

Words from "Sesame Street": Learning Vocabulary While Viewing

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The present study was a longitudinal investigation of preschool children's viewing of "Sesame Street" and their vocabulary development. Five 1-week diaries of television viewing were collected for 2 years from 2 cohorts of children; 1 group was followed from ages 3 to 5 ($n = 160$) and another from ages 5 to 7 ($n = 166$). Child and family measures included children's vocabulary skills, gender, presence of siblings, parent education, parent encouragement of "Sesame Street" viewing, and parent positive attitudes about television. Cross-age multiple regressions, in conjunction with within-age regressions, suggested a positive effect of "Sesame Street" viewing from ages 3 to 5, with declining benefits from ages 5 to 7. Neither positive nor negative effects were evident for viewing other kinds of children's programs, such as cartoons. Results suggest that the content and presentation formats of "Sesame Street" are well suited to preschoolers' vocabulary development, independent of parent education, family size, child gender, and parental attitudes. The findings suggest the feasibility of tutorial uses of the video medium.

Early studies of the effects of children's educational television viewing focused on *what* children learn (Ball & Bogatz, 1970; Bogatz & Ball, 1971). Beginning in the 1970s and continuing into the 1980s, the emphasis shifted to *how* children learn when viewing (cf. Pearl, Bouthilet, & Lazar, 1982). Implicit in the shift is the assumption that the first question has been resolved. What has not been demonstrated, however, is what children can learn from broadcast programming in naturalistic viewing circumstances. Furthermore, information about what is learned is central to models of the processes that young children bring to television viewing, such as attention to the screen and comprehension of narrative content (cf. D. R. Anderson & Collins, 1988). One content area largely overlooked in the process studies is that of language. Yet, there is evidence that visual attention is influenced by the comprehensibility of dialogue (D. R. Anderson, Lorch, Field, & Sanders, 1981), and comprehension of central events is highly correlated with verbal skills (Jacobvitz, Wood, & Albin, 1989). Given evidence of children's active cognitive processing of the medium, including their ability to draw upon linguistic processes when viewing, it may be that they can learn about language when viewing, as well. The purpose of the study reported here was to examine whether young children

learn new words when viewing broadcast educational programming under normal home viewing conditions.

Home viewing presents a strong test of the medium's effects, insofar as the situation offers competing activities, interruptions and other distractions, and in the case of broadcast programming, no opportunities to control the pace and sequencing of material or to return to earlier portions for review. In these circumstances, children must draw upon online processing strategies without benefit of an interaction with the source of information. This scenario is markedly different from the prototypic language learning situation in which an adult negotiates joint attention with a child on a mutual topic, converses with the youngster, and adjusts the conversation to the child's level of linguistic competence. The noninteractive character of broadcast television has led specialists in language development to conclude that young children do not learn vocabulary or other aspects of language from television (e.g., Clark & Clark, 1977, p. 330; Hoff-Ginsberg & Shatz, 1982).

The prediction of no effects on word learning was not supported, however, in a recent experimental study by Rice and Woodsmall (1988). In this investigation, 3- and 5-year-old children individually viewed animated programs that introduced unfamiliar words in a story context. After two viewings, the children comprehended an average of five new words (for the 5-year-olds; 1½ new words for the 3-year-olds). In a follow-up study with 3-year-olds, the findings were replicated (Rice, Buhr, & Nemeth, in press). What remains to be determined is if similar effects are evident in home viewing circumstances.

A prime candidate for a broadcast program source of new words is "Sesame Street." Since its introduction in 1969, it has been the single most successful educational program for children, with a viewing audience of 10.4 million households (Palmer, 1984). Among its target age group of 3- to 5-year-olds, "Sesame Street" is very popular; children in this age range average 3-4 hr per week of viewing (Huston et al., 1985).

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It is somewhat curious that the goals of "Sesame Street" have focused on concepts and other cognitive content, such as alphabet letters, but not on general vocabulary development. Yet initial summative evaluations of the program's effectiveness (Ball & Bogatz, 1970) have reported increased general vocabulary skills, as measured by the Peabody Picture Vocabulary Test (PPVT; Dunn, 1965). What has been overlooked is that the principal means of introducing new concepts is with new words, usually terms for objects or attributes of objects.

