedded in middle of "Cont. Heidelberg" (prose)			[Lago Maggiore] (poem, *Works* 2:377-78)

UCP: Child Dev. Mono., JOB: 945, UNIT: 103, PAGE: 80, 03-29-96 14:35:59

to have a different neurological substrate. It is widely believed, for example, that the most important period of development for musical ability is the preschool period, whereas the most important period of development for logicomathematical ability is the school years. The claim has also been made that the spontaneous development of musical intelligence ends by the age of 7 or so, whereas spontaneous development of logicomathematical thought extends considerably beyond that period (Gardner, 1983). Once again, however, it is hard to know what to make of this claim since there in no common basis for deciding what is important and what is "rapid." Certainly, there are many objective tasks where untrained children continue to show great improvement in musical cognition after the age of 7 (Serafine, 1988). Moreover, in the one study that we know of where an attempt was made to develop a common metric, development was found to be proceeding in this domain at the same general rate as in others (Capodilupo, 1990).

2. *Lack of attention to misleading task features.*—If we focus on studies where some sort of common conceptual metric *is* present, we will still find many examples where development appears to be taking place across different tasks or task domains at a different rate. A second factor that distinguishes many of these studies from the present one is that no attempt is made to eliminate misleading task factors or to control the extent to which such factors are operative across different tasks. A great deal of work has been conducted on this problem by Pascual-Leone (1969), as has already been mentioned. Many other important lines of work have also begun by isolating some important misleading factor in a Piagetian task, then systematically examining its effect (e.g., Markman, 1984). Informed by this work, however, we were able to prevent such factors from overshadowing those in which we were interested in the present study, by the way in which we designed our test battery. This constitutes a second possible reason that the results that we found were more comparable across different domains than those reported by other investigators.

3. *Failure to distinguish specific from general variance.*—Although tests of cognitive development are perhaps unique in the extent to which they involve misleading task factors, a general measurement problem in psychology is that one can never control all the specific task factors that might influence a subject's response and prevent one from forming an accurate assessment of some more general disposition, trait, or structure. When such a state of affairs obtains, the standard procedure in most subfields is to present a battery of tests that includes a large number of specific tasks and then to eliminate the effects of local task factors by averaging.

As Rushton, Brainerd, and Pressley (1983) have pointed out, however, this procedure is almost never used in developmental psychology. Thus, most studies can make statements about the rate of development only from one context or task to the next, not from one general conceptual domain

am/mc

MS VIII Draft	MSS IA,' VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
[The Rhine] (prose)		Unnumbered, following 939-68			[The Rhine] (prose, incorrectly indicated as Ruskin's title, *Works* 2:368)
"Schaffhausen" (poem, so entitled by Ruskin, retitled in Library Edition)		1148-59			[Entrance to Schaffhausen] (poem, entitled "Schaffhausen" by Ruskin in draft, *Works* 2:366)
"The lake smiled sweetly, and the boy" (poem, no. 181, not certainly part of the Account, although thematically related)		Unnumbered, between 1148-59 and 1160-82			Unpublished
[Evening at Chamouni] (poem)		1160-82			[Evening at Chamouni] (poem, *Works* 2:385-86)

pattern was thus one in which conceptual development appeared to be taking place in the two domains at the same general rate.

Discussion

The data from Study 2 confirmed the finding from Study 1 concerning the parallel pattern of development in the numerical and narrative domains. Both in the population as a whole and in individual children, development appeared to go through the same general conceptual progression in each domain. Moreover, it appeared to go through this progression at the same general rate. This being the case, it is important to examine the considerable body of literature in which a different pattern of data is reported or in which a different conclusion about the likelihood of such a pattern has been reached. These studies normally differ from the present one along one or more of the following dimensions.

1. *Presence of a common metric.*—The first feature that unites the majority of studies in which conceptual development appears to take place in different domains at widely different rates—and that distinguishes them from the present study—is that they have no common metric for measuring a child's conceptual sophistication on the different tasks or different domains in which development is being assessed. In the classic Piagetian literature, for example, there is often a surface commonality across tasks, in that subjects can be classified as being at substage A, B, or C on each. As a number of investigators have pointed out, however, Piaget never intended these designations as more than ad hoc ways of classifying the steps along the road to the structures in which he was interested (Chapman, 1988). Since he did not define substage A on task X and substage A on task Y in the same manner, the fact that subjects are often found to be functioning at different levels on two different tasks—even though both are tests of the same general operational structure—is not surprising.

