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Content Analysis of Language-Promoting Teaching Strategies Used in Infant-Directed Media

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The number of videos produced specifically for infants and toddlers has grown exponentially in the last decade. Many of these products make educational claims regarding young children's language development. This study explores infant media producer claims regarding language development, and the extent to which these claims reflect different distributions of strategies known to promote young children's language development in live contexts. A content analysis of 58 DVDs for children under the age of three years was conducted. Claims related to language development and general knowledge information were identified from packaging and promotional materials. Video content was examined scene-by-scene for language-promoting strategies. Finally, scene-level content matching the specific language or general knowledge claims was 'tagged'. Videos with more explicit language claims had a significantly higher percentage of scenes with language content and language-promoting strategies than those without such claims. Verbal labels of onscreen referents were common across videos. Onscreen print significantly co-occurred with language claims, which was surprising given that infants were the target audience and they cannot read. Production techniques that are likely to increase orientation to important language content, such as sound effects, and audience elicitation, significantly co-occurred with language content, but point/give objects or follow gaze teaching strategies and vocabulary definitions were only infrequently used. Implications for the creation of

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developmentally appropriate videos for infants and toddlers are discussed. Copyright © 2010 John Wiley & Sons, Ltd.

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Viewing videos has become a normative behaviour for US infants and toddlers. Recent surveys indicate that 61% of children under age two watch TV and videos on average for 79 minutes in a typical day (Rideout & Hamel, 2006). Reflecting the recent explosion of infant-directed videos, the average US family with a 6-month-old child currently has at least four infant-directed videos, and by 18 months of age this number jumps to more than seven (Barr, Danziger, Hilliard, Andolina, & Ruskis, 2010a). Data are not available for other countries but total usage of media is typically lower in European countries (Obel *et al*., 2004). Many parents of infants and toddlers use these products with the expectation that they will confer some educational or developmental benefit to their child (Zimmerman, Christakis, & Meltzoff, 2007b).

It appears that the producers of infant and toddler media products have realized that the unique developmental stage of infancy warrants specialized content. Generally, young children learn best from media with content and structure that reflect their specific developmental abilities, interests, and needs (see Linebarger & Vaala, 2010). In fact, the majority of popular infant-directed media products market themselves as educational or beneficial for young children's development (Fenstermacher *et al*., a,b, this volume). Unfortunately, most of these educational claims have been made without empirical research to support their accuracy (Garrison & Christakis, 2005). The purpose of this study was to conduct a content analysis of infant-directed videos, focusing on the content and strategies that are germane to language development, a key area of development during the first years of life.

Early Language and Communication Development

Learning to communicate is one of the most vital skills an infant acquires during the first three years of life. By the age of three years, language trajectories are resistant to change even with intensive intervention (Hart & Risley, 1995; Young *et al*., 2002). Language development is a privileged domain, in which there is a delimited period of time when the ability to learn is at its peak, after which the same 'experiential exposure' is not as effective (p. 112; Newport, 1991). Most children learn to communicate despite wide variations in their linguistic exposure (Hart & Risley, 1995; Shonkoff & Phillips, 2000). However, the combination of quantity and quality of linguistic exposure directly influences a number of higher-order language skills whose developmental functions are particularly vulnerable to environmental variations including vocabulary size and expressive language use (Gauvain, 2001; Hart & Risley, 1995; Hoff, 2006; Walker, Greenwood, Hart, & Carta, 1994). Frequent participation in verbal and non-verbal social exchanges with competent others (e.g., older siblings, parents, and teachers) predicts infants' facility with the forms and functions of language (Gauvain, 2001; Hoff, 2006; Linebarger & Vaala, 2010 for a review).

Pairing language that is developmentally appropriate in live contexts with early screen exposure is an important step for understanding whether and how screen media influence language development. The purposes of this study were

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to analyze the content of infant-directed screen media at both the macro- and molecular-levels. Macro-level characteristics are those associated with a video as a whole (e.g., what percentage of the video sample contained language-related educational claims). Molecular-level characteristics are those found within a predefined scene contained within the video. Time spent with infant-directed media containing quality language models and teaching strategies may assist young children's language development (see Linebarger & Vaala, 2010). On the other hand, time spent with media lacking these features may in fact hinder infants' and toddlers' language development by supplanting time that could be spent with better linguistic sources and partners.

Language-Promoting Strategies Used During Adult–Child Interactions

In efforts to establish what constitutes appropriate language stimulation, researchers have conducted studies documenting language exchanges between infants and adults. Two types of talk emerged from a longitudinal study of early language development: business talk and extra talk (Hart & Risley, 1995; Risley & Hart, 2006). Business talk primarily contains directive statements (e.g., pick up your toys and eat your vegetables) and prohibitions (e.g., no, stop that, and shut up), and is relatively unsophisticated and to-the-point. In comparison, extra talk is characterized by the frequent use of strategies such as descriptive talk, questioning, establishment of joint attention, extended turn-taking, and modeling literacy skills. Optimal language outcomes are linked to infant environments that feature many and varied exposure to these extra talk strategies (e.g., Gottfried, 1984). Each strategy is reviewed below.

Descriptive talk

This type of talk is comprised mainly of commenting and labelling strategies. In book-reading contexts, parents' labelling and elaboration, as well as questioning strategies, positively impact young children's receptive (i.e. understood but not spoken) and productive (i.e. spoken) vocabulary acquisition (Fletcher & Reese, 2005; Moerk, 1985). As children's language skills develop, mothers gradually change their labelling during storybook reading from simple object identification (e.g., 'that's a wagon') to increasingly elaborate statements (e.g., 'that's a red wagon like yours'; Moerk, 1985). This progression helps children to build on their existing language skills to develop an increasingly rich vocabulary. Ninio (1983) observed the importance of maternal sensitivity to 17- to 22-month-olds apparent level of knowledge. Mothers in this study increased the number of their child's correct spoken labels by asking questions during book-reading sessions, and by offering labels of objects and actions unknown to the child. Mothers who based their use of either questioning or labelling on the child's existing knowledge had children with larger vocabularies.