Vocabulary acquisition is a primary accomplishment of preschool children. Between the ages of 1½ and 6 years, children learn to comprehend more than 14,000 words (Templin, 1957). This is an average of about 9 new words per day. The emerging lexicon serves as the basis for developing linguistic skills. Furthermore, preschool vocabulary level is a good predictor of early reading ability and school achievement (R. C. Anderson, Hiebert, Scott, & Wilkinson, 1985), perhaps because children who know more words understand written text better than children with more limited vocabularies (R. C. Anderson & Freebody, 1981). Obviously, children manage to acquire their large vocabulary without explicit tutoring, evidently by absorbing new meanings as they encounter them in conversational interactions (Carey, 1978; Rice, in press). Given preschoolers' ability to learn new words incidentally, the dialogue of television could serve as a source of new words.

"Sesame Street" is of particular interest because the dialogue of its characters is adjusted to young viewers' comprehension levels in a manner strikingly similar to the way adults adjust their speech and language to young children in live interactions (Rice & Haight, 1986). The dialogue on "Sesame Street" closely resembles that of a mother talking to her child, with simple sentences, much talk about the here and now, repeated emphasis on key terms, and an avoidance of abstract terminology. Such speech is well suited to introducing word meanings to young viewers. In contrast, simplified dialogue is not evident in children's cartoons or in adult situation comedies (Rice, 1984).

Given these particular attributes of "Sesame Street" and preschoolers' readiness for vocabulary development, there is reason to predict that the program can be an effective vocabulary teacher for its young viewers. Other kinds of programs viewed by children, such as cartoons and adult situation comedies, are not as likely to contribute to vocabulary acquisition.

The general teaching effectiveness of "Sesame Street" in home viewing settings is not a foregone conclusion. Despite its success and a great deal of supportive anecdotal evidence, some scholars have questioned the value of the program for learning at home. Initial summative evaluations (Ball & Bogatz, 1970; Bogatz & Ball, 1971) were accepted by many as evidence of the program's effectiveness in introducing cognitive material, such as body parts, sorting, and classification, to preschoolers (e.g., Liebert, Sprafkin, & Davidson, 1982; Stein & Friedrich, 1975). This conclusion was challenged, however, by a group of researchers who carried out extensive secondary analyses of the data (Cook et al., 1975). They suggested that the apparent effectiveness of the program may have been confounded with the presence of a coviewing adult. Other studies have shown that maternal coviewing increases children's learning from "Sesame Street" (Salomon, 1977). Cook et al. (1975) concluded that

viewing per se had not been demonstrated as a major contributor to most of the cognitive skills measured in the test battery.

The summative studies did not address several important questions. First, does "Sesame Street" viewing lead to gains in competencies other than those tested? Second, are effects cumulative over an extended period of development? Some children were tested after a second year of viewing, but most were followed for less than one year. Third, are some viewing effects specific to a certain age range? The program is aimed at children in the 3- to 5-year-old age range. Three-year-olds gained more than 5-year-olds in the summative evaluation, suggesting that the early preschool years are an especially auspicious period for learning from the program (Ball & Bogatz, 1970).

The present study investigated the relation between naturally occurring home viewing of "Sesame Street" and vocabulary acquisition for the 3- to 7-year-old age range in a 2-year longitudinal study beginning when the children were ages 3 or 5. Tests of vocabulary competency were given at the beginning and the end of the 2-year period. No experimental interventions were imposed on viewing, so the findings represent home viewing as it occurs naturally in children's homes.

Method

Sample and Subject Retention

The initial sample in this 2-year longitudinal study consisted of 326 children and their families in Topeka, Kansas. The children were within 3 months of their third ($n = 160$) or fifth ($n = 166$) birthdays at the beginning of the study. They were recruited through newspaper birth records, preschools, churches, mass media publicity, and posters placed in large office buildings, laundromats, and grocery stores. The sample was predominantly White, and all but 18 families had both parents living in the home at the beginning of the study. Educational level of each parent was coded on a scale in which 1 = *less than high school*, 2 = *high school graduate*, 3 = *some post-high-school training*, 4 = *bachelor's degree*, 5 = *some postgraduate training*, and 6 = *graduate or professional degree*. The mean education for fathers was 3.78 ($SD = 1.40$); for mothers, the mean was 3.35 ($SD = 1.23$).

