MULTIMEDIA RESEARCH

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Summative Evaluation of
Special Effects
with an Adult Audience

Report for
NOVA Large Format Films
WGBH, Boston

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EXECUTIVE SUMMARY OF SUMMATIVE EVALUATION OF
SPECIAL EFFECTS **(ADULT SAMPLE)**
MULTIMEDIA RESEARCH, FEBRUARY 20, 1997

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With funding from the National Science Foundation, NOVA/WGBH Boston with the participation of 14 U.S. and 4 international science museums have produced an IMAX/OMNIMAX film titled, *Special Effects*. The 40-minute film shows the techniques and methods that special effects filmmakers use along with their understanding of the human visual system to create movie illusions.

The summative evaluation reported here focused on the following major outcomes:
- To what extent did the program appeal to adult viewers?
- To what extent did the program achieve its intended viewing goals?
- What did viewers perceive that they learned from the program, if anything?
- Did viewing the program influence the audience beyond the museum visit?

Method

A random sample of 177 adults completed a questionnaire and content test <u>before</u> viewing *Special Effects* at the Museum of Science in Boston, MA. A second random sample of 178 adults completed a questionnaire and content test <u>after</u> viewing the OMNIMAX film. Researchers recruited over a period of two non-holiday weekdays and 1 weekend day, eliciting questionnaires during 11 weekday shows and 7 weekend shows. Weekend respondents represented 40.6% of the final sample.

The pre and post-viewing groups did not differ significantly with respect to the classifications of gender, ethnicity, age group, education, and number of OMNIMAX films ever seen; however, the post-viewing sample included significantly more people who said that their occupation was related to science than the pre-viewing group.

For the sample as a whole, the classification variables of gender, age group, education, and number of OMNIMAX films ever seen were fairly equally distributed. The sample was overwhelmingly white, and about 40% of the sample had occupations related to science.

Of those who completed a questionnaire, 41% agreed to be interviewed by phone one week later. The first 15 males and 15 females in Massachusetts to be reached successfully by phone constituted the interviewed sample.

Findings

• To what extent did the program appeal to adult viewers?

Nearly the entire sample (97.8%) thought *Special Effects* was either "very" or "moderately" interesting. One third of the viewers liked the informative value of the film, and one-fifth of the adults mentioned liking the entertainment quality. Another 12% liked the features of the OMNI theater itself, but 12% also complained of discomfort with the OMNI format and accommodations. When asked what they did not like about the film, half did not respond or said they disliked nothing. The remainder expressed a desire for more action and effects as well as more information about special effects and examples from other films. Two-thirds of the audience felt that the film met or exceeded their expectations. Those disappointed in

the film again wanted more information, more action or more examples of effects. On the other hand, the audience also was surprised by the amount of information in the film, by the complexity of creating special effects and by the realism of the effects.
After seeing the film, respondents were asked to rate how interesting or boring *Special Effects* was. More than three-fourths of the sample rated the program as "very interesting" (76.4%); a little more than one-fifth (21.4%) felt the program was "moderately interesting," 2.2% rated the film as "okay" and nobody in the sample thought the program was "moderately" or "very" boring. The following categories describe what the audience liked about the film:
- 37.1% Information value
- 21.3% Entertainment value
- 12.4% The special effects of the OMNI Theater with its large screen, surround sound
- 10.1% The film's visual effects
- 8.9% The historical context included in the film
- 4.5% Seeing scenes from Star Wars remake
- 3.4% Seeing animal special effects
- 2.3% *No response*

When asked in an open-ended question what they did not like about the film, respondents' answers focused on the following concerns:
- 12.3% Discomforted by OMNI format and screen design
- 10.1% Discomforted by loud volume and unfocused film
- 10.1% Wanted more action/effects
- 9.0% Wanted more information about special effects
- 5.6% Dispels wanted illusions
- 2.3% Film was poorly structured
- 2.3% Film and/or credits were too long
- 2.3% Preferred to have seen additional film examples from other films
- 20.2% *Nothing disliked about Special Effects*
- 25.8% *No response*

Post-viewing respondents were asked to choose from a selection of statements the one that best describes how *Special Effects* compared to their expectations. More than one-fourth (27.7%) of viewers indicated that they had no expectations about *Special Effects* before seeing the film. More than 66% of the sample felt that *Special Effects* had met or exceeded their expectations, but 5.6% felt that the film did not meet their expectations. They wanted more action or information.
- 27.7% Had No Prior Expectations
- 22.5% Exceeded Expectations
- 43.8% Met Expectations
- 5.6% Did Not Meet Expectations