Questioning and turn-taking

The success of questioning as a language-promoting strategy may operate by prompting a young child's engagement in social interactions. In longitudinal analyses, Hart and Risley (1992; 1995) found that the parents' use of questions with their young children was positively associated with subsequent language development and IQ scores. They theorized that asking questions encourages children to become and remain engaged in the verbal exchange. Before children have acquired the language skill necessary to respond, parents answer their own questions. This behaviour models the turn-taking of a real dyadic conversation

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and sustains the interaction for a longer period of time (Hart & Risley, 1992; see also Brown, 2000). In fact, typically developing children learn the form and function of conversational turn-taking before they begin talking (Tomasello & Farrar, 1986).

Joint attention

Joint attentional abilities are characterized by an array of reciprocal and dynamic exchanges among infants, objects or events, and social partners (Moore & Dunham, 1995). To qualify as joint attention, both partners in the exchange must be aware of the other's shared attention (Markus, Mundy, Morales, Delgado, & Yale, 2000). A number of behaviours are used to coordinate attention between an infant, a parent, and an object (Stahl, 2005). These include the ability to follow another's gaze, the ability to engage in social referencing, and the use of gestures, such as pointing, showing, and offering (see Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998). Joint attentional episodes help infants to direct their attention towards key perceptual and linguistic features while filtering out irrelevant or incidental stimuli (Baldwin, 1994; Carpenter *et al*., 1998; Langton & Bruce, 2000). Verbal statements (e.g., 'look!') and non-verbal gestures (e.g., pointing; head-turning) from caregivers help young children to direct their gaze and establish joint attention (Baldwin & Moses, 2001). In longitudinal analyses, shared focus between babies and their caregivers has been consistently associated with better vocabulary development (see Hoff, 2006; Mundy *et al*., 2000).

Early literacy skills

As children approach the preschool years, alphabet knowledge and phoneme awareness become important pre-literacy skills related to their later language and literacy mastery. Alphabet knowledge involves the understanding of the name and sounds associated with each letter of the alphabet, whereas phonemic awareness is the ability to detect and manipulate different sound units of spoken words (i.e. phonemes). In a review of correlational studies, the National Reading Panel (2000) found that phonemic awareness and letter knowledge at school entry are 'the two best school-entry predictors of how well children will learn to read during the first 2 years of instruction' (p. 7). Experimental training studies have further supported the crucial role of phonemic and alphabet awareness in preschoolers' language and literacy development, leading the National Reading Panel's report to conclude that young children's development of alphabet and phonemic awareness requires 'explicit and systematic' training on how to identify and manipulate letters and phonemes. Children begin to learn their 'ABC's' as toddlers and begin to accumulate experience with print and phonemic concepts, though these skills are not formally mastered until the preschool or kindergarten years.

Language-Learning from Mediated TV/Video Experiences

Currently, little is concretely known about infants' and toddlers' language-learning from television, and the features that enhance or inhibit that learning. Existing research suggests that at least some of the language-promoting strategies discussed above may be beneficial to infants and toddlers when embedded in screen media, in addition to aiding learning in live contexts. Observing parents co-viewing with their 12- to 18-month-old infants, Barr, Zack, Garcia, and Muentener (2008) found that caregivers mediated their children's processing of televised content by scaffolding the viewing experience. Infants whose parents asked questions, labelled objects, and described program content displayed increased looking time and higher levels of responsiveness to infant-directed

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video content. Similarly, the quality of co-viewing interactions between parents and their infants predicted 9- to 18-month-olds' looking time in another observational study (Fidler, Zack, & Barr, 2010). It is possible that embedding features such as spoken labels and questioning into infant- and toddler-directed media could also direct young children's attention towards important content, thereby positively influencing language acquisition. These strategies are likely to be particularly beneficial when children co-view with caregivers who repeat, read key content aloud, and link that content to infants' previous experiences and background knowledge.

Screen media content that simulates face-to-face conversational exchanges by prompting viewer participation (e.g., directly addressing the viewer; pausing for a reply; providing feedback and praise) has been found to structure preschoolers' viewing as well as to enhance their involvement and learning from the program (e.g., *Blue's Clues*; *Dora the Explorer*; Calvert, Strong, Jacobs, & Conger, 2007; Crawley, Anderson, Wilder, Williams, & Santomero, 1999). Similarly, one longitudinal study found that infants and toddlers who watched television programs with embedded audience participation prompts had better language skills at 30 months compared with peers who did not watch such programs (Linebarger & Walker, 2005). Although the latter study was correlational, its findings suggest that characters who elicit viewer participation might be able to scaffold and boost babies' learning from the screen much like they do for older children.

Content that encourages joint attentional reference between the viewer and one or more onscreen characters may also aid very young viewers. One experimental study found that infants and toddlers were better able to learn words from video sources when the televised adult speaker explicitly encouraged the viewer's joint attention to the object that was labelled (Krcmar, Grela, & Lin, 2007). Although children's learning in this study was highest in response to video content created by the investigators (i.e. compared to commercially produced videos with puppets and voiceovers), it is possible that commercially available videos may operate similarly if they encourage joint attention and direct viewer engagement in a comparable manner.

The present study

Research linking media exposure and outcomes is mixed. On one hand, exposure displaced both the quantity and quality of parent–child interactions, predicted smaller vocabularies, and predicted attention problems in longitudinal correlational studies (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; Linebarger & Walker, 2005; Zimmerman, Christakis, & Meltzoff, 2007a). By contrast, other such research has linked screen media exposure to larger vocabularies and more expressive language use during play (Linebarger & Walker, 2005) and found no relations between early exposure and later attention problems (Foster & Watkins, 2010). The mixed findings indicate that a direct or straightforward effect from exposure to outcome is too simplistic. Instead, similar to research with children three years and older, outcomes associated with exposure are dependent on program content (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001; Wright *et al*., 2001). Because infants and toddlers have little prior knowledge and even less experience with screen media, it is equally important to evaluate how content has been arranged. Content arrangement is a function of the macro-level genre (e.g., narrative and expository) and the micro-level use of strategies and production techniques designed to facilitate understanding. By kindergarten, young children are quite capable of navigating content and understanding

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editing techniques implying changes in time and place (see Calvert, Huston, Watkins, & Wright, 1982).