Occupational status was rated on the Duncan scale, which has a range from 1 to 99 (Duncan, 1961). For fathers, $M = 52.73$, $SD = 23.90$; for mothers, $M = 52.18$, $SD = 18.52$. Although individual occupations receive different ratings on the Duncan, they can be understood from the following average ratings: Professional and technical workers = 75; managers, officials, and proprietors = 57; clerical and sales workers = 47; craftsmen and foremen = 31; operatives and service workers = 17-18; and laborers = 7. The sample appeared to represent a wide range of educational and occupational levels, but it was a volunteer sample in which White, intact, relatively stable families were overrepresented. (One necessary criterion for inclusion in the study was the intention to stay in Topeka for at least 2 years.)

Design

The design was a combination of cross-sequential and cohort sequential methods (Baltes, Cornelius, & Nesselroade, 1979). Two cohorts of children who were within 3 months of their third and fifth birthdays at the onset of the study were followed for a 2-year period. Within each of these cohorts there were two subcohorts: Children with birthdays from February through August 1978 and 1976 began the study in the spring 1981; children with birthdays from September 1978 and 1976 through the following February began in the fall 1981.

Television viewing diaries were collected every 6 months, for five

waves, for each child. The viewing measure was a diary record of viewing by all family members for 1 week in the spring and 1 week in the fall for 2 years (a total of 5 diaries). Spring and fall were sampled to avoid the extremes of heavy viewing in winter or light viewing in summer. Although each family kept a diary for only 1 week, each time of measurement lasted approximately 3 weeks, with families spread across them in order to reduce the effects of weather and idiosyncratic events on the viewing measure. The diary contained a report of viewing by all members of the household in 15-min intervals from 6:00 a.m. to 2:00 a.m. for each day.

Viewing was defined as being present for more than one half of a 15-min interval in which the television was turned on. This definition was adopted to avoid parental judgments about when the child was "watching," but it undoubtedly resulted in a slight overestimate of true viewing. One recent investigation included a comparison of diary measures with videotapes made in the home during viewing (D. R. Anderson, Field, Collins, Lorch, & Nathan, 1985). Diaries slightly overestimated children's viewing time, but the correlations between the two methods were .84, indicating that diaries are a valid method of assessing individual differences.

In the present study, validity was assessed indirectly by examining errors in the diaries (e.g., wrong program title for time and channel listed). Two subjects were eliminated because their diaries contained large numbers of errors.

A total of 271 subjects returned four ($n = 27$) or five ($n = 244$) diaries and were, therefore, considered to have sufficient data for analyses of viewing (0 diaries, $n = 14$; 1 diary, $n = 11$; 2 diaries, $n = 10$; and 3 diaries, $n = 21$). To determine whether there was selective retention, t tests were performed comparing the retained sample with those who were dropped for the following variables measured in an initial home visit: sex of child, starting season, parent education, parent occupational status, maternal employment, family size, sibling composition, cable options, number of television sets, child's score on the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981), child's preschool attendance, and child's media preferences. The retained sample was not significantly different from the whole sample.

Program categories. Each television program was classified according to the intended audience—child or adult—and whether it was intended to be informative. Children's viewing frequencies were calculated for four types of programs: child audience informative, child audience noninformative, adult audience informative, and adult audience noninformative. Frequency of viewing "Sesame Street" was also calculated separately from other child informative programs. Because the distributions were positively skewed, the viewing data were transformed into square roots ($X + 1$; Winer, 1971). Frequency distributions of these transformed variables showed that the distributions approximated a normal distribution.

Previewing Interview

Prior to the first viewing diary, a staff member visited the home to explain the diary procedure, interview a parent (usually the mother), and administer the PPVT to the child. The PPVT is a standardized instrument measuring vocabulary. It contains norms for ages 2 through adult. Its correlations with other vocabulary tests range from .30 with the Wechsler Preschool Primary Scale of Intelligence (WPPSI) to .72 with the Stanford-Binet. Its correlations with total IQ are .62 with the Stanford-Binet and .58 with the WPPSI (Dunn & Dunn, 1981).