A similar point can be made with regard to tasks designed to measure children's conceptual development in the modular and/or neonativist tradition. As Keil (1986) has pointed out, there is a universal progression in children's conceptual development, in the sense that children invariably begin by defining any new concept in terms of its surface or perceptual features and end up by defining it in terms of its deeper semantic features. When one looks at the age at which this progression takes place, however, one finds a wide difference from one task to the next. From the present point of view, the important point to note is that, since the concepts have not been scaled in terms of a common metric, the conclusions that one can draw from this finding are limited.

The same may be said for the less formally documented but frequently cited findings on the rate of cognitive change across tasks that are known

ay/mc

MS VIII Draft	MSS IA,[†] VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
"The foam globes round come riding fast" (poem, not certainly part of the Account, although thematically related)		Unnumbered, following poems for John James's May 1834 birthday (see Part 1, MS VIII, "Content," b)			"The foam globes round come riding fast" (poem, paired with prose [The Source of the Arveron], *Works* 2:387)
"Cadenabbia" (poem)		1417-61			"Cadenbbia" (poem, *Works* 2:375-76)
"Villa Pliniana" (poem)		1462-84			"Villa Pliniana" (poem, *Works* 2:376)
	"Milan Cathedral" (poem, MS IA)	360-77			"Milan Cathedral" (poem, *Works*, 2:376-77)
	"Passing the Alps" (poem, MS IA)	326-59			"Passing the Alps" (poem, *Works*, 2:379-80
	"The Rhine" (poem, MS VII)	Unnumbered?			"The Rhine" (poem, *Works*, 2:368-69)
	"Chamouni" (poem, MS VII)	Unnumbered?			"Chamouni" (poem, *Works*, 2:382-84)

78

TABLE 11

MEANS, STANDARD DEVIATIONS, AND RANGES OBTAINED FOR TASKS ON THE NUMERICAL AND NARRATIVE BATTERIES

	Numerical Battery							Narrative Battery					
	Number	Money	Time	Balance	Birthday	Justice	Overall Quant.	Story	Motives	Feeling	Emp. Cog.	Pictures	Overall Narrative
4 years:													
M	.98	.73	.75	1.05	1.10	1.50	1.03	1.34	1.30	1.26	1.24	1.28	1.28
SD	.33	.26	.32	.50	.70	.70	.30	.64	.52	.61	.49	.39	.41
Range	.4–1.4	.4–1.2	0–1.4	.5–2	.5–2	.5–2	.53–1.6	.5–2.5	.5–2.5	.5–3	.8–2.5	.8–2.3	.8–2.4
6 years:													
M	1.82	1.66	1.82	1.90	1.84	2.00	1.75	2.04	1.63	1.98	1.88	1.95	1.90
SD	.31	.47	.42	.42	.51	.30	.25	.78	.41	.49	.62	.57	.38
Range	1.2–2.6	1.2–3.2	.8–2.3	1–3	.5–3	1–3	1.2–2.5	.5–3	.9–2.5	.9–3	.8–3.3	1–2.8	1.3–2.7
8 years:													
M	2.90	2.17	2.87	2.39	2.21	2.50	2.70	2.63	2.17	2.65	2.81	2.88	2.63
SD	.30	.43	.63	.58	.89	.74	.33	.58	.57	.60	.69	.45	.40
Range	2.3–3.5	2.3–3.8	1.8–4.7	1–3	.5–4	2–5	2.1–3.7	2–4	1.1–3.5	1.6–4	1.6–4	2–3.7	2–3.2
10 years:													
M	3.92	4.19	3.88	3.35	3.34	3.91	3.78	3.45	2.94	3.45	3.46	3.37	3.31
SD	.69	.61	.59	.63	1.50	1.12	.66	.67	.91	.85	.69	.60	.55
Range	2.6–4.9	1.8–5	2.95	2–4.5	.5–5	1–5	2.3–4.9	2–4.5	1.8–4.8	1.6–4.5	2.3–5	2.3–4.5	2.2–4.1

NOTE.—Scores of 1–4 are defined by substages 1–4.