To date, there is no published research systematically documenting the types and relative quantities of language-promoting strategies used in commercially available infant and toddler media. Given the lack of explanation from producers regarding the specific techniques used in their videos to promote language development, the documentation of strategies that effectively teach language skills to young children in real life settings is an appropriate starting place. Many of these techniques are likely to be helpful when used in media contexts; therefore, documenting their occurrence will allow follow-up study of their effectiveness in video format.

In a study published in this special issue, infant-directed video packaging, websites, and promotional materials make a variety of claims regarding the educational advantages for young viewers, particularly in the domains of language and communication, and general knowledge (e.g., animal names, math concepts; see Fenstermacher *et al*., a, this volume). In this study, we assessed whether strategies used to promote young children's language development in live contexts were more likely to be systematically used in programs that made language claims compared with general knowledge claims. Of particular interest was whether and how strategies and content co-occurred at the scene-level. The specific goals of this study were to conduct a content analysis of: (1) the frequency and nature of language-related claims found on media products designed for children under the age of three years, (2) to examine the quantity and type of language-promoting strategies (e.g., labelling; questions) known to promote young children's language development in live contexts in infant-directed videos, and (3) to investigate differences in language-promoting strategies based on specific language-related claims by producers.

One previous content analysis that used the same sample of videos described below was performed to detail a number of production techniques thought to mediate infant comprehension by reducing or increasing the complexity of presented content has been recently published (e.g., long, reflective zooms may support understanding while numerous cuts may reduce comprehension; Goodrich, Pempek, & Calvert, 2009). Another content analysis featured in this special issue based on the sample described below documents the macro-level features that were used to arrange and present content including genre (e.g., narrative, magazine, and expository) and program continuity (e.g., plot actions tightly connected, magazine with a loose thematic connection, and magazine with no thematic connection) (Fenstermacher *et al*., a, this volume). As a result, the content analysis presented below describes only molecular-level linguistic strategies that have been embedded in video content.

METHOD

Sample

This sample was the same one used in a formal feature analysis conducted by Goodrich *et al*. (2009), and the sampling procedure is described in detail in Fenstermacher *et al*. (a,b, this volume). An Internet search was conducted between Fall 2007 and Spring 2008 for all screen media available for children under the age of three years, yielding a comprehensive and exhaustive list of 218 DVDs. With the exception of five individually marketed infant DVDs, the

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majority of videos produced for infants were part of a series of two or more products. For each of these 26 series, two video titles were randomly selected for inclusion in our final sample by drawing them from a hat. In one case, due to packaging, three videos in a series were included. The final sample was 58 DVDs.

Claims Coding

All video claims were identified and coded according to the domain and to the nature of the claim (see Fenstermacher *et al*., a,b, this volume). Domains included the areas of language/communication, social-emotional, physical/motor, cognitive, and general knowledge. *Explicit* claims used specific verbs and strong wording (e.g., '*teaches* your child whole language and phonics…'). *Implicit* claims implied learning goals using non-specific terms including verbs such as 'explore' and 'introduce' paired with a specific behaviour (e.g., '*inspiring* early language development - from simple gestures to first spoken words'; '*encourages* speech'). *Explanatory statements* were claims regarding featured content, made in the absence of verbs or any learning outcomes (e.g., '*includes* music, letters, shapes and colors'; '*highlights* concepts of 'stop' and 'go''). Coding each discrete claim was mutually exclusive, although videos with multiple claims could be coded for more than one type of claim.

This study focuses on language/communication domain claims, as well as general knowledge claims for comparison purposes in scene-level co-occurrence analyses. Analyses testing for differences in the distribution of language strategies between videos were conducted using a combined implicit/explanatory category yielding three categories of video claims: no language claims ($N = 23$), explicit claims that infants would learn language-related content (explicit, $N = 18$), and either explanatory or implicit claims (explanatory/implicit, $N = 17$).

An operational definition was assigned to specific learning outcomes, goals, or behaviours listed for each type of claim (Scott-Little, Kagan, Frelow, & Reid, 2008). For example, where producers claimed that a video would teach new words, an operational definition of 'Demonstrates understanding of the meaning of words or identity of specific objects, through verbal or non-verbal communication; understanding of basic linguistic concepts such as opposites or action words' was assigned to that particular video (see Fenstermacher *et al*., a, this volume for a more detailed analysis of video claims).

Content Analysis

Scenes

The 58 videos were coded by scene to break the content into meaningful units of analysis. A scene was defined as one physical location where some action takes place (Wright *et al*., 1984). The mean scene change rate was 3.21 scene changes per minute (S.D. = 2.75; see Goodrich *et al*., 2009).

Domain content

The dominant developmental domain represented by the general content was identified for each scene. Scenes that were coded for dominant content reflecting language/communication (e.g., interpreting meaning from written symbols, letter-writing, book reading) or general knowledge/information domains (e.g., concepts related to mathematics or animals; see Fenstermacher *et al*., a, this volume) were analyzed in this study.

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Claims within scenes

Coders then tagged all scenes for content that reflected the specific claims made by the producers. For example, if a video claimed to teach 'numbers', any scenes featuring numbers were 'tagged' as having content that matched producers' educational claims.