The variables obtained from the initial parent interview included parent demographic information, family composition, parent regulation, and encouragement of the child's television viewing. Encouragement to view "Sesame Street" was assessed by asking whether there were any programs the parent encouraged the child to watch. If they said *yes*, they were asked which ones. Encouragement was scored if "Sesame Street" was named.

Postviewing Procedures

Within 3 months of their last diary, 261 parents and children participated in individual interviews and tests at a laboratory facility in Topeka. Children were again given the PPVT and several other measures.

The parent interview reassessed demographic information, family composition, regulation and encouragement of television viewing, and attitudes about television. One parent report measure from this interview used in the present report was attitudes about television, measured by a questionnaire from the Television Addiction Scale developed by Smith (1981). It contains 14 Likert-type items consisting of statements about television such as, "Television makes people more passive," "Television is entertaining." The responses are made on a 5-point scale ranging from *strongly disagree* to *strongly agree*. Factor analysis of the scale indicated two independent sets of items: positive attitudes (agreement with positive statements about television) and negative attitudes (agreement with negative statements). The Cronbach alphas for the two were .74 and .73, respectively.

Results

The major purpose of the analyses was to determine whether "Sesame Street" viewing predicts vocabulary development. The PPVT was administered to each child at the beginning and the end of the 2-year period during which viewing was assessed. Initial analyses were performed on data from each time of measurement to determine what parental and home environment variables were associated with PPVT scores and to determine the relations of viewing to vocabulary. Viewing data from the first two waves were collapsed as an index of early viewing, and the final two waves were collapsed as an index of later viewing. The correlations between Waves 1 and 2 were .60 and .34 for the younger and older cohorts, respectively; the correlations between Waves 4 and 5 were .59 and .50 for the two cohorts, respectively. The waves were collapsed to average seasonal variations in viewing across spring and fall and to increase the reliability of the indexes. The correlations were sufficient for collapsed scores.

The following parent and child variables were included in the analyses because their zero-order correlations with PPVT were significant for one or both cohorts: parent education (mean of two parents), presence or absence of older siblings in the home, child gender, parental encouragement of "Sesame Street" viewing, and positive parental attitudes about television. The means and standard deviations for all variables as well as their correlations with PPVT scores appear in Table 1.

Relations of Viewing to Vocabulary Within Age Levels

Multiple regressions were performed separately for each cohort to predict initial PPVT scores from early "Sesame Street" viewing (Waves 1 and 2). Although these analyses provided information about relations among more or less concurrent measures of vocabulary and viewing (the PPVT and viewing measures were collected within 1 year of one another), viewing was measured 6 months to a year *after* the PPVT was administered.

The family and child variables previously listed were entered first in order to partial out their effects on PPVT, then viewing was entered. Stepwise selection was used after each block of variables to retain those contributing significantly to PPVT scores. The results are shown in Table 2. "Sesame Street" view-

Table 1
Means and Standard Deviations for Parent and Child Variables and Their Correlation With PPVT Scores

Variable	Cohort 1		Cohort 2		Correlation with PPVT	
	M	SD	M	SD	Initial	Final
Parent						
Education	3.60	1.03	3.56	1.18	.26***	.31***
Encourages "Sesame Street"	.65	.48	.25	.43	-.15**	-.20***
Positive attitudes about television	20.56	3.30	19.67	3.28	-.16**	-.20***
Child						
Gender (1 = boy, 2 = girl)	1.43	0.50	1.50	0.50	-.03	-.17**
Older siblings	.84	1.00	.87	1.00	-.27***	-.30***
Viewing of "Sesame Street"						
Waves 1 + 2 ^a	6.87	3.30	5.18	2.70	.08	.14**
Waves 4 + 5 ^a	6.33	3.29	2.34	2.55	.04	.06
Initial PPVT	106.23	12.98	108.01	13.22		.59***
Final PPVT	107.17	12.14	111.12	13.91	.59***	

Note. PPVT = Peabody Picture Vocabulary Test.

^a The mean frequency of viewing for 2 weeks is derived from the square root + 1 transformation of the total of 15-min viewing intervals.

