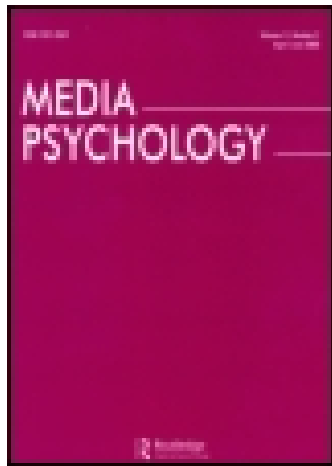


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Impact of Televised Songs on Children's and Young Adults' Memory of Educational Content

Sandra L. Calvert
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In two experiments, children's and young adults' memory of content presented via educational televised songs from School House Rock was examined. Single exposures favored verbal over sung presentations for recognition of important verbal content. After repeated exposure to a second vignette, children and adults remembered more educational material verbatim, and boys were better able to sequence important visual material, but participants still did not recognize significant verbal program content. The results suggest that songs improve verbatim memory, but spoken presentations improve verbal comprehension of content. Policy implications concerning the educational and informational requirements of the Children's Television Act are considered.

Songs have long been used to teach children verbal educational concepts. Children learn concepts as basic as their ABCs via songs in school, and educational television programs such as *Sesame Street*, *Mister Rogers' Neighborhood*, and *Barney and Friends* have adapted the song format to teach diverse cognitive lessons to children as they view in their homes.

Although children appear to preserve the exact words of a song in a lyrical form, verbatim memory does not ensure that children have accurately comprehended that material. That is, children can conceivably sing a song without thinking about the meaning embedded in the lyrics. With the implementation of the Children's Television Act, which requires broadcasters to provide educational and informational programming for children (Hundt & Minow, 1995), effective transmission of televised messages now has legal and policy as well as educational implications. Decisions made by the Federal Communication Commission (FCC), the government agency charged with implementing the law, should be based on sound empirical research.

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The purpose of the studies presented here was to examine the impact of televised songs on children's memory of educational material from *School House Rock*. *School House Rock* is an educational television series that teaches history, science, math, and English lessons via short, animated songs targeted to an 8- to 10-year-old audience.

The Content of Children's Television

Concern about the content of television programs has been raised since the beginnings of television. Violent content on the air waves has been the target of repeated public hearings, particularly the impact that viewing this type of content has on the aggressive and antisocial behavior of children. Moreover, deregulation policies in the 1980s left the market with strictly entertainment programs with little educational fare (Calvert, 1999).

Public complaints about the poor quality of children's television programs, particularly from child advocacy groups, eventually led Congress to pass the Children's Television Act of 1990 (Hundt & Minow, 1995). This law requires broadcasters to provide educational and informational programming for children as part of their fiduciary obligation to young audiences in exchange for the broadcasters' free access to the public's airwaves (Hundt & Minow, 1995). In implementing the Children's Television Act, the FCC defined educational programming as content that furthers "the positive development of the child in any respect, including the child's cognitive/intellectual or social/emotional needs" (FCC, 1991, p. 2114). Thus, educational programming had to include content that enhanced children's well-being in some measurable respect.

When the affiliates' licenses were up for renewal, the FCC asked them to list the programs that met the requirements of the law. *School House Rock* was one of the original programs listed.

School House Rock is an animated, short-form television program consisting of 3-minute educational vignettes. The *School House* content areas include history, science, English, and math. The "Rock" refers to the musical nature of the vignettes. This series, initially broadcast by ABC during the 1970s, disappeared from the air waves during the 1980s and is now being rebroadcast because of the Children's Television Act. The networks argued that this type of short program, dropped into the Saturday morning schedule, meets the requirements of the law (Trias, 1994). But what aspects of the program made the program educational? The brief amount of time involved in broadcasting short-form programs was clearly beneficial to broadcasters who wanted to maximize the amount of time that strictly entertaining programs were on the air waves, but

the musical and academic nature of the series made it unique as a short-form program. Does viewing *School House Rock* improve children's learning of educational content?