Language-strategies coding

The final set of passes involved coding each scene for the presence of specific language-teaching strategies. These strategy codes were developed by conducting an iterative review of the extant research on young children's language development. Individual strategies were coded as absent or present in each scene even when a scene contained more than one instance of the given feature. The present analysis was based on 13 strategies, 10 of which were considered potentially appropriate for promoting language, while three strategies (i.e. simple label with mismatched visual referent; descriptive label with mismatched referent; and onscreen print with no matched referent) were deemed inappropriate or poor language models because they included either a mismatched visual referent or none at all (see Table 1 for code descriptions). To examine the relative density of distribution of language-promoting strategies broadly, variables were constructed regarding the percentage of scenes in each video with at least one language-promoting strategy, and the average number of language-promoting strategies in each video. The strategies deemed inappropriate (i.e. labels and onscreen print with mismatched or missing visual referents) were not included in the construction of these variables.

DATA ANALYSIS PLAN

Analyses of Variance

Analysis of variance (ANOVA) models were used to test the relations among types of claims targeting language and communication development (i.e. on packaging; producer's website), the amount of language domain content, and the number of language-promoting strategies at the macro- or video-level. Videos were classified as having explicit, explanatory/implicit, or no language claims. Differences between the mean of these three groups were compared for the following: percent of scenes containing general language/communication domain content; percent of scenes containing at least one language-promoting strategy; average number of strategies per scene; and percent of scenes featuring each of the language-promoting strategies of interest. To determine which specific groups differed, *post hoc* tests (i.e. Tukey's HSD; or Dunnett's T3 depending on significance of Levene's test) were calculated for significant models.

Co-occurrence Analyses

To further contextualize how language content and language-promoting strategies were depicted onscreen, co-occurrence analyses were conducted as described in Fenstermacher *et al*. (b, this volume). In this paper, we test whether (1) language-promoting strategies co-occurred in scenes tagged for language claims or for general knowledge claims and whether (2) any discrete language strategies co-occurred (e.g., questions and labels) with each other more or less

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Table 1. Language-promoting strategy descriptions and distributions across videos and scenes

Language strategy	Coding description	% videos with strategy[a]	% scenes with strategy[b]
Letter/phoneme identification[9,19,22]	Verbal/visual identification of letters or the basic sounds in words	15.52 (9 videos)	1.26
Simple label			
Matched referent*[3,7,11,12,17,20]	The name/title of an object is stated and matched with a visual depiction	22.41 (13 videos)	5.99
Mismatched referent*[3,7,11,12,17,20]	The name/title of an object is stated and mismatched to visual depiction	13.79 (8 videos)	0.27
Descriptive label			
Matched referent*[3,7,11,12,17,20]	Label (in sentence with elaboration) matches a visual depiction	89.66 (52 videos)	21.30
Mismatched referent*[3,7,11,12,17,20]	Label (in sentence with elaboration) unmatched visual depiction	39.66 (23 videos)	1.17
Onscreen print[15,25]		87.93 (51 videos)	22.52
Matched referent	Print accompanied by a matched visual picture or verbal statement	79.31 (46 videos)	19.78
No matched referent	Print is not accompanied by either a verbal statement or a visual depiction	51.72 (30 videos)	2.52
Questions[4,10,11,12,17,24]		51.72 (30 videos)	3.29
'Wh' question	Open-ended questions between characters (e.g. 'where'; 'why')	41.38 (24 videos)	1.67
Yes/no question	Questions that elicit a yes/no response	44.83 (26 videos)	1.67
Verbal vocabulary definition[11,12,21]	A word is presented in some way to teach its meaning	36.21 (21 videos)	0.36
Orienting to Objects[1,2,5,6,23]	Character speech or visual production techniques to elicit/direct attention	86.21 (50 videos)	15.18
Point/give or follow gaze[1,2,6,14,18,23]	Character points to/looks towards object/person to signal other character	10.34 (6 videos)	0.11
Audience elicitation[4,8,10,13,16,17]	Character looks at and directs speech directly to the viewer	58.62 (34 videos)	8.54

[a]$N = 58$ videos.
[b]$N = 6691$ scenes in all videos.
*_Note_: Labeling codes (i.e. simple; descriptive) included both ostensive labels (i.e. spoken words directed at the child while a visual referent is depicted) and 'over-heard' labels (i.e. one character labeling an object for another character). These two label types were collapsed because the 'over-hearing' labels were both rare and at times difficult to distinguish from ostensive labeling in our sample. Though research indicates young children can also learn from the presentation of a visual referent before or after the spoken label (i.e. non-ostensive labeling; see Tomasello & Barton, 1994; Tomasello *et al.*, 1996), such instances were both rare and difficult to reliably code in our sample and were thus omitted. *References*. [1]Baldwin (1994); [2]Baldwin and Moses (2001); [3]Barr *et al.* (2008); [4]Brown (2000); [5]Calvert *et al.* (1982); [6]Carpenter *et al.* (1998); [7]Fletcher and Reese (2005); [8]Hardy-Brown and Plomin (1985); [9]Harste, Woodward, and Burke (1984); [10]Hart and Risley (1992); [11](1995); [12] Risley and Hart (2006); [13]Krcmar, Grela, and Lin (2007); [14]Langton and Bruce (2000); [15]Lawhon and Cobb (2002); [16]Linebarger and Walker (2005); [17]Moerk (1985); [18]Mundy *et al.* (2000); [19]National Reading Panel (2000); [20]Ninio (1983); [21]Senechal *et al.* (1995); [22]Shonkoff and Phillips (2000); [23]Stahl (2005); [24]Tomasello and Farrar (1986); [25]Whitehurst *et al.* (1988).

than expected by chance. All the variables were dichotomous (i.e. each strategy was present or absent in a scene). Expected co-occurrences were calculated as the proportion of occurrences for one strategy multiplied by the number of occurrences for the other strategy (i.e. the number of co-occurrences expected by chance given the relative distributions of each strategy).

