

Word Learning From Baby Videos

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Objective: To examine whether children between 12 and 25 months of age learn words from an infant-directed DVD designed for that purpose.

Design: Half of the children received a DVD to watch in their home over the course of 6 weeks.

Setting: All participants returned to a laboratory for testing on vocabulary acquisition every 2 weeks.

Participants: Ninety-six 12- to 24-month-old children.

Main Exposure: Baby videos.

Main Outcome Measures: Parent report and observational measures of vocabulary acquisition related to

words highlighted in the DVD; parent report of general language development; and parent report of children's media use.

Results: The age at first viewing of baby DVDs was related to children's general language development. There was no evidence of learning words highlighted in the infant-directed DVD independent of parental intervention.

Conclusions: Researchers should continue to examine whether infant-directed media are effective in teaching infants and toddlers content and consider the cognitive factors related to whether very young viewers should be expected to learn from a DVD.

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ACCORDING TO PARENTS, children between the ages of 0 and 2 years spend about 2 hours per day with screen media,¹ and current estimates suggest the average age at which children begin watching infant-directed programming is 5 months.² Given the significant amount of time this represents in the lives of infants and toddlers, the American Academy of Pediatrics³ continues to recommend parents avoid media exposure for their children younger than 2 years, considering both the lack of evidence proving the educational efficacy of infant-focused media and the potential negative effects on brain and health development in these early years.⁴

One area of focus for research on the effects of infants' exposure to screen media has been word learning, including general language development or learning words from on-screen models. Gross measures of language learning have indicated that, to some extent, exposure to baby videos in the first years of life is correlated with lower language abilities between 7 and 16 months of age, although this effect disappears by the age of 2 years.⁵ There may also be a relationship between tele-

vision viewing and language delays; children with language delays have been shown to start watching television earlier and watch more television than normally developing children.⁶ Other research has demonstrated no effect of television viewing on language development in Thai children.⁷ In other words, the findings regarding general language development, while suggestive, are mixed.

Regarding specific language learning from media, the claims of infant-directed media to teach children specific vocabulary have gone unsubstantiated.⁴ Research has shown that children are less likely to learn words from a televised labeler than from a live model in a laboratory setting. In 1 study, 22-month-old children were more likely to learn a label from a televised adult than from a television program but most likely to learn a new word from a live adult.⁸

While viewing a DVD in a laboratory setting may aid in controlling external distractions, the research question addressed in the current study is whether children could learn specific words from viewing a commercially available infant-directed DVD in the way that children traditionally view these types of products—in the home. To

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our knowledge, only 1 study has examined whether children younger than 2 years learn words from a DVD designed to teach specific vocabulary when viewed in their natural viewing environment. Robb et al⁹ focused on children between the ages of 12 and 15 months and demonstrated no evidence of specific word learning from a DVD over a 6-week period. To address this gap, the current study expanded on the data from Robb et al by combining the Robb et al sample with a sample of older children. The purpose of the study was to explore whether children between the ages of 12 and 25 months learned words from *Baby Wordsworth*, a commercially available DVD from the Walt Disney Company's *Baby Einstein* DVD series (The Baby Einstein Company, Glendale, California). The 35-minute DVD highlights 30 English labels for common objects and rooms in the house and combines short puppet skits with live footage of children and parents playing and interacting around the house. When object labels are introduced, the screen is split between a picture of an object on one side, a woman signing the word on the other side, and the text of the word at the bottom of the screen, while a voice-over speaks the object label. Children were tested for whether they demonstrated evidence of learning after viewing the DVD in their home environment over a 6-week period.

METHODS

Participants were randomly assigned to a DVD viewing group and a no DVD group; each group made 4 visits to the laboratory, spaced approximately 2 weeks apart (initial visit, 2 weeks, 4 weeks, and 6 weeks). For analyses in this article, we compared the first and final visits; the mean (SD) time between the first and final visit was 6.17 (0.98) weeks. The DVD viewing group was instructed to watch the DVD 5 times in each 2-week period between visits but otherwise follow their normal routine. Parents were told to use the DVD as they would use other children's media in their homes, leaving it up to the parents to decide who, if anyone, would watch the DVD with their children. To monitor usage, parents were given a viewing-time diary to fill in dates and times when viewing occurred. Although there was no mechanism to monitor children's attention to the screen at home, previous research has found high levels of looking by children 12 to 18 months of age when watching *Baby Mozart* (The Baby Einstein Company), a video specifically for babies.¹⁰ The no DVD control group did not view the target DVD and were instructed to follow their normal home routines. Because there was no comparable intervention with the no DVD group, participants in the no DVD group returned at the same intervals as the DVD exposure group to ensure all participants had equal exposure to our testing materials. Thus, all parents knew the specific words we were tracking.