* $p < .05$. ** $p < .01$. *** $p < .001$.

ing was positively related to vocabulary scores at ages 3 (younger cohort) and 5 (older cohort), but the betas were both at borderline levels of significance.

A second set of regressions was performed to predict the final PPVT from later "Sesame Street" viewing (Waves 4 + 5). In these analyses, the viewing occurred within 6 months to a year before the PPVT. Viewing was a significant predictor of vocabulary at age 5 (younger cohort), but not at age 7 (older cohort; see Table 3). Children who were high viewers in the age range of 4 to 5 performed better on the PPVT at age 5 than those who were not.

Some family and child attributes were also related to PPVT scores. It is not surprising that parent education was positively

related to vocabulary at all age levels. First-born children performed better than did later-borns. Parents' positive attitudes to television in general and their encouragement to view "Sesame Street" in particular were negatively related to vocabulary levels at some age levels. At the final testing, there were gender differences for both cohorts—boys performed better than girls.

Cross-Time Relations

The relations between PPVT and "Sesame Street" viewing could indicate that viewing affects vocabulary, that advanced vocabulary affects children's tendency to view, or that other factors influence both. Cross-time analyses were designed to test the two causal direction hypotheses. Two regression equations

Table 2
Predictors of Initial PPVT Scores

Predictor	Cohort 1 (age 3)		Cohort 2 (age 5)	
	β	t	β	t
Parent education	.190	2.08*	.184	2.06*
No. of older siblings	-.209	-2.33*	-.229	-2.68**
Positive attitudes about TV	-.177	-1.96***	-.050	0.60
Encourage "Sesame Street"	-.093	-1.05	-.192	-2.15*
Gender of child	-.026	-0.30	-.015	-0.18
"Sesame Street" viewing (Waves 1 + 2)	.152	1.71***	.157	1.82***

Note. Cohort 1: Total $R^2 = .18$ (.14 adjusted), $F(6, 108) = 4.00$, $p < .01$. Cohort 2: Total $R^2 = .18$ (.14 adjusted), $F(6, 118) = 4.24$, $p < .001$. PPVT = Peabody Picture Vocabulary Test.

* $p < .05$. ** $p < .01$. *** $p < .010$.

Table 3
Predictors of Final PPVT Scores

Predictor	Cohort 1 (age 5)		Cohort 2 (age 7)	
	β	t	β	t
Parent education	.203	2.31*	.287	3.19**
Number of older siblings	-.194	-2.21*	-.261	-3.07**
Positive attitudes about TV	-.195	-2.25*	-.050	-0.59
Encourage "Sesame Street"	-.189	-2.20*	-.100	-1.13
Gender of child	-.204	-2.38*	-.186	-2.24*
"Sesame Street" viewing (Waves 4 + 5)	.213	2.43*	.062	0.72

Note. Cohort 1: Total $R^2 = .26$ (.22 adjusted), $F(6, 105) = 6.26$, $p < .001$. Cohort 2: Total $R^2 = .25$ (.21 adjusted), $F(6, 111) = 6.16$, $p < .001$. PPVT = Peabody Picture Vocabulary Test.

* $p < .05$. ** $p < .01$.

Table 4
Cross-Time Regressions Predicting Final PPVT Scores from Early Viewing of Sesame Street (Waves 1 + 2)

Predictor	Cohort 1 (age 3)		Cohort 2 (age 5)	
	β	<i>t</i>	β	<i>t</i>
Initial PPVT-R	.387	4.81***	.514	6.79***
Parent education	.142	1.80†	.189	2.57**
Older siblings	-.076	-0.96	-.106	-1.45
Gender of child	-.205	-2.69**	-.170	-2.43*
Encourage "Sesame Street"	-.086	-1.09	.088	1.26
Parent positive attitudes to TV	-.133	-1.68†	-.047	-0.67
Early viewing of "Sesame Street" (Waves 1 + 2)	.233	2.93**	.018	0.26

Note. Cohort 1: Total $R^2 = .40$ (.36 adjusted), $F(7, 107) = 9.98$, $p < .001$. Cohort 2: Total $R^2 = .44$ (.41 adjusted), $F(7, 117) = 13.17$, $p < .001$. PPVT = Peabody Picture Vocabulary Test.
* $p < .05$. ** $p < .001$. *** $p < .001$. † $p < .10$.

were compared, following a logic often used in longitudinal research to establish the likely causal direction in a correlation (e.g., Huesmann, Lagerspetz, & Eron, 1984).