Only one study (Calvert & Tart, 1993) has actually examined the impact of the *School House Rock* series on learning. The study found that verbatim memory of the Preamble to the Constitution improved after repeated exposures to a sung over a prose vignette of this material. However, this study examined adults, not children, and the target age of the series is children.

The purpose of the current study was to extend the range of program vignettes sampled, to compare child and adult participants' memory of content, and to include various types of memory measures to assess learning. The research bears on policy issues concerning the kinds of programs that should count when broadcasters report their programming requirements to the FCC.

Children's Learning from Media

All learning requires information to be stored in some manner, and therefore requires a user to represent that information (Mandler, 1998). In information processing theories, the user takes in information in short-term store, represents and stores parts of that information in long-term store, and later retrieves it from long-term store (Atkinson & Shiffrin, 1968). Learning can be considered a synonym for storage, and remembering describes various retrieval activities such as recall and recognition (Schneider & Bjorklund, 1998).

Verbatim recall refers to an exact rendition of content (Calvert & Tart, 1993) where few retrieval cues are provided. Sequencing pictures of visual content have also been referred to as recall measures, in part because children are often asked to retell the program events, as well as order the pictures sequentially (Wright et al., 1984). Recognition of content adds retrieval cues, and multiple-choice measures have been a common recognition measure in the television literature (e.g., Collins, 1983). All of these measures tap into children's learning of content via some form of memory index.

Modality of Presentation

To be an effective educational television program, both the content and the forms of the presentation must be comprehensible to children. Television presents content in a unique audio-visual format that parallels the verbal, symbolic, as well as the visual iconic ways that children can think about information (Calvert, 1999).

Educators have long assumed that songs, a unique form that combines language with music, are an effective form for teaching children, yet evidence to support such a belief is lacking. In Craik and Lockhart's (1972) levels of processing theory, information can be processed at a relatively superficial level or at a deeper semantic level. Because of their rhyming qualities, children may allocate their processing efforts of both nursery rhymes and songs to a relatively superficial level. Put another way, they may pay attention to the sound of the music or rhyme rather than to the words. There is some evidence that this is indeed the case. For example, memory for the meaning of a passage was superior after exposure to a prose rather than to a nursery rhyme presentation (Johnson & Hayes, 1987). Similarly, preschoolers remembered their specific phone numbers and understood how to use that information more often when they were exposed to a spoken rather than to a sung presentation (Calvert & Billingsley, 1998). Finally, songs from a *Sesame Street* segment were effective in attracting children's attention and in emphasizing verbal points about the narrative, but less effective when only the song carried the message (Gemark, 1994). Such findings suggest that songs are processed at a relatively superficial level, at the expense of the deeper semantic meaning of the content.

Modality of the Retrieval Task

Another way of explaining these "interference" effects is to consider the match between the mode of presentation and the mode called upon in the retrieval task. For example, Hayes and Birnbaum (1980) found that children processed the visually presented content at the expense of the verbally presented content, a phenomenon that they named the *visual superiority hypothesis*. However, the visual superiority hypothesis mainly occurs when visual and audio tracks are mismatched.

By contrast, when tests are conducted within the same modality that the information is learned, visual presentation facilitates sequencing of pictorial information, whereas verbal narration facilitates recognition of verbally presented implicit content (Calvert, Huston, & Wright, 1987). The implication is that visual interference effects are found when verbal memory measures are used, not visual ones. Similarly, Hayes, Chemelski, and Palmer (1982) found that nursery rhymes improved verbatim memory more than did a prose passage of the same material. Taken together, these findings suggest that memory will be best when the form of the retrieval task matches the form in which that information was initially experienced and encoded.

Multiple methods for assessing memory of songs have rarely been used. Verbatim measures have been the focus for memories of songs, and these studies

have tended to focus on adults, with little regard to how age or gender might impact memory (Calvert & Tart, 1993; Hyman & Rubin, 1990; Rubin, 1977; Wallace, 1994).