Two-way contingency tables were constructed for each variable combination across all 6691 total scenes across the 58 videos in the sample. Co-occurrence outcomes included: (1) the probability of a co-occurrence (the proportion of scenes where both variables occur); (2) the probability of each variable occurring independently of the other variable; (3) the conditional probability of one variable occurring given that the other occurred; and (4) the expected probability of co-occurrence (the product of the two independent probabilities of occurrence for each variable). Hypothesis testing involved testing for the presence of a dependency among multiple variable combinations (see Fenstermacher *et al*., b, this volume for further detail regarding co-occurrence analysis strategy). When the expected value of any of the cells in the contingency table was below five, Fisher's exact test was used. Pearson's Chi-Square test was used when no cells contained fewer than five cases. We used the method of Benjamini and Hochberg to control the false-discovery rate (Benjamini & Hochberg, 1995; see Fenstermacher *et al*., a,b, this volume for further detail regarding multiplicity correction).

RESULTS

Reliability

For claims coding, inter-rater reliability was calculated for 15 of the 58 videos surveyed (25% of the sample). For all educational claims, two coders independently assessed the macro-level content. Categories were mutually exclusive. Overall percent agreement between coders was 89% (kappa = 0.87). Overall inter-rater reliability for tagging claim-matching scene content was 81.57% agreement (kappa = 0.78). The language-teaching strategies codes included in the present analyses were broken into three different coding schemes. Between 20 and 25% of the videos were double-coded and the average Cohen's κ values was 0.81 (range 0.68–1.00).

Descriptive Statistics

Claims

General knowledge claims (30.8%) and language/literacy claims (28.75%) comprised the majority of claims found on packaging, website, and promotional materials. At the scene-level, tagged language claim content represented 36.57% of all tagged content. General knowledge represented 47.30% of all tagged content (for further detail see Fenstermacher *et al*., a,b, this volume).

Content

In total, 56.9% of videos contained at least one scene where language and literacy was the dominant content domain. The average video contained 23.24% of scenes with dominant language/literacy content (S.D. = 35.95). All videos contained at least one language-promoting strategy ($N = 58$). The average video contained 54.28% of scenes with at least one of these strategies (S.D. = 27.40).

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Table 1 details the language-promoting strategy distributions across videos and scenes. Descriptive matched labelling occurred in almost all videos (89.66% of videos). Onscreen print was the second highest at the video level (87.93%) and the most frequently included strategy at the scene level (22.52% of scenes). The rarest strategy at both the video level and the scene level was point/give or follow gaze (10.34% of videos; 0.11% of scenes).

Scenes and Strategies

A one-way (three levels; language claim type) between subjects ANOVA was computed for the mean percentage of scenes with language domain content. There was a significant main effect of claim type, $F(2, 55) = 40.07$; $p < 0.01$. A Levene's test of homogeneity of variance indicated that the variances were not equal across groups. *Post hoc* analyses were therefore performed using a Dunnett T3 analysis. As seen in Table 2, videos with explicit language claims contained a significantly higher percentage of scenes with language content ($M = 63.99$, S.D. = 40.11) than videos with explanatory/implicit language claims ($M = 8.30$, S.D. = 10.60, $p < 0.01$) and videos with no language claims ($M = 2.38$, S.D. = 6.16, $p < 0.01$).

A one-way (three levels; language claims type) between subjects ANOVA was computed for the mean percentage of scenes containing at least one language-promoting strategy. There was again a significant main effect of language claim type, $F(2, 55) = 3.87$, $p < 0.05$. *Post hoc* analyses (Dunnett T3) revealed that videos with no language claims contained the lowest percentage of scenes with at least one language-promoting strategy ($M = 42.96\%$, S.D. = 31.07) followed by videos with explanatory/implicit claims ($M = 58.26\%$, S.D. = 20.85). The highest percentage of scenes was found in videos with explicit claims ($M = 64.98\%$, S.D. = 23.43, $p < 0.05$). Only the differences between no language claims and explicit language claims were significant (see Table 2).

A one-way (three levels; language claims type) between subjects ANOVA was computed for the average number of language-promoting strategies across scenes. There was a significant main effect of claim type, $F(2, 55) = 3.46$, $p < 0.05$. Because a Levene's test indicated homogenous variance, Tukey's HSD *post hoc* analyses were used. The average number of language-promoting strategies per scene in videos making explicit claims was higher ($M = 1.11$, S.D. = 0.52) than the average in videos with no language claims ($M = 0.68$, S.D. = 0.56, $p < 0.05$). The average number of strategies in videos with explanatory/implicit claims

Table 2. Differences in percentage of scenes with language content and at least one language-promoting strategy, and average number of strategies per scene based on language claim type

Language feature	Language claim type		
	None	Explanatory/ implicit	Explicit
Language domain content (Mean % of scenes)	2.38 (6.16)	8.30 (10.60)	63.99 (40.11)
At least 1 language strategy (Mean % of scenes)	42.96 (31.07)	58.26 (20.85)	64.98 (23.43)
Number of strategies per scene (Average ♯ strategies)	0.68 (0.56)	1.01 (0.56)	1.11 (0.52)

$N = 58$ videos. Values in parentheses represent S.D.

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($M = 1.01$, S.D. = 0.56), however, was not different from the other two groups (Table 2).

A one-way (three levels; language claims type) between subjects ANOVA was computed for differences in strategy distribution by type of language/literacy claim. There was a main effect of claim type on the distribution of scenes containing 'wh' questions (e.g., who, why), $F(2, 55) = 3.76$, $p < 0.05$. Videos with explanatory or implicit claims contained an average of 9.70% of scenes with this strategy (S.D. = 14.45), whereas videos with explicit language claims contained 2.32% of scenes with 'wh' questions (S.D. = 6.08). Videos with no language-related claims used 'wh' questions in 2.86% of scenes (S.D. = 4.48). Dunnett's T3 *post hoc* tests indicated no significant differences across groups. No other individual language strategies differed significantly by language claim-types.