Visitors were asked to complete the sentence, "I was surprised...". Approximately 18% of the sample wrote no answer to the question, and 1.2% indicated that they were not surprised. The remaining responses were sorted into the following mutually exclusive categories:
- 23.6% Surprised by the amount of information contained in the film
- 15.7% Surprised by the complexity of producing special effects
- 11.2% Surprised by the effects of the OMNI Theater's large screen, surround sound
- 7.6% Surprised by the way explosions are created
- 5.6% Surprised by Stars Wars re-released with new scenes and special effects
- 5.6% Surprised by the King Kong scene
- 3.4% Surprised by how realistic special effects can seem
- 3.4% Surprised by special effects from early films
- 2.2% Surprised by how interesting the film was

- 2.2% Surprised by the number of film examples
- 1.2% Not surprised by Special Effects
- 18.0% *No response*

Viewers also completed the sentence stem: "I was most disappointed...". About one-fourth (24.7%) of the sample wrote no answer to the question, and 23.6% indicated that they were not disappointed by *Special Effects*. Members of the audience were disappointed as follows:

- 13.5% Disappointed that the film was not longer
- 9.1% Disappointed that there wasn't more information about special effects
- 5.6% Disappointed that there wasn't more action
- 5.6% Disappointed that there weren't more examples of special effects
- 3.4% Disappointed that the film dispels wanted illusions
- 3.4% Disappointed by the lack of OMNI-unique effects
- 3.4% Disappointed that there wasn't more of a historical context
- 2.2% Disappointed that the sound was too loud
- 1.1% Disappointed by the OMNI theater's design/accomodations
- 1.1% Disappointed that the film was out of focus
- 1.1% Disappointed by a feeling of motion sickness
- 1.1% Disappointed that it wouldn't hold children's interest
- 1.1% Disappointed by the lion scene
- 23.6% *Not disappointed by Special Effects*
- 24.7% *No response*

- ***To what extent did the program achieve its intended viewing goals?***

  Viewing the film significantly increased knowledge about special effects, as measured by a 10-point content test on the intended viewing goals. Viewers of *Special Effects* came away knowing more about how filmmakers produce effects of movement, scale, three-dimensionality, explosions and realistic computer images.

  There was a statistically significant difference between audience knowledge of the film's content before viewing the film (Mean score = 5.94) and knowledge after viewing (Mean score = 7.45). With an interest in interaction effects, separate two-way ANOVAs on the scores were calculated for Viewing Group (Pre, Post) and individual demographic and background variables of Gender, Age Group, Education, Occupation and Seen Other IMAX Films. None of the interactions were statistically significant. Short answer questions on the 10-point content test covered why an audience perceives continuous movement in a film; why explosions look more realistic when filmed in slow motion; how filmmakers can make an object appear larger than it actually is, appear farther away than it actually is or appear to be moving; and finally, how computers play a role in special effects and what filmmakers must consider to make computer-generated images look realistic.

- **What did viewers perceive that they learned from the program, if anything?**

  Almost 90% of the sample provided one idea or fact that they learned from the film. Viewers felt that they learned how motion can be created by moving the camera, how explosions and animals and other special effects can be made to appear realistic, and how composite scenes are made. Smaller groups reported learning how computers are used in special effects, how complex the creation process is, ways objects are made to appear larger than they are, and information about human perception.

The majority of respondents (89.3%) could describe one idea or fact that they learned from the film, whereas 2.3% reported that they had learned nothing new and 8.4% did not answer the question.

- 14.6% Learned how the appearance of motion can be created by moving the camera
- 9.0% Learned how small-scale explosions filmed in slow motion appear realistic
- 8.4% Learned techniques filmmakers use to make non-real animals appear realistic
- 6.7% Learned how composite scenes are made
- 6.7% Learned that special effects can appear to be realistic
- 5.6% Learned how computers are used to produce special effects
- 5.6% Learned about the complexity of creating special effects
- 5.6% Learned ways to make an object appear larger
- 5.6% Learned information about human perception
- 5.1% Learned miscellaneous information about special effects
- 4.5% Learned about history of special effects
- 4.5% Learned information about Star Wars
- 3.9% Learned how burning models are tilted on their side to create realistic fires
- 3.4% Learned how frequently models are used in films
- 2.3% *Learned nothing*
- 8.4% *No response*

Additionally, significantly more viewers than non-viewers were able to provide examples of ways that knowledge of science and/or math is used in producing special effects. Those who had seen the film were significantly more likely than non-viewers to refer to Explosions, Perspective or Lighting to explain how science and math are used in producing special effects.