In this research, various retrieval tasks were employed in different experiments to assess the role that the actual retrieval task plays in learning outcomes. Because songs are sensitive to the order of events (Wallace, 1994), tasks that call upon participants to recall events in a particular sequence may show facilitative effects more than will other tasks. Hence, verbatim memory and the order of visual events may favor songs or visual presentation, respectively, whereas remembering the verbal material may favor a spoken presentation.

Developmental Differences

Young children often remember the irrelevant, incidental content of a television program at the expense of the central, plot-relevant content. By about third grade, however, children begin to understand more of the content that adults usually take for granted as they view televised depictions (Collins, 1983). Multiple-choice tests are typically used to index children's recognition of central program material.

One reason for these developmental differences in children's recognition of central material may be cognitive shifts in what children are able to understand. With age, children are able to go beyond the information given and understand the abstract information in a television program (Collins, 1983).

Children may also think about and represent information in different forms at different ages (Huston & Wright, 1998). For instance, young children may rely on iconic forms of information processing more so than do adults (Bruner, Olver, & Greenfield, 1968). Adults, by contrast, may use verbal forms of representation more readily than do children.

In these studies, second- and third-grade children, who were at the transitional age between immature and mature processing of televised narratives, were studied. These children were also part of the target age group for the *School House Rock* series. Their memory was compared to that of young adults to examine if differences in learning might be, in part, a function of age differences in the skills needed to understand different forms of presentation.

EXPERIMENT 1

The purpose of Experiment 1 was to examine the impact of a sung versus a spoken presentation on children's and young adults' memory of verbal and visual

educational content. The use of a televised versus an audio-only presentation was also varied. Recognition of verbal content and sequencing of pictorial content was assessed after exposure to either a televised or an audio presentation of educational content about the American Revolution. The major hypotheses were that (a) memory would be sensitive to the kind of retrieval task used, and (b) older participants would remember more information on both tasks than would younger ones.

METHOD

Participants

There were 40 participants, equally distributed by grades 2 and college ($M = 7$ years 10 months vs. 20 years 11 months). There were 12 boys and 8 girls in the second grade, and 8 men and 12 women in college. Participants, who attended private schools in a large metropolitan area, were predominantly from middle- or upper-middle-class backgrounds. Participants were randomly assigned to one of four treatment conditions.

Television Vignette

The television vignette selected was part of an educational series called *School House Rock* that was not currently being broadcast when the data were collected. This vignette, titled a "Shot Heard Round the World," was part of History Rock. The 2 min 30 sec animated vignette depicted events of the American Revolution through a televised song.

Treatment Conditions and Procedure

Using the original television program and its musical soundtrack, four treatment conditions were created. These conditions crossed visual versus nonvisual presentation with a sung versus a spoken soundtrack. The song condition was the original vignette. The spoken condition was produced in the following manner. First, the words from the song were transcribed verbatim. Then a musician listened to the original sung soundtrack on headphones. As he listened, he read the words from the auditory script in synch with the sung soundtrack, thereby dubbing that spoken audio track onto the original visual track. In this way, the original words, be they spoken or sung, were paired with the same visual events. The rhythm of the song was also preserved. The nonvisual condition was made

by taping only the soundtrack of these two audiovisual programs for play on a tape recorder. This procedure resulted in four treatment conditions: spoken only, sung only, spoken television, and sung television.

Small groups of students either listened to or viewed this vignette about the Revolutionary War once in one of the four treatment conditions. They were told to watch or to listen carefully as they would be asked questions about the program later. In nonvisual conditions, participants listened to either the sung or the spoken audio recording. In visual conditions, participants watched and listened to either the sung or the spoken televised vignette.

Multiple-Choice Recognition. Immediately after exposure to their respective condition, students answered 13 verbal multiple-choice questions assessing memory of the central program content. College students read the questions and circled a response alternative. An adult read each item to the second graders, and children circled their choices.

These questions had been created following procedures developed by Collins (1983). Specifically, adults who were familiar with the program selected important program events and placed them in an open-ended questionnaire. Next, 20 adult judges viewed the vignette, rated each question as central or incidental to the program plot, and answered each question. Items with a minimum centrality rating of 70% were retained.