All children participated in an initial visit in our laboratory in which they were tested on a variety of measures, including the Bayley Scales of Infant and Toddler Development-III (BSID-III).¹¹ Parents answered a series of questions about their children's exposure to DVDs in general and to *Baby Einstein* DVDs specifically. On this survey, parents indicated how often their child watched DVDs and *Baby Einstein* DVDs on a scale of 1 (never) to 5 (every day). Parents also indicated the first age at which their child had watched a DVD or a *Baby Einstein* DVD on a scale from 0 (not yet) to 5 (15 months).

Knowledge of the specific words highlighted in the target DVD was measured 3 ways at all 4 visits. First, in the "words

understood" checklist, parents self-reported which words their children could understand of a list of 30 words highlighted in the DVD. Second, in the "words said" checklist, parents identified which words their children could say of the same 30 words. The parental report of words understood and words said is similar to the widely used MacArthur Communicative Development Inventory (CDI),^{12,13} which was given to approximately half of the parents at the final visit (n=37). Third, in the "picture identification" task, children were shown paired pictures of objects, chosen from among the 30 DVD-highlighted words, and asked to point to a target word. Because all parents knew which words were being tested, we expected any parental coaching effects to be the same in the DVD and no DVD groups.

In their final visit to the laboratory, and after collecting the words understood, words said, and picture identification measures, parents and children in both the DVD and no DVD groups engaged in a joint viewing of the target DVD. Viewing took place in a special viewing room set up like a living room, with 2 couches and assorted toys and books accessible to children. Parents were instructed to view the DVD with their children as they would at home but were not given special instructions about talking to their children or trying to teach content. The transcriptions of these joint-viewing episodes were coded for instances of parent and child use of the same 30 DVD-highlighted words in the parent report vocabulary tasks, including different versions of the same words (eg, fridge, phone, doggy) while excluding similar but distinct words (eg, kitty, puppy). Transcripts were coded for instances of the DVD-highlighted words for both parents and children individually to create 2 variables (range, 0-30): parent target word use and child target word use. The means of these variables for each group are in the **Table**. Thirteen of the transcripts (approximately 20%) were coded by 2 independent coders to calculate interrater reliability. Overall percentage of agreement was 98.8%, and Pearson *r* was 0.99 and 0.97 for parent and child use of the target words, respectively.

Participants in this study were 96 children between the ages of 12 and 25 months and their primary caregivers (77 mothers, 7 fathers, and 4 other) in Riverside County and surrounding communities in southern California. Participants' age ranged from 52 weeks to 109 weeks (mean [SD], 72.68 [17.14]). There were 52 boys and 44 girls. The participants were ethnically diverse: 50% white, 25% Hispanic/Latino, 8% black, 5% Asian, and 3% multiracial. The mean yearly household income was \$55 234.45. Parents were recruited through direct mailings and local advertisements to participate in a study about the impact of baby videos on young children. All participants were compensated \$25 for each visit to the laboratory.

To participate, English had to be spoken as the primary language in the home; 8 participants were excluded because English was not their primary language. The demographic information for the remaining participants in each exposure group can be found in the **Table**. None of the demographic variables significantly differed between exposure groups. In addition, because the nature of our analyses required that participants with missing data be dropped at certain points, not all participants were included in all analyses. The **Table** lists the number of participants included in each analysis. The subset of participants for each set of analyses did not differ significantly from the full set of participants on any of the demographic variables, with 1 exception. Participants in the CDI analyses were significantly older than the participants not included in those analyses ($t_{86}=13.08$; $P<.001$; mean=89.00 vs 60.84 weeks, respectively).