Co-occurrence Analyses

Table 3 presents the co-occurrence analyses for the tagged general knowledge and language claims content and the language-promoting strategies. In scenes tagged as matching producers' language claims, seven strategies occurred more frequently and one strategy occurred less frequently than would be expected by chance. Three of the seven strategies (i.e. letter/phoneme identification, onscreen print with referent, and onscreen print without referent) targeted early literacy. The other four strategies occurring more frequently than chance included simple labelling with a matched visual referent, descriptive labelling with a mismatched referent, orienting to objects, and audience elicitation. Verbal vocabulary definitions occurred significantly less frequently than expected by chance. Seven co-occurrences among strategies and scenes tagged for general knowledge claims

Table 3. Scene level co-occurrences between tagged claims and language-promoting strategies

Language-promoting strategy	Any language claim		Any general knowledge claim	
	Actual ♯ within-scene co-occurrences (expected ♯)	% scenes containing co-occurrence	Actual ♯ within-scene co-occurrences (expected ♯)	% scenes containing co-occurrence
Letter/phoneme identification	**47 (21)**[a]	**2.67**	33 (32)	1.27
Simple matched label	**157 (92)**[a]	**8.93**	153 (136)	5.87
Descriptive matched label	330 (342)	18.76	**725 (507)**[a]	**27.80**
Simple mismatched label	4 (4)	0.23	11 (6)	0.42
Descriptive mismatched label	**43 (19)**[a]	**2.44**	35 (29)	1.34
Onscreen print with referent	**585 (315)**[a]	**33.26**	**619 (467)**[a]	**23.73**
Onscreen print without referent	**70 (42)**[a]	**3.98**	**85 (63)**[a]	**3.26**
Wh question	37 (33)	2.10	**71 (48)**[a]	**2.72**
Yes/no question	22 (29)	1.25	49 (43)	1.88
Verbal vocabulary definition	**18 (38)**[b]	**1.02**	**116 (57)**[a]	**4.45**
Orienting to objects	**385 (261)**[a]	**21.89**	**480 (388)**[a]	**18.41**
Point/give or follow gaze	3 (4)	0.17	6 (6)	0.23
Audience elicitation	**199 (143)**[a]	**11.31**	**247 (212)**[a]	**9.47**

Note: Bold indicates that the co-occurrence differs significantly from chance.
[a]Co-occurrence significantly greater than predicted by chance ($p < 0.05$).
[b]Co-occurrence significantly less than predicted by chance.

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(i.e. descriptive matched, onscreen print with and without a visual referent, 'wh' questions, verbal vocabulary definitions, orienting to objects, and audience elicitation) occurred more frequently than expected by chance.

The final analysis examined the co-occurrences of the language-promoting strategies with one another. Overall, there were 43 pairs of strategies that co-occurred significantly more than expected by chance, representing 55.13% of the 78 total pairs. No strategies co-occurred significantly less than expected by chance. Table 4 presents the actual and expected co-occurrences of each pair of strategies. For 11 of the 78 pairings, a 'poor' strategy (i.e. mismatched label, onscreen print without a matched referent) co-occurred above chance with another strategy. In total, co-occurrences containing at least one language strategy were found in 363 instances (5.4% of total scenes), while pairings of two potentially appropriate strategies (i.e. not containing a mismatched visual referent) occurred 2810 times (42.0% of total scenes).

DISCUSSION

Our results offer a number of insights into producers' language-related claims and corresponding content contained within infant- and toddler-media products deemed educational. Screen media products for children under three commonly cite language- or literacy-related benefits for young viewers (see also Fenstermacher *et al*., a, this volume). Infant-directed media contained a relatively large amount of general language-related content (i.e. nearly a quarter of scenes in an average video) and specific strategies known to promote young children's language development when used in live contexts (i.e. over 50% of scenes in a typical video). The most frequently used strategies were labelling of objects and actions (present in 90% of videos), onscreen print (88% of videos), and speech and production techniques aimed at orienting viewers to particular objects (86% of videos).

Infant-directed screen media with explicit language claims did contain more language-related content and more of the examined language-promoting strategies than those with implict/explanatory or no language claims. Explicit claims were linked to a greater percentage of scenes with at least one language-promoting strategy as well as a greater diversity of strategies per scene, especially in comparison with videos without a language claim. These results suggest that the producers of infant-directed screen media content do make an effort to include language-specific content and strategies known to promote language in real life contexts. However, many videos contained mismatches or did not even pair visual representations with verbal labels and onscreen print.

The lack of differences in the distribution of individual language-promoting strategies based on claims (language/communication or general knowledge) suggests that although videos targeting language development tend to use a greater number of strategies in greater densities, they cannot be distinguished from videos teaching other skills based on the presence or absence of certain language-promoting strategies. Furthermore, videos that purport to teach skills across other domains (e.g., general knowledge) use a number of teaching strategies that may concurrently promote language development as well. One explanation is that many strategies like labelling, orienting to object, audience elicitation, and vocabulary definitions help to convey information from other educational domains in addition to language skills (Barr *et al*., 2008; Linebarger & Walker, 2005). The number of language strategies that co-occurred beyond chance with tagged general knowledge content and the fact that many of these strategies

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Table 4. Scene level co-occurrences (and expected counts) between language-promoting strategies