To construct multiple-choice alternatives, one correct and three incorrect verbal responses were selected. Incorrect responses were typically constructed from errors made by the adult judges on their questionnaires. The final measure consisted of 13 central, verbal questions with four response options. An example of a central item is "What was Paul Revere's famous quote?": (a) "Four score and seven years ago"; (b) "Give me liberty or give me death"; (c) "Taxation without representation!"; or (d) "The British are coming! The British are coming!"

Picture Sequencing. Next, participants sequenced one set of five still pictures that had been traced from the television program. These visual events represented important content from the entire program, a task referred to as whole program sequencing (Wright et al., 1984).

For second graders, the experimenter randomly arranged the five pictures in two rows and said, "Here are some pictures of things that happened in the story. I want you to put these pictures in order from the first thing that happened in the story to the last—in a line right in front of you." After the child sequenced the pictures, the experimenter said, "Now tell me what happened in the story." The

experimenter recorded the child's response order from numbers on the back side of the pictures.

For college students, the five pictures were randomly arranged and then xeroxed onto one sheet of paper. The paper was divided into five cells with a picture and a small box in the upper right hand corner of each cell. College students read the task directions. They recorded their responses by writing the numbers 1–5 in each of the five small boxes.

Following procedures developed by Wright et al. (1984), picture sequence scores were calculated by comparing the respondent's picture order to its correct absolute position. Specifically, one point was awarded for every picture with a lower number to its left. In addition, one point was awarded for each picture that was placed correctly to its adjacent pair. These two scores were then summed, resulting in a maximum possible score of 14.

RESULTS

The number of verbal multiple-choice questions answered correctly and the number of visual events sequenced correctly were submitted, in turn, to a 2 (sung vs. spoken) \times 2 (visual vs. nonvisual) \times 2 (grade: second vs. college) between-subjects analysis of variance (ANOVA). Given a significant F ratio, Duncan's multiple-range, follow-up contrasts were used to determine significant differences between means.

Multiple-Choice Recognition Scores

The three-factor ANOVA computed on verbal multiple-choice recognition scores yielded main effects of singing, $F(1,32) = 8.70$, $p < .01$, and grade, $F(1,32) = 53.66$, $p < .001$; and a visual by grade interaction, $F(1,32) = 7.61$, $p < .01$. Participants in spoken conditions recognized more central information than did participants in singing conditions, ($M = 7.90$, $SD = 2.73$ vs. 6.35 , $SD = 2.54$). Not surprisingly, college students recognized more information than did second graders ($M = 9.05$, $SD = 2.19$ vs. 5.20 , $SD = 1.61$). As seen in Table 1, college students recognized more central content in nonvisual than in visual conditions, whereas second graders recognized more central content in visual than in nonvisual conditions. There was no three-way interaction.

TABLE 1

Means and Standard Deviations for Recognition of Central Content by Visual Versus Nonvisual Condition

	Nonvisual		Visual	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Second-Grade Students	4.50	1.43	5.90	1.52
College Students	9.80	2.39	8.30	1.77

Picture-Sequencing Scores

The three-factor ANOVA computed on picture-sequencing scores yielded main effects of visual presentation, $F(1,32) = 4.42$, $p < .05$, and grade, $F(1,32) = 4.89$, $p < .05$. As predicted, participants in visual conditions sequenced more pictures correctly than did participants in nonvisual conditions ($M = 8.70$, $SD = 2.79$ vs. 6.80 , $SD = 2.97$), and college students sequenced more pictures correctly than did second graders ($M = 8.75$, $SD = 2.59$ vs. 6.75 , $SD = 3.11$). Singing or spoken presentations had no impact on picture-sequencing scores. There were no two-way or three-way interactions.

Summary

The purpose of Experiment 1 was to examine the impact of an educational televised song on children's memory of content. Singing had a negative impact on recognition of verbally presented content. Instead, the spoken presentation was better understood. Visual presentation improved children's, but disrupted adults', recognition of this same verbally presented content. Visual presentation improved picture sequencing scores, but singing had no effect on visual sequencing. These findings suggest that the modality of the input and output measures is important in understanding the way that songs impact children's and adults' memory.