The first set of analyses examined the relationship between children's exposure to DVDs in the home environment and their gross measurements of language (CDI) and cognitive ability (BSID-III). On the CDI, 8 of the words were also highlighted in the DVD. We compared 3 aspects of the CDI scores for the 2 exposure groups: children's overall CDI score, children's CDI

Table. Participant Information

	Mean (SE)		
	Overall (n=88)	DVD (n=44)	No DVD (n=44)
Age, wk	72.68 (1.83)	74.55 (2.66)	70.82 (2.50)
Sex			
M	47	22	25
F	41	22	19
Household monthly income, \$	5138.98 (689.32)	4309.03 (565.86)	5983.52 (1267.53)
Ethnicity, No. of participants			
White	48	24	24
Hispanic/Latino	20	9	11
Black	8	4	4
Asian	3	0	3
Other	9	7	2
BSID-III score	49.12 (0.93)	50.62 (1.22)	47.65 (1.37)
Child's media environment			
Amount viewing DVDs score	3.10 (0.13)	3.39 (0.16)	2.81 (0.20)
Amount viewing BE DVDs score	1.93 (0.11)	2.11 (0.17)	1.75 (0.14)
First age watched DVD, mo	3.40 (0.44)	3.87 (0.73)	2.98 (0.50)
First age watched BE DVD, mo	1.76 (0.19)	1.71 (0.25)	1.81 (0.30)
Educational importance score	3.45 (0.07)	3.57 (0.09)	3.03 (0.11)
Noneducational importance score	2.60 (0.11)	2.66 (0.13)	2.50 (0.17)
CDI score (n=37)			
Overall	42.38 (4.10)	38.19 (4.95)	47.88 (6.83)
DVD-highlighted words only	5.57 (0.38)	5.24 (0.53)	6.00 (0.52)
Without DVD-highlighted words	36.81 (3.82)	32.95 (4.54)	41.88 (6.47)
Words understood (n=61)			
Time 1	17.09 (0.81)	17.92 (1.19)	16.26 (1.13)
Time 4	20.57 (0.90)	20.83 (1.32)	20.31 (1.25)
Words said (n=62)			
Time 1	5.97 (0.70)	5.54 (1.01)	6.40 (0.98)
Time 4	9.81 (0.62)	9.54 (1.00)	10.09 (0.97)
Picture identification (n=71)			
Time 1	1.53 (0.15)	1.60 (0.21)	1.47 (0.21)
Time 4	1.92 (0.17)	1.91 (0.23)	1.93 (0.24)
Joint viewing (n=65)			
Parent DVD words	15.43 (0.97)	17.50 (1.40)	13.36 (1.36)
Child DVD words	3.08 (0.40)	1.98 (0.58)	4.18 (0.56)
Child new DVD words	0.37 (0.11)	0.26 (0.10)	0.47 (0.17)

Abbreviations: BE, *Baby Einstein* (Walt Disney Company The Baby Einstein Company, Glendale, California); BSID-III, Bayley Scales of Infant and Toddler Development-III¹¹; CDI, MacArthur Communicative Development Inventory.¹²

scores subtracting the DVD-highlighted words, and children's knowledge of the DVD-highlighted words. As noted later, there were no significant differences between the groups on any of these measures, so the remaining analyses focused on the overall CDI scores. We conducted a series of simple regression analyses predicting overall CDI score from parents' reports of children's daily exposure to DVDs, children's exposure to *Baby Einstein* DVDs specifically, and the first age at which children had watched a DVD and a *Baby Einstein* DVD. These same regression analyses were conducted using children's BSID-III scores as the dependent variable. We controlled for age in all regression analyses.

In the second set of analyses, we examined the relationship between DVD exposure and children's knowledge of the spe-

cific words highlighted in the DVD by conducting 3 separate repeated-measures analyses of covariance (ANCOVAs) for words understood, words said, and picture identification. Because not all participants had data for the middle visits, only data from the first and final visits were included in the analysis. As noted in the Table, missing or incorrectly filled in forms resulted in different numbers of participants being included in each ANCOVA. In each ANCOVA, time (time 1 vs time 4) was the within-subjects variable, exposure group (DVD vs no DVD) was the between-subjects variable, and age (in weeks) was the covariate. The means and standard errors of these variables are indicated in the Table.

In the third set of analyses, we examined the transcripts of parent-child coviewing in the final session to provide a description of how parents and children watched the DVD. This analysis provided us with the means of contextualizing the findings regarding word learning from the DVD. Although a laboratory environment is not as natural as a home environment, the coviewing provided a means for documenting how much of parents' talk reflected the intended educational content of the DVD and whether parents' attempts to engage children with the DVD resulted in children's use of DVD-highlighted words. Two ANCOVAs were used to examine parents' and children's use of the 30 target words highlighted in the DVD during the joint-viewing session with exposure group (DVD group vs no DVD group) as the between-subjects variable and age as a covariate. Regression analyses were conducted to examine the relationship between parents' and children's use of the target words in the joint-viewing session.