- ***Did viewing the program influence the audience beyond the museum visit?***

Of the thirty viewers who participated in a telephone interview about one week after seeing the film, the majority reported that they had discussed the film with their co-viewers immediately after seeing it, discussed the film with others in the week following their visit, and recommended to others that they see the film. More than half of the respondents felt that seeing *Special Effects* had affected something that they had thought about or done in the previous week and that they had read or seen something on television that had made them think of the film.

Fifteen men and fifteen women participated in a telephone interview about one week following their viewing of *Special Effects*. Analysis of telephone interview data indicated that 93% of the interviewees discussed the film with their co-viewers immediately after seeing it, 76% discussed the film with others in the week following their visit, and 83% had recommended to others that they see *Special Effects*. A little more than half of the respondents agreed that seeing *Special Effects* had affected something that they had thought about during the week after the viewing; for example, paying closer attention to special effects in programs they watched or seeing a movie mentioned in the film. Half of the interviewed sample also agreed that something they had read or seen on television had made them think of *Special Effects*. Although it is difficult to assess reliably the impact of a program beyond its real-time frame, it appears that half of the audience felt that they were still influenced by the film one week later.

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INTRODUCTION

With funding from the National Science Foundation, NOVA/WGBH Boston with the participation of 14 U.S. and 4 international science museums has produced an IMAX$^{®}$/OMNIMAX film titled, *Special Effects*. The 40-minute film shows the techniques and methods that special effects filmmakers use along with their understanding of the human visual system to create movie illusions.

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SUMMATIVE EVALUATION DESIGN

A quasi-experimental separate-sample pretest/posttest design was used to evaluate the film in its natural theater setting. Over a period of three days at the Boston Museum of Science's Mugar OMNI Theater, researchers asked randomly chosen adults, stratified by gender, to complete questionnaires. A random sample was surveyed prior to viewing the film and a different random sample was surveyed after viewing. Several characteristics of the population and treatment (i.e., the IMAX film) led to the decision to use this design, which Campbell and Stanley (1963) refer to as Design 12.

First, the population to which we wish to generalize are self-selected museum visitors whose intention is to view an OMNIMAX film. Locating an equivalent control group who would <u>not</u> view the film was virtually impossible. There were no comparable museum visitors from whom the treatment (the film) could be withheld. The best control group was a sample of museum visitors who intended to view the film but had not yet done so.

Secondly, we could not assume that the scientifically predisposed museum visitors would be unfamiliar with the film content, thus it was important to include a pretest that established what the audience knew prior to seeing the film. Pretesting and posttesting the <u>same</u> sample, however, was not an acceptable procedure, because the pretest almost certainly would sensitize the audience to the content of the film and affect their posttest results. The separate-sample design controls for the main and interactive effects of testing.   One group is tested prior to seeing the film and a randomized equivalent group tested after seeing the film.

Third, random sampling was logistically simple in the theater environment where the audience lines up before showtime. Randomization was used to eliminate systematic bias between the pre-viewing sample and the post-viewing sample. As argued by

Campbell and Stanley (1963), "the most adequate all-purpose assurance of lack of initial biases between groups is randomization" (p. 25).

Finally, the drawbacks of this design, in general, are its failure to control for history, maturation, mortality and the interaction of these. However, in this specific case, where the film treatment is only 40 minutes long and the adult audience is virtually captive, there is little chance of changes in groups due to history, maturation, or mortality; thus, these are non-issues for this evaluation.

In conclusion, the separate-sample pretest-posttest design was considered the strongest approach for evaluating the OMNIMAX film in the natural theater setting with a random sampling of the population of movie-goers. This research design was found effective in evaluating the OMNIMAX film *Stormchasers* (Flagg & Johnson, 1996) and was applied to *Special Effects* to add to our baseline knowledge about effects of large format films.

METHOD

Sample

The population from which the sample was randomly chosen was comprised of audience members 18 years of age or older who stood in the waiting line to view *Special Effects* during a period of three days in late summer. Single adults accompanied by children below the age of five and adults who were part of a group of five or more were excluded.

Of the 385 adults who were randomly selected to participate in the evaluation, 5 people (1.3%) declined responding to the pre-viewing questionnaire because of ongoing conversations with spouse/friends or attending to a child. Additionally, 9 people (2.3%) declined responding to the post-viewing questionnaire because of prior commitments. Another 10 adults (2.6%) initially agreed to participate but did not carry through after viewing; one of these respondents needed to attend to a child and the remaining nine slipped by the researchers on their way out, even though bright orange labels were placed on their clothing in order to aid identification. Thus, about 6.2% of the adults who were approached did not participate in the evaluation.