EXPERIMENT 2

The purpose of Experiment 2 was to examine the impact of modality specific processing on children's learning. Because the measures used in the first experiment may have been insensitive to how and what children and adults learned from the song, a verbatim memory measure was included in Experiment

2. Modality-specific processing was considered by including the following: (a) a multiple-choice recognition task to assess verbal memory; (b) a picture sequencing task to assess visual memory; and (c) a verbatim free-recall memory task to assess a sung memory. We examined third graders rather than second graders to determine if older children were better able to process songs than slightly younger ones. Third graders are at a transitional age in understanding television programs, and this age group may well prove to be a pivotal one. However, if third graders still did poorly in comprehending sung material, the generality of the problem could be documented. Although gender has not been examined in studies of adults' processing of songs (e.g., Calvert & Tart, 1993; Rubin, 1977), we included gender as part of the design to examine if young males may be better visual processors, and young girls may be better verbal processors.

The single exposure involved in Experiment 1 also meant that participants had to get the message quickly. Sung presentations may require repeated exposure for effective memory of information to occur (Calvert & Tart, 1993; Wallace, 1994). Single exposures may actually distract the learner from remembering verbal material (Wallace, 1994). In fact, the *School House Rock* series was played repeatedly on the airwaves. Hence, to improve the ecological validity of the research and to examine the impact of repetition on memory, repeated versus single exposures to the vignette were varied in Experiment 2. A second *School House Rock* vignette titled "I'm Just a Bill" was selected for study.

The following were the major hypotheses:

Hypothesis 1: Participants will perform better on measures that were sensitive to a sung order (i.e., verbatim memory) after repeated, but not after a single, exposure to the vignette.

Hypothesis 2: Participants will not perform better on tasks that focused solely on verbal properties of information (i.e., multiple-choice content), even after repeated exposure.

Hypothesis 3: Participants will perform better on visual sequencing tasks after repeated than after a single exposure.

Hypothesis 4: College students will perform better than will third graders on all memory tasks.

METHOD

Participants

Participants were 48 students, equally distributed by gender and by grades three and college ($M = 8$ years 6 months vs. 20 years 7 months), who attended private university or elementary schools in a large metropolitan area. Participants were from predominantly middle- and upper-middle-class backgrounds.

Television Vignette and Treatment Conditions

The target vignette was a 3 minute, animated depiction from *History Rock* entitled "I'm Just a Bill." The "Bill" was an animated character who was represented as a piece of paper with eyes, arms, and legs attached. There was writing on his "body." The vignette traced the steps that the bill underwent to become a law. *School House Rock* was not being broadcast when the data were collected.

Procedure

Within age and gender groups, participants were randomly assigned to one of two conditions: no repetition or repetition. Small groups of participants viewed this vignette of "I'm Just a Bill" on a television monitor either once or four times in a classroom. In repetition conditions, participants viewed the vignette twice a week over a 2-week period, resulting in four exposures to the same vignette. In no-repetition conditions, participants viewed the vignette one time only on the last day that the repetition condition saw the vignette.

Two days after completing their viewing conditions, participants answered a delayed memory test consisting of three measures: verbatim recall, multiple-choice recognition, and picture sequencing. College students wrote their own answers, and third graders told their responses to an adult who wrote their verbal responses as she or he taped the session. The tape recorded sessions were later transcribed.

Verbatim Recall. First, participants were asked to tell or to write all the exact words that they could remember from "I'm Just a Bill." Following procedures developed by Rubin (1977), one point was awarded for each word that was in its correct order. Reliability, assessed as 2 times the number of agreements divided by the total number of scores for Scorer 1 and Scorer 2, was calculated at 96% for 48 protocols.

Multiple-Choice Recognition. Participants then answered six multiple-choice questions assessing recognition of the central, verbal story information. Following the same procedures as in Experiment 1, questions had been rated by those same 20 adult judges as central to an understanding of the bill vignette. Four verbal response alternatives were developed for each question. A sample question is, “In what location does the federal legislative process begin? (a) Bunker Hill, Boston, Massachusetts; (b) Capitol Hill, Washington, DC; (c) United Nations, New York, New York; or (d) Liberty Hall, Philadelphia, Pennsylvania.” The wording was simplified on some questions for third graders.