RESULTS

In the first set of analyses, we examined measures of children's general language knowledge (CDI) and cognitive ability (BSID-III). Analyses of covariance indicated no significant difference in the BSID-III scores for the 2 exposure groups, and none of the parent report variables regarding exposure to DVDs generally or *Baby Einstein* DVDs specifically significantly predicted children's BSID-III scores when controlling for age.

Three ANCOVAs were conducted comparing the CDI scores (CDI overall, CDI DVD-highlighted words only, and CDI without DVD-highlighted words) for the 2 exposure groups (DVD vs no DVD). None of the CDI scores were significantly different by exposure group, and remaining analyses focused on the overall CDI scores. The regression analyses, controlling for age, indicated children's overall CDI scores were not significantly predicted by how often they watched DVDs in general, *Baby Einstein* DVDs specifically, or the first age at which they had watched a DVD. However, CDI scores were significantly predicted by the first age at which children had watched a *Baby Einstein* DVD ($B = 3.91$; $P = .05$; 95% confidence interval [CI], 0.051-7.76), independently of the effects of age (model $r^2 = 0.33$; $P < .001$; age: $B = 0.81$; $P = .01$; 95% CI, 0.23-1.396). Because parents responded ordinally to these questions, there is not a 1-to-1 relationship between the B value and age. Children who first watched a *Baby Einstein* DVD when they were younger had lower CDI scores.

In the second set of analyses, we examined whether children demonstrated learning of the 30 specific words highlighted in the DVD and found a similar pattern of findings for the 2 parent report measures of word learn-

ing. For words understood, the repeated-measures ANCOVA revealed a main effect of time ($F_{1,58}=15.51$; $P<.001$; partial $\eta^2=0.21$; power=0.97), a main effect of age ($F_{1,58}=42.45$; $P<.001$; partial $\eta^2=0.42$; power=1.00), and an interaction between time and age ($F_{1,58}=6.23$; $P=.02$; partial $\eta^2=0.10$; power=0.69). For words said, there was a main effect of time ($F_{1,59}=5.51$; $P=.02$; partial $\eta^2=0.09$; power=0.64), a main effect of age ($F_{1,59}=42.45$; $P<.001$; partial $\eta^2=0.62$; power=1.00), and an interaction between time and age ($F_{1,59}=97.69$; $P<.001$; partial $\eta^2=0.23$; power=0.98). For the picture identification measure, there was only a main effect of age ($F_{1,68}=68.69$; $P<.001$; partial $\eta^2=0.50$; power=1.00). However, there were no differences between the DVD group and the no DVD group for words understood, words said, or picture identification. Thus, regardless of DVD group, parents reported children understood and said more target words at the end of 6 weeks. Older children understood and said more words during that period than did younger children. In summary, other than the general gains in word knowledge attributable to time and age, children who viewed the DVD at home over 6 weeks did not demonstrate new knowledge of the DVD-highlighted words.

The third set of analyses examined transcripts of parent-child joint viewing of the DVD. First, we would not expect children to repeat every word they could say while watching the video, and parents may not be aware of every word their children can say. Second, the following analyses should be interpreted within the context of parents' and children's observed use of the target words in comparison with parents' reports of the words children could already say in the final visit. In the case of the joint-viewing episode, children only said about one-third of the DVD-highlighted words (mean [SD], 2.84 [4.92]) that their parents indicated the children could say (mean [SD], 9.12 [9.19]). In contrast, parents said nearly twice as many of the DVD-highlighted words (mean [SD], 15.09 [8.01]) than they reported their children could say at the final visit, indicating some attempt by parents to use the DVD to teach their children words in this setting. Given these findings, we examined if parents differed based on whether they had been in the DVD or no DVD group and how children responded to these attempts by parents.

For parents' use of the target words during the joint-viewing session, there was a main effect of DVD group ($F_{1,60}=5.87$; $P=.02$; partial $\eta^2=0.09$; power=0.66) and a significant interaction between DVD group and age ($F_{1,60}=3.92$; $P=.05$; partial $\eta^2=0.06$; power=0.50). In follow-up regression analyses with only the participants in the DVD group, age did not significantly predict parents' use of the words. For the no DVD group, age was a significant predictor of parents' use of the target words ($r^2=0.17$; $P=.02$; $B=0.18$; 95% CI, 0.03-0.34). As evidenced in **Figure 1**, parents of the older children did not vary the number of words used based on prior exposure, whereas parents of the younger children were more likely to use the target words if their children had seen the DVD before. In other words, parents of younger children who had prior exposure to the DVD were more likely to engage their younger children with the content of the DVD.