UCP: Child Dev. Mono., JOB: 945, UNIT: 103, PAGE: 78, 03-29-96 14:35:58

MS VIII Draft	MSS IA,[†] VII	Ruskin's Line Numbering, MSS IA, VIII	MS IX Fair Copy	MS VIII Endpaper List of Proposed Topics	Library Edition
	"Chamouni" (prose, MS XI)	Unnumbered?			"Chamouni" (prose, *Works*, 2:380-82)

NOTE.—Quotation marks indicate Ruskin's title in manuscript. Square brackets indicate that a piece is untitled in manuscript and/or that the title is editorial. Square brackets enclosing first lines in quotation marks indicate that a piece is untitled either in manuscript or in the Library Edition. For details, consult part 1, MSS IA, VII, VIII, and IX, "Content."

[*] Only the columns for the MS IX fair copy and for the MS VIII endpaper list sections in the sequence they appear in those manuscripts. The sequences of sections in MSS IA, VII, and VIII (draft) can be inferred from Ruskin's line numbering, listed in column three. As cautioned in part 1, MS VIII, "Content," *b*, Ruskin's line numbering reflects the sections' manuscript sequence but may or may not reflect their *compositional* sequence.

[†] See part 1, MS IA, "Content," *g*, for the order of sections within the three separate sheets contained in MS IA. Those respective orderings are not distinguished in this table.

[‡] Certain gaps in MS IX suggest either that Ruskin intended to paste in a drawing or that a drawing has been removed; these gaps are described as "blank space for drawing." A phrase such as "no drawing at end of poem" means that, in my judgment, no drawing was intended, since the space is too small. All these assertions, however, are more or less conjectural.

plete all 12 tasks contained in the two batteries. The task administration procedure was identical, with one exception; the order of task administration was slightly modified to include the Number Knowledge task in the first session. The tasks were administered in the following order: *Session 1:* (1) Balance Beam, (2) Storytelling, (3) Number Knowledge, and (4) Psychological Verbs; *Session 2:* (1) Mother's Motives, (2) Birthday Party, (3) Affective Change, and (4) Money Knowledge; and *Session 3:* (1) Time Telling, (2) Definition of Feelings, (3) Distributive Justice, and (4) Empathic Cognition. A total of eight individuals conducted the interviews; six of them were the same interviewers who had participated in Study 1; the other two were newly trained prior to the actual interviews, using the same training procedure. The elementary school children were interviewed at the end of the school year; interviews with preschoolers were conducted in the summer of the same year.

Scoring

The general procedure for scoring was the same as for the first study in this series, although certain refinements were introduced, as indicated in Appendices A and B. For the numerical battery, the percentage of agreement between raters ranged between 91% and 98%; for the narrative battery, the percentage of agreement ranged between 73% and 90%. In each case, disagreements were resolved by discussion.

Results

Since preliminary analyses indicated that there were no sex differences, boys and girls were treated as one group. The mean scores obtained on each task by each age group are reported in Table 11. As may be seen, mean scores obtained by the 6-year-olds were similar to those reported for the sample in Study 1, and the age-related progression on each task was similar in magnitude to what we reported for the Number Knowledge test in Chapter II.

Turning to the correspondence of overall performance across the two batteries, the pattern at all ages was very similar to what we obtained in Study 1. The correlation between the two batteries was .83, and a repeated-measures analysis found no significant difference in mean battery scores ($F[1, 85] = .25, p < .61$). The majority of individual children also scored at the same level on the two batteries; no child showed a difference greater than one level at age 4, and only one child at each of ages 6 and 8 years showed a discrepancy of this magnitude. The 10-year-old group showed a sizable percentage of the discrepancies of this magnitude; however, even at this level, only two of the children showed a discrepancy greater than 1.5 points. The most common

aupmc