In the first regression, early viewing of "Sesame Street" was tested as a predictor of the final PPVT score. Initial PPVT was entered first to control for initial individual differences associated with viewing, then the parent and child variables included in the analyses previously reported were entered. Hence, the analysis tested the contribution of viewing during the first year of the study to vocabulary at the end of the study, with initial vocabulary and parent and child variables statistically controlled. The results appear in Table 4. For the younger cohort, early viewing of "Sesame Street" (at ages 3-3½) was significantly related to vocabulary scores at age 5. For Cohort 2, viewing "Sesame Street" at ages 5-5½ did not contribute significantly to vocabulary at age 7.

The second regression was designed to test the reverse causal direction hypothesis—that early vocabulary skills determine the amount of "Sesame Street" viewing. The dependent variable was later "Sesame Street" viewing. Initial viewing (Waves 1 + 2) was entered first, then the parent and child attributes, then initial PPVT score. Hence, this analysis parallels the previous one, in testing for the contribution of vocabulary skills during the first year of the study to viewing at the end of the study with initial viewing and parent and child variables statistically controlled. The results appear in Table 5. For the younger cohort, PPVT scores at age 3 did not predict viewing at 4½ to 5. For the older cohort, PPVT scores at age 5 were marginally negatively related to viewing at ages 6½ to 7.

These cross-age analyses suggest a cumulative effect of "Sesame Street" viewing during the age period from 3 to 5, with declining benefits after age 5 to 5½. Children's vocabulary levels at age 3 were not related to their viewing of "Sesame Street" at age 5, but viewing between ages 3 and 3½ was a strong predictor of vocabulary at age 5. On the other hand, for the older cohort, improvements in vocabulary as a function of viewing after age 5 were not evident. In fact, children with high PPVT scores at age 5 were slightly more apt than were poorer performers to

show declines in viewing by age 6½ to 7, suggesting that they had moved beyond the level of the program.

To determine whether these patterns were specific to "Sesame Street" or were characteristic of viewing other types of children's television, cross-time regressions were carried out for child-audience noninformative programs, most of which were cartoons. Early viewing of child and general audience noninformative programs did not predict later improvements in vocabulary scores, nor did initial PPVT predict changes in viewing noninformative programs.

Adult Coviewing

The positive effects of educational programming have sometimes been attributed to parental coviewing and encouragement of children's viewing. To test the contribution of coviewing to children's learning of vocabulary from educational programs, viewing was divided into that which occurred with a parent and that which occurred without a parent. Most viewing took place without a parent in the room (74% for the younger cohort and 82% for the older cohort; see St. Peters, Fitch, Huston, Wright, & Eakins, 1988). All child informative programs were included in order to have sufficiently high frequencies. "Sesame Street" accounted for 73% of all the child informative viewing for the younger cohort (ages 3-5) and 62% for the older cohort (ages 5-7).

Regressions performed for these analyses were identical to those discussed earlier, except that viewing with a parent was a predictor in one set; in a second set, viewing without a parent was entered as a predictor. The concurrent relations of viewing in Waves 1 and 2 with initial PPVT (parallel to Table 2) were stronger for viewing with parents than for viewing without parents. For both cohorts, viewing with parents predicted initial PPVT (younger cohort, ages 3 to 3½, $\beta = .19$, $t = 2.09$, $p < .05$; older cohort, ages 5 to 5½, $\beta = .19$, $t = 2.24$, $p < .05$). Viewing without parents was positively but less strongly related to vocabulary for the younger cohort ($\beta = .14$, $t = 1.62$, *ns*). There was virtually no relation for the older cohort ($\beta = .04$, $t = 0.51$, *ns*).