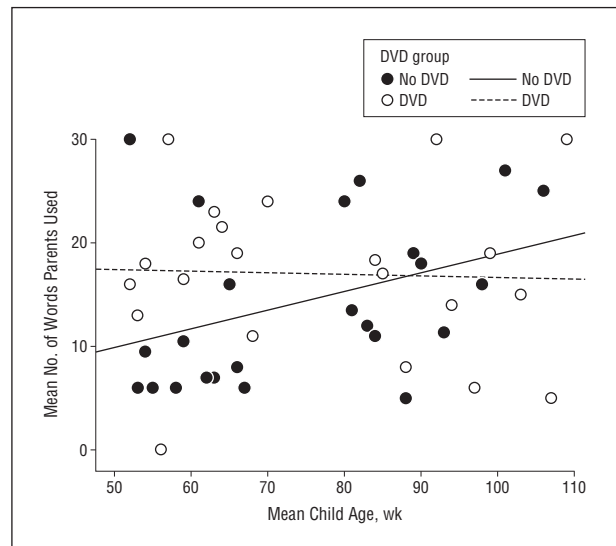


Figure 1. Age \times DVD group interaction for words said by parents.

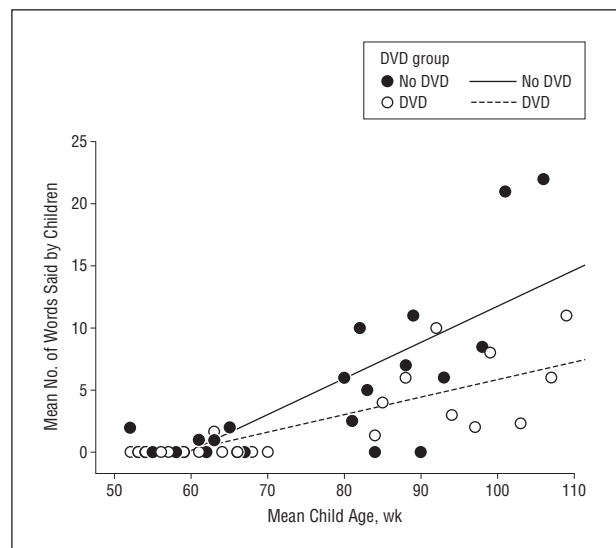


Figure 2. Age \times DVD group interaction for words said by children.

In terms of children's use of the target words during the joint-viewing session, there was a main effect of DVD group ($F_{1,60}=5.43$; $P=.02$; partial $\eta^2=0.08$; power=0.63), a significant effect of age ($F_{1,60}=67.28$; $P<.001$; partial $\eta^2=0.53$; power=1.00), and a significant interaction between DVD group and age ($F_{1,60}=9.33$; $P=.003$; partial $\eta^2=0.14$; power=0.85). In follow-up regression analyses with only the participants in the DVD group, age was a significant predictor of children's use of the words ($r^2=0.46$; $P<.001$; $B=0.12$; 95% CI, 0.07-0.11). For the no DVD group, age was a significant predictor of children's use of the target words ($r^2=0.58$; $P<.001$; $B=0.25$; 95% CI, 0.17-0.32). As is evident in **Figure 2**, the interaction between age and DVD group can be seen in the different slopes in the lines; younger infants were unlikely to say DVD-highlighted words regardless of DVD group, whereas older children were more likely to say DVD-highlighted words if they were in the no DVD group and watching the DVD for the first time.

Finally, we examined whether children used new words in the joint-viewing session that their parents had not previously indicated the child could say. Overall, children said a total of 22 new DVD-highlighted words in the joint-viewing session that parents had not reported children could say at the final visit. A simple regression analysis indicated use of new words in the joint-viewing session increased with age ($r^2=0.45$; $P<.001$; $B=0.18$; 95% CI, 0.13-0.22). Six of the children saying new words were in the DVD group and 10 were in the non-DVD group. Examined more closely, of the 22 total new words said by children in both groups during the joint-viewing session, in 12 of those instances the parent said the word first. In the remaining 6 instances, parents were actively drawing their children's attention to the screen or into discussion about what was happening on-screen. In only 4 cases did children spontaneously say the word after it was highlighted in the DVD.