Of the 361 questionnaires collected, 6 (1.7%) were not included in the analysis for a number of reasons: either the respondents were not over 18, elicited answers from another person or left most of the questionnaire blank. Thus, the total number of usable questionnaires (N=355) included 177 pre-viewing questionnaires and 178 post-viewing questionnaires.

Researchers recruited over a period of 2 non-holiday weekdays and 1 weekend day, eliciting questionnaires during 11 weekday shows and 7 weekend shows. Weekend respondents represented 40.6% of the final sample. Information from demographic and background questions was used to determine whether the randomization worked well in equalizing the pre and post-viewing groups and whether the two independent samples should be looked at as having come from the same population. Chi-square analyses revealed that the Viewing Groups (pre and post) did not differ significantly

with respect to the classifications of gender, ethnicity, age group, education, and the number of IMAX films ever seen. The distribution of the sample on these classification variables is presented in Table 1.

For the sample as a whole, the classification variables of gender, age group, education, and number of IMAX films seen were fairly equally distributed across the categories. The sample was overwhelmingly white, so ethnicity was not analyzed further in the data analyses.

Table 1. Non-significant Demographic and Background Variables

Variable	N	Categories	Percent
Gender	355	Female	49.6%
		Male	50.4%
Ethnicity	355	White	98.0%
		Minority	2.0%
Age Group	350	18-27	19.7%
		28-37	23.7%
		38-47	36.9%
		48+	19.7%
Education	354	Some college or less	25.1%
		College graduate	41.0%
		Post graduate	33.9%
Number of IMAX films ever seen	354	This is my first film.	25.1%
		One other film.	18.4%
		2–3 other films.	20.6%
		Four or more films.	35.9%

In contrast, chi-square analyses revealed that the Viewing Groups (pre, post) did differ significantly with respect to whether occupation was related to science. Table 2 presents the distribution of the sample on this classification variable.

Occupations were related to science for 28.4% of the pre-viewing group and 39.9% of the post-viewing group.

Table 2. Significant Demographic and Background Variables

Variable	N	Categories	Pre %	Post %	χ^2
Occupation	354	Related to science	28.4%	39.9%	5.18
		Not related to science	71.6%	60.1%	($p = 0.023$)

Each member of the pre-viewing group only was asked if they had seen *Star Wars*, *Independence Day*, *Kazaam*, or *Jumanji*. As specified in Table 3, the majority of survey participants had seen *Star Wars*. In contrast, the majority of participants had not seen the other three films that were discussed in the IMAX film.

Table 3. Featured Films Seen Prior to Viewing Special Effects

Film	N	Seen	Not Seen
Star Wars	177	87.6%	12.4%
Jumanji	177	43.5%	56.5%
Independence Day	177	39.0%	61.0%
Kazaam	177	3.4%	96.6%

Interviewed sample. Each of the pre and post-viewing respondents were asked if they were willing to be interviewed by telephone one week later. Approximately 41% provided their names, telephone numbers and suggested times for a follow-up interview; this group included 38.4% of the pre-viewing sample and 43.8% of the post-viewing sample. Only those with telephone numbers in Massachusetts were called about one week after their museum visit. The first 15 males and 15 females to be reached successfully by telephone constituted the interviewed sample.

Procedure

The sample was selected from adults as they lined up in front of the doors of the Mugar OMNI Theater. Using random numbers to determine which museum visitors over 18 years of age were eligible for selection, the researchers alternately approached men and women and recruited them to complete a pre-viewing questionnaire for *Special Effects* or, alternately, to remain after viewing the film and fill out a post-viewing questionnaire. Respondents were told that the questionnaires were to provide the producers of *Special Effects* with audience feedback and that they were to answer the questions without receiving help from other people in their group.

The pre-viewing questionnaires required about ten minutes and were completed on clipboards as respondents stood in line at the entrance doors. Questions on the pre-viewing questionnaire focused on demographic variables, background classification variables, and pre-viewing knowledge about the film's topics.

Those selected to complete a post-viewing questionnaire were provided with orange sticky labels to help identify them in the exiting crowd. The post-viewing questionnaires were completed at tables set up near the exit doors, and they required from ten to twenty minutes to complete, depending upon how thoughtful the respondent chose to be. Questions on the post-viewing questionnaire included the pre-viewing questions of demographics, background, and knowledge about the film's topics. In addition, the questionnaire assessed viewers' reactions to the program (as described below).

Because we were able to anticipate audience sizes from prior theater attendance records, one researcher collected data at all of the 20 shows surveyed and another researcher collaborated in collecting data at seven of the shows, on a weekend day. On average, researchers collected 19 questionnaires per show during the weekday and 20 questionnaires per show during the weekend.