Picture Sequencing. Finally, participants sequenced six pictures from the program. As in Experiment 1, third graders ordered the six pictures and then told the story after sequencing the events. College students, who had a photocopied page of those same six pictures, ordered them by writing the numbers 1–6 in a small box in the upper right-hand cell of each picture.

RESULTS

The correct number of words in verbatim order, the number of pictures sequenced correctly, and the number of verbal, multiple-choice items correctly recognized were submitted, in turn, to a 2 (treatment) \times 2 (gender) \times 2 (grade) between-subjects ANOVA. Duncan’s multiple-range contrasts were run to determine significant differences between means, given a significant *F* ratio.

Verbatim Recall Scores

The three-factor ANOVA computed on verbatim recall scores yielded main effects of grade, $F(1,40) = 18.37, p < .0001$, and treatment, $F(1,40) = 8.74, p < .005$. As expected, college students recalled more words correctly in verbatim order than did third graders ($M = 28.96, SD = 21.49$ vs. $10.17, SD = 7.15$). Participants in repetition conditions also recalled more words verbatim than did participants in no-repetition conditions ($M = 26.04, SD = 20.61$ vs. $13.08, SD = 13.61$). There was no three-way interaction.

Picture-Sequencing Scores

The three-factor ANOVA computed on picture sequencing scores yielded main effects of grade, $F(1,40) = 6.33, p < .05$; gender, $F(1,40) = 6.98, p < .01$; and treatment, $F(1,40) = 8.37, p < .01$. Gender and treatment main effects were

qualified by a gender by treatment interaction, $F(1,40) = 9.11, p < .01$. As seen in Table 2, boys in repetition conditions sequenced more pictures correctly than did girls in repetition conditions; however, boys and girls in no-repetition conditions performed equally well. Not surprisingly, college students sequenced more pictures correctly than did third graders ($M = 16.00, SD = 2.54$ vs. $14.33, SD = 3.00$, respectively). There was no three-way interaction.

TABLE 2

Means and Standard Deviations for Picture Sequencing by Repetition and Gender

	No Repetition		Repetition	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Girls	14.33	2.27	14.25	2.18
Boys	14.08	3.23	18.00	1.81

Multiple-Choice Recognition Scores

The three-factor ANOVA computed on verbal multiple-choice recognition scores yielded only a main effect of grade, $F(1,40) = 46.42, p < .0001$. College students recognized more central content than did third graders ($M = 5.25, SD = .79$ vs. $3.50, SD = .93$, respectively). Repetition of the vignette did not increase learning of verbally presented material.

Summary

In summary, Experiment 2 demonstrated that repetition affects memory of information from songs differently, depending on the kind of measure used. Performance on the verbatim recall measure was positively influenced by repeated exposure to the song. By contrast, performance on the verbal multiple-choice items about factual material was not affected by songs, even after repeated exposure to the same vignette. Repeated exposure to the vignette improved boys', but not girls', picture-sequencing performance. Taken together, these findings suggest that children's and adults' memories of sung material is influenced by the form of the presentation and the form of the retrieval task.

GENERAL DISCUSSION

The purpose of this study was to examine the impact of *School House Rock*, comprised of short-form musical television vignettes, on children's and young adults' learning of educational content. The networks have used this type of program to meet the educational requirements of the Children's Television Act (Trias, 1994).

In Experiment 1, a singing track was compared to a spoken track, and visual versus nonvisual presentations were contrasted. Contrary to popular beliefs, a spoken sound track improved children's and adults' memory of central material more than the song did. These findings parallel those reported in the nursery rhyme and song literature in that a spoken presentation improves children's learning of content more than does a rhyming (Hayes et al., 1982) or a sung presentation (Calvert & Billingsley, 1998; Gemark, 1994).