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Letter/phoneme identification	—	3 (4)	14 (16)	0 (0)	0 (1)	**71 (15)**[a]	**23 (2)**[a]	0 (2)	0 (1)	0 (2)	15 (11)	0 (0)	4 (7)
2. Simple matched label	—	—	**178 (68)**[a]	**4 (1)**[a]	8 (4)	62 (62)	14 (8)	**22 (6)**[a]	**24 (6)**[a]	**17 (8)**[a]	**113 (49)**[a]	**4 (1)**[a]	**67 (28)**[a]
3. Descriptive matched label	—	—	—	**9 (3)**[a]	17 (14)	255 (233)	34 (31)	**68 (24)**[a]	**60 (22)**[a]	**82 (28)**[a]	**371 (181)**[a]	4 (3)	**273 (106)**[a]
4. Simple mismatched label	—	—	—	—	**2 (0)**[a]	3 (3)	2 (0)	**3 (0)**[a]	2 (0)	**4 (0)**[a]	5 (2)	0 (0)	3 (1)
5. Descriptive mismatched label	—	—	—	—	—	**24 (13)**[a]	3 (2)	**9 (1)**[a]	**7 (1)**[a]	3 (2)	**17 (10)**[a]	1 (0)	12 (8)
6. Onscreen print with matched referent	—	—	—	—	—	—	**58 (29)**[a]	23 (22)	11 (20)	**56 (26)**[a]	**358 (167)**[a]	3 (3)	**187 (97)**[a]
7. Onscreen print without referent	—	—	—	—	—	—	—	**11 (3)**[a]	**7 (3)**[a]	**10 (3)**[a]	**41 (22)**[a]	1 (0)	21 (13)
8. Wh question (e.g., who, why)	—	—	—	—	—	—	—	—	**40 (2)**[a]	**12 (3)**[a]	**65 (17)**[a]	**6 (0)**[a]	**18 (10)**[a]
9. Yes/no question	—	—	—	—	—	—	—	—	—	**15 (2)**[a]	**47 (15)**[a]	**4 (0)**[a]	**20 (9)**[a]
10. Verbal vocabulary definition	—	—	—	—	—	—	—	—	—	—	**42 (20)**[a]	0 (0)	**27 (12)**[a]
11. Orienting to objects	—	—	—	—	—	—	—	—	—	—	—	6 (2)	**163 (76)**[a]
12. Point/give or follow gaze	—	—	—	—	—	—	—	—	—	—	—	—	0 (1)
13. Audience elicitation	—	—	—	—	—	—	—	—	—	—	—	—	—

Note: Bold indicates that the co-occurrence differs significantly from chance.
[a]Co-occurrence significantly greater than predicted by chance ($p < 0.05$).

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overlapped with those language strategies that co-occurred beyond chance with tagged language claim content provides support for this argument.

Notably, more than half (55.13%) of all strategy pairs co-occurred in scenes significantly more than was expected by chance, and in no cases were two strategies found together less frequently than expected. However, over a quarter of these pairings included a 'poor' strategy (i.e. label or onscreen print with mismatched visual referent), though these instances were still relatively infrequent compared with co-occurrences of two appropriate strategies (i.e. 363 versus 2810 instances). Particularly common were the presence of simple and descriptive labels with audience elicitation and orienting to object techniques. Orienting viewers to objects also co-occurred frequently with the use of audience elicitation strategies. These findings suggest that the producers may use techniques to try to draw young children's attention at times when they are teaching words for objects that are being visually depicted onscreen.

Our findings indicate that while the use of audience elicitation as a strategy was relatively common at the video level (i.e. over 58% of videos), it was rarely found at the scene level (i.e. less than 9% of total scenes). In live situations, young children's language-learning is best supported when more competent language users engage the child directly and respond contingently to the child's attempts to communicate (Hardy-Brown & Plomin, 1985). Through audience elicitation strategies, screen media may be able to create and sustain a similar set of conversational turns via 'explicit prompting routines' (Brown, 2000, p. 225). Previous experimental research indicates that the use of characters who employ audience elicitation techniques helps preschoolers to engage with and learn from the screen (Anderson *et al*., 2000; Calvert *et al*., 2007), and one longitudinal correlational study suggests this strategy embedded in media content aids infants' language-learning as well (Linebarger & Walker, 2005).

Of note is the number of other language strategies that co-occurred with audience elicitations. Specifically, character questioning (e.g., yes/no; 'wh' questions such as who, why), labeling with matched referent (i.e. simple; descriptive), verbal vocabulary definitions, and onscreen print with matched referent co-occurred much more frequently with audience elicitations than would be expected by chance. Thus, it appears that infant media producers do attempt to directly engage viewers at times when they are employing other language-promoting strategies as well. This practice may serve to bolster very young children's learning, compared with the individual strategies alone. Additional content analysis research should investigate the exact timing of these features in comparison with each other.

The majority of infant- and toddler-directed videos, both with language claims and without, employ onscreen print (i.e. 88% of videos). In fact, onscreen print significantly co-occurred with both language claims and general knowledge claims in these videos. By the age of two or three years, children begin to develop a limited awareness of printed letters and words (Harste, Woodward, & Burke, 1984). They see adults around them reading, writing, and using printed words for many purposes in their everyday lives. Given infants' developmental stage, the disproportionate use of onscreen print in comparison with other strategies may be of concern, however. Since infants cannot read and are still acquiring basic underlying language skills, text on the screen may be more distracting than useful.

If infants do attend to onscreen print, they probably interpret it as an object. Typically, onscreen print visually stands out. As a result, infants may attend to the print at the expense of the other, perhaps more comprehensible, visual

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content. Research on the interactions between caregivers and infants and toddlers during storybook reading is potentially illuminating. In such situations, the attention of both adult and child tends to be more focused on illustrations than on print when both are static (Bus & van IJzendoorn, 1988; DeLoache & DeMendoza, 1987; Honig & Shin, 2001; Martin, 1998; Ninio, 1980). Martin (1998) found that mothers frequently deviate from printed text during storybook sessions with their infant and toddler, often omitting text completely in favour of impromptu picture descriptions. Moreover, involving young children in discussion regarding the illustrations in books helps to engage them in the activity and over-time leads to vocabulary gains (Martin, 1998; Ninio, 1980; Senechal, Cornell, & Broda, 1995; Whitehurst *et al*., 1988). Infants and toddlers are just beginning to grasp very basic understanding of symbols (DeLoache & Ganea, 2009). They are more likely to understand and glean information from a pictorial representation, which has some semblance to its real life referent, though mapping connections between spoken labels, pictures and highly abstract text is beyond their developmental capabilities. To the extent that print is made more salient when employed in infant-directed videos (e.g., with movement; highlighting; other production techniques), print may attract more attention from young viewers, though the impact of this increased attention on learning language is unclear.