COMMENT

The primary goal of this study was to examine whether 12- to 25-month-old children learned words from multiple exposures to a DVD produced for that purpose when viewed in their home environment. Apart from the gains in word knowledge we would expect from developing children, there was no evidence that children learned words specifically highlighted in a DVD focused on teaching children those words. Additionally, exposure to the DVD was unrelated to our measures of general language learning, providing no evidence that exposure to this DVD over 6 weeks either helped or hindered children's general language learning.

A secondary goal was to examine whether general exposure to *Baby Einstein* DVDs was related to children's general language knowledge. Although we did not find evidence of a relationship between amount of viewing *Baby Einstein* DVDs and general language development, there was a relationship between general language knowledge and the age at first exposure to *Baby Einstein* DVDs. Earlier exposure was related to lower scores on a measure of general vocabulary knowledge. Our finding that the age of first viewing of a *Baby Einstein* DVD is related to vocabulary is important because it is an indicator that an "early-viewing" home may be different in important ways than a "late-viewing" home. Other research demonstrating a relationship between early viewing of baby DVDs and poor language development has speculated several possibilities for this result: parents who are concerned about their children's poor language abilities may use baby DVDs to try to teach their children, parents who use baby DVDs early may be less likely to engage in behaviors that promote language development, or early viewing of baby DVDs may actually impair language development.⁵ Our findings do not indicate that early exposure is equivalent to cumulative exposure or allow us to delineate which aspects of an early-viewing home environment may affect language learning. However, our findings do contribute to a growing body of research suggesting the importance of considering the timing of first exposure to infant-directed media.

Finally, although increases in the amount of audible video noise from television have been associated with decreased parent talk,¹⁴ we found parents tended to repeat many of the words highlighted in the video in a laboratory setting. Even in this setting, however, in which we may expect increased attempts by parents to teach their children using the DVD, the repetition of words was not always associated with children's use of those words. When children did say words their parents had previously indicated the children could not say, this primarily occurred when the parents had also said the word or were drawing children's attention to the DVD.

We conclude by encouraging researchers, parents, practitioners, and programmers to consider the variety of cognitive factors related to whether very young viewers should be expected to learn from a DVD, regardless of DVD intent.¹⁵ Many cognitive factors play a role in learning from screens at this age, including children's developing perceptual systems,¹⁶ their understanding of symbols and analogy,¹⁵ and their developing abilities to discriminate how much they should trust different sources of information.¹⁷ Given that children younger than 2 years are developing all of these capabilities, we may not expect them to learn some kinds of content from a television screen.

Regarding word learning specifically, a large body of language acquisition research suggests infants are more likely to learn words for novel objects if a speaker is looking at an object rather than attending elsewhere or looking directly at the child.¹⁸ Thus, learning words from a television screen requires children to be paying attention to the screen and also to be aware of the relevant referent object to which the on-screen labeler is referring. In the case of the DVD used in this study, the on-screen character looked directly at the children and signed the name for the object while a voice-over spoke the label. This scenario is very different from the optimal word-learning scenario for children younger than 2 years.

Furthermore, recent research has demonstrated that even children aged 2.5 to 3 years needed the support of social interaction to successfully learn verbs from video.¹⁹ The additional support of the social interaction may have led to heightened arousal of the children, provided additional verbal and nonverbal information, and offered another mode of presentation. As we observed in our joint-viewing sessions, children who spoke new words were most likely to do so either following parents' use of the word or parents' general talk about what was happening on screen. Given that infant-directed media have become nearly ubiquitous aspects of many infants' lives, future research should continue to examine whether and how parents can use these DVDs effectively to teach their young children.

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Announcement

Submissions. The Editors welcome contributions to Picture of the Month. Submissions should describe common problems presenting uncommonly, rather than total zebras. Cases should be of interest to practicing pediatricians, highlighting problems that they are likely to at least occasionally encounter in the office or hospital setting. High-quality clinical images (in either 35-mm slide or electronic format) along with parent or patient permission to use these images must accompany the submission. The entire discussion should comprise no more than 750 words. Articles and photographs accepted for publication will bear the contributor's name. There is no charge for reproduction and printing of color illustrations. For details regarding electronic submission, please see: <http://archpedi.ama-assn.org>.