Experiment 1 also revealed that the song had no impact on children's or adults' skills at ordering important visual events. Instead, the ability to sequence visual events was associated with exposure to the visual track. Children and adults who saw events depicted were able to sequence key events better than those who only heard the audio track. These results suggest that content is remembered best when there is a match between the input (i.e., visual presentation) and the expected output (i.e., visual sequencing). These findings support other reports of modality specific processing in television and radio comparisons (Greenfield, 1993).

When there was a discrepancy between input and output, the visual superiority hypothesis occurred (Hayes & Birnbaum, 1980). In the visual-superiority hypothesis, visual presentation distracts the viewer from processing the verbal material, which is often more informative. In the present study, visual presentation disrupted college students' recognition of important verbal content, but aided second graders' recognition of that material. With development, people tend to become more verbal, abstract thinkers, whereas they tend to rely on concrete visual depictions at younger ages (Calvert, 1999). It also seems that singing can interfere with memory of verbal material as much as visual presentation can. Indeed, a major finding of Experiment 1 was a negative impact of the song on both children's and adults' learning of factual verbal content.

In Experiment 2, learning measures were expanded to tap into verbatim memory, a measure that was most likely to be responsive to the structure of the song (e.g., Rubin, 1977). Repeated exposure to the vignette was included to ensure that learning the song was not interfering with learning the sound track (Wallace, 1994), as well as to increase the ecological validity of the results.

Repetition clearly bolstered third graders' and college students' memory of the educational content. Those who saw the vignette four times remembered the verbal material verbatim, and boys in repetition conditions improved at sequencing the visual events of how a bill becomes a law. However, recognition of important verbal content was not improved by repeated exposure. The positive effects of repetition are similar to those found for other programs, including *Sesame Street* (Palmer & Fisch, 2001). Taken together, the findings of the experiments presented here suggest that televised songs can improve mastery of certain types of tasks, but improved learning of factual verbal material is best when it is spoken.

The findings reported here have implications for policy decisions about children's educational television programming requirements. If the goal of such programming includes verbatim memory, then short-form musical vignettes, such as those found in *School House Rock*, should qualify as meeting the requirements of the Children's Television Act. The value of songs for increases in verbatim memory have been found by those who study songs only (Rubin, 1977), as well as by those who study televised songs (Calvert & Tart, 1993). Schools do require children to remember information in verbatim form at times, and songs are especially useful in these instances. Nonetheless, learning involves more than a verbatim memory. It also requires children to understand the meaning of the messages embedded in the song. It is in the realm of true learning that songs do not live up to their promise.

This study is limited in that the sample was based predominantly on middle-class or upper-class children and young adults. It is possible that children from lower classes, who tend to watch more television, may be more attuned to jingles and music-based learning, particularly those who are viewers of educational programs like *Sesame Street*, which pioneered the blend of music-line and concept learning. Another limitation is that there were different numbers of males and females in the two grades for the first experiment, a problem that was corrected in Experiment 2.

In future studies, it would be useful to examine ways to increase children's understanding of songs, be they televised or live presentations. For example, having children enact song meanings, such as "tip me over and pour me out" in the "I'm a Little Teapot" song, could be examined for their potential value as a learning aid, as they provide an enactive mode for children to represent the meaning of the content. Comparisons of various subgroups in the population would also be worthy of future attention. Boys in this study were better visual processors than were girls, a finding that could be due to gender differences in visual skills (Ruble & Martin, 1998). Perhaps those who grow up in oral

traditions or who come from musical backgrounds might also be more responsive to the messages embedded in the song than was the current sample.

In conclusion, short-form educational programs like *School House Rock* that use songs to teach children can improve viewers' memory of verbatim content. Repeated exposure to vignettes also enhances boys' sequencing of important visual events. However, deeper understanding of the messages favors the use of spoken, not sung, content. The new science of learning emphasizes understanding of knowledge (Bransford, Brown & Cocking, 1999). The implication is that short-form programs like *School House Rock* have educational merit, but the challenge remains to make this type of format maximally effective for deeper levels of learning, not just superficial verbatim recitation of lyrics. In so doing, the education of children will be enhanced, thereby fulfilling the promise of the Children's Television Act.

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