For the follow-up telephone interview one week later, only those respondents available in Massachusetts were called at their suggested times. One researcher handled the telephone interviews and tried each number at least three times before dropping an individual from the list. The first 15 males and 15 females to be reached successfully were interviewed. The telephone interviews were approximately seven minutes, depending upon the garrulousness of the respondent. The interviews concentrated on assessing whether the IMAX visitor had taken actions related to the film in the week after viewing (as described below).

Questionnaires

Demographic and Background Variables. Both the pre-viewing and post-viewing questionnaires established respondents' status with respect to five demographic

classification variables (gender, age group, ethnicity, education, and occupation) and one background classification variable (number of IMAX films ever seen).

Program Appeal. Post-viewing respondents chose one of five scaled statements to indicate how interesting or boring they found *Special Effects*. Similarly, viewers were asked to select one of four statements that expressed the degree to which the film compared to their expectations. Pilot testing revealed that it would be necessary to reduce the amount of time required for viewers to complete the questionnaire; thus, two versions of the survey instrument were administered. Each one contained the same questions with the exception of two items. Half of the viewers were asked to explain what they liked and did not like about the film and why, whereas the other half of the sample was asked to respond to two sentence completion items: "I was surprised . . ." and "I was most disappointed . . . ."

Knowledge about special effects. Both the pre-viewing and post-viewing questionnaires included a knowledge test to assess understanding of the viewing goals. Seven short answer questions comprised a 10-point test about the following topics covered in the 40 minute film. The questions and answers drawn from the film's content appear below.

1. If a film is made up of a series of still images, why does an audience perceive continuous movement.
   An audience perceives continuous movement in a film for the following three reasons: (1) The brain fills in the gap between still images, (2) after-image effect, and (3) apparent motion.
2. A filmmaker uses multiple ways to make an object appear to be larger than it actually is. One way is zooming in. Please describe two other ways a filmmaker can make an object appear to be larger than it actually is.
   Ways that a filmmaker makes an object appear to be larger than it actually is, besides zooming in, are: (1) shooting from an angle looking up, (2) placing a smaller-scale object in the background, (3) adding objects of familiar size so models look big, (4) using miniature props, and (5) filming a small-scale explosion in slow motion to make it look more realistic.
3. Describe two ways a filmmaker can make a stationary object appear to be moving.
   Ways that a filmmaker can make a stationary object appear to be moving are: (1) changing the size of the object, (2) using a computer to replace the color blue with a film of a moving scene or object in the background, and (3) pointing a moving camera at a stationary model of an object or scene.
4. Describe one way a filmmaker can make an object appear to be farther away than it actually is.
   Ways that a filmmaker can make an object appear to be farther away than it actually is are: (1) using two or more models built to different scales in order to create the perception of depth, and (2) combining two different models of different scales – smaller in the background, larger in the foreground.
5. Describe why explosions using small-scale models look more realistic when filmed in slow motion.
   Explosions using small-scale models look more realistic when filmed in slow motion because it makes the debris from the explosion appear on the screen for a longer time, thus making the explosion look bigger.

6. Give one example of a role that a computer might play in producing special effects in a movie.

Some of the roles that a computer might play in producing special effects are: (1) combining background plates and other images using a blue screen, (2) controlling a camera that takes pictures of models, (3) inserting graphics/animations.

7. Describe two design issues a filmmaker has to consider to make a computer-generated image of an object look realistic.

Some of the design issues a filmmaker has to consider to make a computer-generated image of an object look realistic are: (1) placement of the object in a scene and its relationship to other objects in the scene, (2) shadowing and lighting of the object, (3) the object's motion/movement (e.g., right attitude, rhythm, and timing), (4) small graphic details, (5) the object's color and its relationship to background colors, and (6) the object's texture.

Those who viewed the film responded to additional open-ended content questions: (a) describe one idea or fact learned from the film; and (b) give an example of how knowledge of science and/or math is used in producing special effects.

Influence of the film beyond the museum visit. The telephone interview, one week later, asked whether the respondents had discussed the film with anyone immediately after viewing or within the last week, whether they had recommended the film to anyone, whether they had purchased anything from the museum store, whether seeing *Special Effects* had affected anything they had thought about or done in the last week, or whether they had read anything or seen anything on television that made them think of the film. With any affirmative response, the interviewer asked the respondent to explain further. Finally, respondents were asked if they had seen recently the films discussed in *Special Effects*: *Star Wars*, *Jumanji*, *Independence Day*, and *Kazaam*.