Table 5
Cross-Time Regressions Predicting Later Sesame Street Viewing (Waves 4 + 5) from Initial PPVT Scores

Predictor	Cohort 1 (age 5)		Cohort 2 (age 7)	
	β	<i>t</i>	β	<i>t</i>
Early "Sesame Street" viewing (Waves 1 + 2)	.403	4.78***	.431	5.23***
Parent education	-.063	-0.76	.222	2.57*
Older siblings	-.194	-2.33*	-.242	2.83*
Gender of child	.088	1.90	-.069	-0.85
Encourage "Sesame Street"	.218	2.61**	-.009	-0.11
Parent positive attitude to TV	-.013	-0.16	.034	0.40
Initial PPVT	.067	0.79	-.164	-1.84†

Note. Cohort 1: Total $R^2 = .34$ (.30 adjusted), $F(7, 104) = 7.64$, $p < .001$. Cohort 2: Total $R^2 = .28$ (.24 adjusted), $F(7, 109) = 6.12$, $p < .001$. PPVT = Peabody Picture Vocabulary Test.
* $p < .05$. ** $p < .01$. *** $p < .001$. † $p < .10$.

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By contrast, viewing without an adult predicted vocabulary at age 5 for the younger cohort better than did coviewing. The concurrent relation of viewing in Waves 4 and 5 to final PPVT (parallel to Table 3) was significant ($\beta = .25, t = 2.95, p < .01$). Viewing with an adult was not related to vocabulary ($\beta = .07, t = 0.74, ns$). For the older cohort, viewing without an adult at ages 6½ to 7 was unrelated to vocabulary ($\beta = -.04, t = -0.48, ns$), and viewing with an adult was slightly related to vocabulary ($\beta = .17, t = 1.96, ns$).

The most critical comparisons are the cross-time relations (Table 4). Viewing without an adult at age 3 to 3½ predicted vocabulary at age 5 ($\beta = .22, t = 3.05, p = .01$). Viewing with an adult was unrelated to later vocabulary ($\beta = .08, t = 1.03, ns$). For the older cohort, there were no relations of viewing at age 5 to later vocabulary. The tests of reverse causal direction, parallel to those in Table 5, predicting later viewing with and without adults from earlier vocabulary were all nonsignificant.

These results suggest that the positive predictive relations between viewing and vocabulary cannot be attributed solely to parental coviewing or influence. Most viewing occurred without parents. The viewing that took place without parents predicted later vocabulary in the cross-time comparisons for the 3-year-old cohort, whereas the viewing with an adult was unrelated to later vocabulary. Although there are some positive concurrent relations between coviewing and vocabulary at the initial testing, the critical comparisons are the relations across time. Furthermore, there is some reason for caution in interpreting the coviewing correlations because of the low frequencies, especially for the older subjects, who had only 18% of viewing with a parent.

Discussion

The prediction that "Sesame Street" viewing contributes to preschool children's vocabulary development was supported, along with the prediction that similar effects would not be evident for other kinds of viewing. Furthermore, the vocabulary-enriching effects of "Sesame Street" are apparently independent of parent education, family size, child gender, and parental attitudes. It is possible that home influences do not mediate the program's effectiveness, but more likely that contributing home variables are constant across levels of parent education, family size, child gender, and parental encouragement to view.

Counter to the conclusions of Cook et al. (1975), much of the learning suggested in the present study can probably be attributed to viewing without direct parental intervention. The viewing diary records show that adults were present during slightly less than one fourth of the time that children watched child informative programs. Furthermore, early coviewing did not predict later vocabulary, but early viewing of the 3-year-olds without an adult present did predict their vocabulary levels at age 5.

The apparent age dependence of viewing effects from this study is consistent with the idea of an interaction between viewer characteristics and program content and forms. Children show rapid growth in oral language abilities from ages 3 to 5, the target age range for the content presented in "Sesame Street." Hence, it is reasonable to find that viewing "Sesame Street" at ages 3 to 3½ related to vocabulary scores 2 years later. During the time from ages 5 to 7, children continue to acquire

new vocabulary but at a level more sophisticated than that emphasized by "Sesame Street." At the same time, the program's appeal is beginning to wane as children shift their preferences to cartoons and adult programs. Low PPVT scores at age 5, however, were marginally related to "Sesame Street" viewing at ages 6½ to 7, suggesting that more slowly developing children may continue to find the program interesting even when they are slightly beyond the age of its intended audience.