It is possible that the high level of onscreen print serves the purpose of fostering interactions a parent and a child when a parent is present for the video viewing. In a telephone survey of more than 1000 parents of children aged 2–24 months, however, Zimmerman *et al*. (2007b) found that only 32% of parents report watching television or videos with their child every time the child watches. Thus, parents do not consistently co-view to explain what the onscreen print words mean. Furthermore, research on the effects of television exposure on infant and caregiver behaviours has shown that the amount of caregiver–infant interaction is reduced when the television is on (Kirkorian, Pempek, Murphy, Schmidt, & Anderson, 2009; Mendelsohn *et al*., 2008; Pempek, Demers, Anderson, & Kirkorian, 2007). Onscreen print as a language-promoting strategy is likely better suited to preschoolers (alphabet letters; simple words) and school-age children (full words; sentences), though research is needed to determine the nature of its effects, if any, on infants and toddlers. Additional content analyses and eye-track research should explore the manner in which print is displayed onscreen in infant-directed videos, as well as the degree to which it attracts very young viewers' attention.

Embedded strategies aimed at orienting attention to onscreen objects occurred frequently across videos. In addition to verbal and non-verbal character cues, this strategy was also coded for production techniques such as sound effects and camera zooms that drew emphasis to a particular onscreen object. More broadly, this sample of infant videos relies heavily on such perceptually salient production features (e.g., frequent camera cuts, sound effects, and rapid pacing) that may get infants to look at the screen, but some of these features may be difficult for infants to understand (Goodrich *et al*., 2009). Previous research with older children found beneficial effects of certain production features, such as pairing moderate action with language and presenting character vocalizations immediately before educational content (Calvert *et al*., 1982). Sound effects also improve infant imitation of targeted content (Barr, Shuck, Salerno, Atkinson, & Linebarger, 2010b), though research is not available about the potential role of moderate action as an additional representational mode to support infant language skills. Analyses indicate a very low level of characters explicitly pointing to or giving objects or following another's gaze in infant- and toddler-directed

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videos. Gestures like pointing and verbal statements like 'look!' help young children to direct their gaze and establish joint attention in real life contexts. It is possible, however, that the basic function of these techniques may be fulfilled with the media production strategies such as camera zooms that model the action of the eyes as they increasingly focus on a targeted object. In real life settings, verbal and gestural techniques are necessary in the face of many competing referents for a word, a problem that may be overcome by certain production techniques in the context of screen media.

The use of questions, phoneme/letter identifications and vocabulary definitions were also infrequent; these strategies were found in fewer than 10% of episode scenes (i.e. questions: 8.8% of scenes; phoneme/letter identifications: 1.8% of scenes; definitions: less than 1% of scenes). The use of questioning is particularly helpful in fostering higher-order language skills in young children when used in live interactions (Hart & Risley, 1995). Furthermore, understanding the phonemes in one's native language (i.e. that words consist of smaller sound units and becoming familiar with those sound units) is an important step in language development for children under three (Shonkoff & Phillips, 2000). If media constitute a common source of language input for young children, the scarcity of language-promoting strategies like these may be of concern.

Verbal vocabulary definitions were also quite rare at the scene level, though it is not clear whether this strategy would be particularly helpful for infants and toddlers. During the first few years of life, children strive to grasp basic mapping of simple words to their object or action referents. In this regard, the labelling of onscreen objects and behaviours may be sufficient, and possibly better for promoting vocabulary development among infant- and toddler-age viewers. When spoken vocabulary definitions were found, they co-occurred with several others beyond the expected distributions. In addition to audience elicitation, word definitions were found at higher than expected rates with questions (yes/no; 'wh'), onscreen print with matched referent, and matched labelling (i.e. simple; descriptive). The pattern of co-occurrence between these strategies is similar to descriptions of adult storybook reading with infants and toddlers. Senechal *et al*. (1995), for example, found that parents provided increasingly elaborate verbal information about storybook pictures as the child progressed in age from 9 to 27 months. For 9-month-olds, labelling objects with minimal additional illustration was common, while parents of 17- and 27-month-olds used more questions and topic elaboration in addition to labelling (see also DeLoache & DeMendoza, 1987; Moerk, 1985). Additional research should determine whether patterns of these strategies in infant and toddler videos differ based on the target age-range, as well as the learning outcomes associated with more or less verbal elaboration regarding onscreen visual referents.

The application of our findings is limited by several factors. Our coding scheme treated scenes as the unit of analysis due to the number of variables involved in coding as well as the variability in video length. As such, we did not code the total frequencies of learning strategies in videos, though the field would benefit from additional studies that include this level of analysis. Additionally, although language-promoting feature codes were intended to be as comprehensive as possible, important language-promoting techniques may have been over-looked given a lack of existing research in this area. Although we expect many of the examined strategies to aid infants' and toddlers' language-learning from video sources based on their utility in live interactions, it is unknown whether these strategies when embedded in screen media are in fact able to promote language development in similar ways. Although documenting the use in infant-directed videos of strategies

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that enhance young children's language growth in live settings was a logical starting point for this line of research, next steps should examine their actual efficacy in media formats, as well as determine additional media techniques that can aid infants' and toddlers' language development.

Future content analyses will investigate similar patterns within other educational domains (e.g., executive functioning; social/emotional skills), and for preschool-age programming. In other analyses, we will also delve further into investigating more nuanced patterns of teaching strategies, which co-occur in scenes. Given the differences in language domain content between explicit claims and implicit/explanatory claims, it is also important to determine how parents and caregivers interpret these and other types of infant and toddler media claims (e.g., series/title wording) so that they receive accurate information to guide their young children's media diet.

In conclusion, little research currently exists regarding the general direct harms or benefits of screen media for the lives and development of infants and toddlers. To determine if media teaches children more or less effectively than other alternatives, we need to increase research on the impact of educational media products on very young children using controlled designs. Clearly, future research is needed to investigate the extent to which these strategies relate to actual child outcomes in order to verify the claims accompanying educational and developmental claims. Documenting these and other embedded strategies is a crucial first-step towards tying content features to child outcomes and determining whether specific content affects infants' and toddlers' language development.

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