RESULTS

Appeal of *Special Effects*

After seeing the film, respondents were asked to rate how interesting or boring *Special Effects* was (see Table 4). More than three-fourths (76.4%) of the sample rated the film as "Very Interesting." Additionally, another 21.4% of the sample rated the film as "Moderately Interesting" and 2.2% rated it as "Okay." None of the respondents thought the film was boring.

Table 4. Rating of Appeal of *Special Effects* by Post-viewing Sample

Variable	N	Categories	Percent
Appeal	178	Very Interesting	76.4%
		Moderately Interesting	21.4%
		Okay	2.2%
		Moderately Boring	0.0%
		Very Boring	0.0%

Appeal ratings were found to be independent of gender, age group, education, occupation, and number of IMAX films ever seen.

What viewers liked. After viewing the film, half of the post-viewing respondents were asked what they liked about *Special Effects* and why. Of the 89 viewers who were asked to respond to this question, almost all of them (97.8%) provided an answer. Responses were sorted into the categories presented in Table 5 below. More than one-third of the sample (37.1%) liked *Special Effects* because it was <u>informative</u>. More than a one-fifth of the audience (21.3%) liked *Special Effects* because it was <u>entertaining/interesting</u>. The <u>OMNI Theater's video & audio effects</u> with its large screen, surround sound, and "you are there" feeling was most appealing to 12.4% of the viewers. Approximately 10% liked the <u>film's special effects</u>. Another 8.9% liked that film content was placed in a <u>historical context</u>. About 4.5% of the sample liked seeing footage of <u>the *Star Wars* remake</u>. A few respondents (3.4%) liked that the film showed <u>animal special effects</u>.

Table 5. What Viewers Liked about *Special Effects*

Categories	%	Examples of Responses
Informative	37.1%	• "It was very informative and the demonstrations of how the effects were done were excellent." • "I liked that it both informed and entertained, one without the other would either be boring or not substantial." • "The film, as a whole was excellent. It was informative, impressive, as well as exciting. It gave the audience the experience of how many of the effects they see in the movies are created."
Entertaining/ Interesting	21.3%	• "Very entertaining." • "Very interesting." • "It was fun looking behind the scenes. The technology is fascinating." • "What a fun way to present science, and how it can be enjoyable."
OMNI Theater audio & video	12.4%	• "The camera angles because the dome made them more intense." • "Its presentation in the OMNI theater gave it a huge impact." • "The info. is given to the audience in an exciting manner using the IMAX format which uses lots of motion."
Film's visual effects	10.1%	• "Great visual effects - fun to watch." • "The visual effects enhanced the movie and made actions realistic."
Included a historical context	8.9%	• "Continual use of current examples and relating them to how much the same concepts from the past are still used." • "Tie in to current and historical movies." • "Dramatic scenes from recent films and comparisons to older technologies which also did a good job in special effects."
Scenes from *Star Wars* remake	4.5%	• "Enjoyed previews of new Star Wars movies because I am looking forward to seeing it. I also enjoyed the learning experience." • "I was happy to see advanced look at the new Star Wars."
Animal special effects	3.4%	• "The way they make the animals come to life." • "I very much liked seeing how they created the animals. I gave me a great appreciation."
No response	2.3%	

What viewers did not like. After the film, visitors were asked also what they did not like about *Special Effects* and why. Of the 89 viewers who were asked to respond to this question, approximately three-fourths (74.2%) provided an answer. More than one-fourth of these responses (27.0%) indicated that there was nothing about the film that the respondent did not like. For example, one respondent wrote "I was so engrossed in the film that I was disappointed when it ended." Another respondent commented

"Nothing [disliked]. I believe it is the best IMAX/OMNIMAX film I have ever seen." A third respondent answered "I loved everything."

Responses indicating a disliked feature were sorted into categories presented in Table 6 below. About one-tenth (12.3%) of the audience were discomforted by the OMNI format, complaining about motion sickness (6.7%) or screen design (5.6%). Another tenth of the sample felt the film was too loud (6.7%) or out of focus (3.4%). Approximately one-tenth (10.1%) of the sample felt that there was <u>not enough action</u>. Another 9.0% thought there was <u>not enough information</u> about special effects provided by the film. In contrast, 5.6% of the respondents felt that the film contained <u>disillusioning information</u> that may take some of the magic out of future film viewing. Small groups of viewers (2.3%) expressed opinions that the film was <u>poorly structured,</u> that the film and/or credits were <u>too long</u>, and that <u>additional examples</u> should have been selected from other currently popular movies.