We do not wish to imply, however, that older children cannot learn new vocabulary when viewing television. What we suggest is that their vocabulary levels are beyond the targeted level of "Sesame Street," and their viewing preferences are shifting from the "Sesame Street" format. Likewise, this study cannot substantiate a claim that the ages of 3–5 years are "optimal" for learning new vocabulary. Instead, we suggest that "Sesame Street" is well suited to the vocabulary levels of children in this age range and that they are able to incorporate new words into their lexicon as a consequence of viewing. This finding is consistent with the idea that preschoolers can draw upon Quick Incidental Learning (QUIL; Rice, in press) processes for lexical acquisition. Although the specific nature of these processes are as yet undetermined, there are indications that QUIL is available to 3-year-olds and is more robust for 5-year-olds (cf. Rice & Woodsmall, 1988). Developmental trends beyond this range remain to be seen.

In the present study, vocabulary scores were related to the family and child variables measured. Parent education was the most consistent positive predictor of receptive vocabulary. Children without older siblings (i.e., first-borns) performed better than those with older siblings, a finding consistent with the literature on birth order in relation to older children's achievement (Zajonc, 1986). It is not clear, however, why boys performed better than girls at the second testing; in general, girls' verbal skills average slightly higher than those of boys (Maccoby & Jacklin, 1974).

Parents with positive attitudes to television in general had children with relatively low vocabulary scores, perhaps because those parents were less apt to engage children in activities other than television. Encouragement to view "Sesame Street" was also negatively related to PPVT scores, despite the apparent positive contribution of the program to children's performance. This finding may indicate that parents respond to slow development by encouraging "Sesame Street" viewing, which they consider to be educational. In addition, parents who encourage "Sesame Street" may be more positive about television in general and encourage other types of viewing as well.

The results did not confirm Cook et al.'s (1975) conclusion that "Sesame Street" is viewed more often by economically advantaged than disadvantaged children. The sample represented a wide range of educational and occupational levels, and there was no correlation between these demographic variables and viewing frequency. In its earliest years, "Sesame Street" was less well-known and was often not available on VHS without cable, so families with limited income may have been slower to adopt it as part of their regular viewing schedules. By the early 1980s, the program was widely known and almost universally available.

These conclusions are, of course, constrained by the inherent limitations of correlational data. Although the results suggest

that the direction of influence is from viewing to vocabulary development, additional evidence is needed to establish causality. Closely associated with the causality issue is one of measurement. The PPVT is a general measure of vocabulary development and, therefore, probably a conservative estimate of the effects of viewing. What is needed is a measure of children's comprehension of words presented on "Sesame Street" that are not likely to be introduced in other settings. This is an unlikely scenario, however, given that the dialogue of "Sesame Street" is deliberately written with words familiar to young children and, therefore, likely to be heard in other settings. In addition, if we are to learn about the way in which media-introduced vocabulary influences children's language development, we also must take into account a child's initial lexicon and how the new word meanings interface with existing language skills. Even with these limitations, the findings suggest powerful verbal processing mechanisms for learning new words. Furthermore, this kind of learning can mediate the introduction of other new content via broadcast programming.

These findings also address more general questions about the value of the television medium for learning. One reason for the success of "Sesame Street" may be the use of formats and production techniques designed to elicit viewer participation and mental activity. For example, songs are often presented once with words, then a second time without words so that children will fill in the lyrics.

In fact, the medium may be particularly well suited for introduction of new word meanings to young children. Television allows for the introduction of familiar and novel words in a manner that focuses young viewers' attention, with visual and verbal redundancies, and the potential of repeated experiences with the same material (cf. Greenfield, 1984). In this time of repeated calls for improved literacy, both verbal and written (e.g., R. C. Anderson et al., 1985), all potential tutorial sources may be considered, particularly those with popular appeal. Furthermore, as Palmer (1984) has pointed out, broadcast educational television programming is a highly cost-effective way to teach children. He concluded that the cost per child of a week-day children's public television schedule for 2- to 13-year-olds in the United States would be less than one cent per day. The burgeoning home videocassette resources are as yet unexplored as potential sources of enlightening as well as entertaining materials for children. The potential impact is not limited to "Sesame Street." The key consideration is the development of age-appropriate video materials and a corresponding scientific literature exploring the medium's effects.

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