Table 6. What Viewers Did Not Like About *Special Effects*

Categories	*%*	*Examples of Responses*
Motion caused discomfort	6.7%	• "I have tendency to motion sickness - found some sequences too much." • "King Kong free fall scene. Almost made my wife sick (she's very subject to motion sickness)."
Screen design	5.6%	• "Hard to view entire screen – especially any parts overhead." • "Don't like the curvature of straight objects on screen. Takes away from the experience." • "Some effects were too close and seemed 'in your face'."
OMNI format	**12.3%**	
Too loud	6.7%	• "Too loud - I got a headache and a little sick to my stomach." • "The movie was too loud."
Film was out of focus	3.4%	• "Poor focus." • "At times the picture appeared blurry."
OMNI accommodations	**10.1%**	
Not enough action/effects	10.1%	• "Too much talking, not enough effect." • "There weren't enough scenes where you felt like you yourself were actually moving, which is something I've enjoyed at other Omni films."
Not enough information	9.0%	• "Too little detail in how effects are used to enhance routine imagery." • "Possibly some more history how special effects were achieved in the past – this would illustrate the advances."
Dispels wanted illusions	5.6%	• "Might take magic out of real movies." • "Disillusionment – took away from conceived reality."
Film was poorly structured	2.3%	• "Some of the sequences were strung together but not necessarily related." • "Big lanes and modern cars, army, etc. together made no sense."
Film and/or credits too long	2.3%	• "Captive audience at the end, watching all of the credits." • "Just a little bit too long for younger kids."
Prefer other film examples	2.3%	• "[I didn't like] Kazaam because it's a dumb movie." • "I wish there were more scenes from Toy Story since I have young children."
Nothing disliked	20.2%	
No response	25.8%	

How film did or did not meet expectations. Post-viewing respondents were asked to choose from a selection of four statements the one that best described how *Special Effects*

compared to their expectations. Responses were received from 177 (99.4%) of these viewers. As illustrated in Table 7, 27.5% of the sample reported having <u>no expectations</u> before seeing the film.   Fewer (5.6%) members of the sample felt that the film <u>did not meet</u> their expectations. The following comments were offered as explanations for why *Special Effects* had not met viewer expectations:

> The film did not meet my expectations because
> - "it was lacking more historical background of how it is accomplished."
> - "there was not more variety; it was almost all explosions; there was not enough excitement or information."
> - "most of the information I already knew."
> - "I had hoped to see more explosions."
> - "I thought it would be a little scarier."
> - "I would have liked more motion scenes."
> - "there weren't enough scenes where you felt like you yourself were actually moving, which is something I've enjoyed at other Omni films."
> - "I have seen better."

In contrast, 43.8% reported that the film <u>did meet</u> their expectations and 22.5% reported it <u>exceeded</u> their expectations. Thus, 66.3% of the post-viewing sample felt that *Special Effects* had met or exceeded their expectations, whereas a small group (5.6%) felt the film did not meet their expectations.

Table 7. How *Special Effects* Compared to Viewer Expectations

N	Categories	Number	Percent
178	I had no expectation before seeing the film	49	27.5%
	The film did not meet my expectations.	10	5.6%
	The film met my expectations.	78	43.8%
	The film exceeded my expectations	40	22.5%
	No response	1	0.6%

What surprised viewers. In order to capture unplanned appeal effects, half of the post-viewing sample was asked to complete the sentence, " I was surprised . . . ." Responses were sorted with keywords, and percentages of each mutually exclusive category are presented in Table 8 on the next page. Nearly one-quarter (23.6%) of the sample were surprised by the <u>information</u> in *Special Effects*. Another 15.7% were surprised by the <u>complexity</u> of producing special effects in films. About 11% of the respondents were surprised by the <u>OMNI Theater's visual and audio features</u>. Seeing how special effects are used to make <u>explosions</u> look realistic surprised 7.9% of the sample.   The inclusion of new footage and special effects in a <u>re-release version of *Star Wars*</u> surprised 5.6% of respondents. Similarly, 5.6% were surprised by the film's opening scenes showing <u>King Kong falling</u>. About 3.4% of the sample were surprised by how <u>realistic</u> special effects can seem and by the inclusion of "old movies" in *Special Effects*. Another 2% were surprised by how <u>interesting</u> the film was and by the <u>numerous examples</u> of effects shown from a wide variety of films. Only one respondent was <u>not surprised</u> by *Special Effects*. Approximately 18% of the sample <u>wrote no answer</u> to the question.

Table 8. Respondents' Completion of "I was surprised . . . "

Categories of Surprise	%	Examples of Responses "I was surprised . . . "
Information contained in film	23.6%	• "with the amount of information I got in such a short period of time." • "there was so much information" • "that it makes me know about how to make a film, special effects." • "to learn how Jumanji was filmed."
Complexity of producing special effects	15.7%	• "at the degree of work needed to produce a brief moment of the film." • "by the complexity of the process." • "to see how long and how much work is really involved in special effects."
OMNI Theatre audio & video	11.2%	• "by the screen and the type of movement; by the size of the objects." • "by the enhancement of the special effects in Omnimax." • "in the realisticness of the surround-image and sound."
Explosions	7.9%	• "to see explosions slowed down." • "that the explosions are done on miniatures." • "at the volume and amount of explosions shown."
Star Wars is being re-released	5.6%	• "by all the new footage and effects of Star Wars." • "they are re-doing scenes from Star Wars." • "to learn additional scenes will be added to the 20th Anniversary Star Wars."
King Kong scene	5.6%	• "at Kong's toy-like size." • "when King Kong fell and was caught in the net." • "when Kong began to fall."
How realistic special effects can seem	3.4%	• "by the reality of the movie." • "that special effects appeared so realistic."
Scenes from early films	3.4%	• "that examples of early films were used." • "that so much time was devoted to old movie footage." • "to see so much old footage."
How interesting it was	2.2%	• "at how interesting it was." • "my 14 year old male child enjoyed this more than a previous Omni film."
Number of film examples	2.2%	• "at the number of movies that were covered." • "by the various examples, Star Wars to Jumanji."
Not surprised	1.2%	
No response	18.0%	

What most disappointed viewers. Survey respondents also completed the sentence stem: "I was most disappointed . . . . " Responses were sorted with keywords, and percentages of each mutually exclusive category are shown in Table 9 on the next page. Nearly one-fourth (24.7%) of the sample wrote <u>no answer</u> to the question.   About one-fourth (23.6%) were <u>not disappointed</u> by *Special Effects*. Approximately 13.5% felt the length of the <u>film was too short</u>. Slightly more than 9% thought that there was <u>not enough information</u>. Other respondents (5.6%) indicated that there was a <u>lack of action footage</u> or there were <u>not enough examples</u> of special effects. Another 3.4% were disappointed by the <u>lack of OMNI-unique effects</u>; 3.4% were disappointed because the film had <u>dispelled wanted illusions</u>, and 3.4% felt the film had a <u>limited historical context</u>. Other disappointing aspects of the film experience included the film's <u>excessive sound volume</u> (2.2%), <u>theatre accommodations</u> (1.1%), film <u>out of focus</u> (1.1%), feeling of <u>motion sickness</u> (1.1%), explanations <u>wouldn't hold interest of children</u> (1.1%), and by the <u>lion scene</u> (1.1%).

Table 9. Respondents' Completion of "I was most disappointed . . . "

Categories of Disappointment	%	Examples of Responses "I was most disappointed . . . "
Film was too short	13.5%	"it wasn't as long as I would have liked; I've seen this type of demonstration before." "that it wasn't longer and covered more effects." "when the film was over as I wish it had been longer."
Not enough information	9.1%	"by the lack of depth. Would have preferred more technical detail." "that the film did not go into greater detail regarding the computer technology." "that there was no more information about model and mask making." "that I knew most of what was presented."
Not enough action	5.6%	"that there was not more excitement or information." "they did not show more action scenes." "wanted more action. Had seen making of Independence Day on HBO."
Not enough examples of special effects	5.6%	"that there were not more examples, past and present." "by the number of actual effects." "only a few specific films were represented – I wanted to see more."
Dispels wanted illusions	3.4%	"that it takes some of the "magic" away from film." "to find that some things weren't real." "of discovering that some things are just toys."
Lack of OMNI- unique effects	3.4%	"with the lack of effects – most effects were for flat screens." "that the Imax effect wasn't used to its full potential, not enough."
Not enough historical context	3.4%	"that the film wasn't done as a history of the development of special effects. It looked like an ad for Star Wars II." "would like to see comparison of old and new."
Volume was too loud	2.2%	"at the volume being uncomfortably loud." "in the loud volume level."
Theatre design/ accommodations	1.1%	"that I could not eat popcorn."
Film was out of focus	1.1%	"from where I was sitting, some parts were blurred (3rd row center)."
Feeling of motion sickness	1.1%	"I got so dizzy."
Wouldn't hold children's interest	1.1%	"because I thought that children would start to be bored with all the explaining of the technical aspects detailed."
By the lion scene	1.1%	"by the lion scene."
Not disappointed	23.6%	
No response	24.7%	

Impact on Knowledge

Achievement of intended viewing goals. Understanding of special effects and perception, as presented in *Special Effects*, was assessed via a 10-point test with seven short answer items. Figure 1 shows the distribution of the test scores for both the pre-viewing and post-viewing samples.

Figure 1. Distribution of Test Scores for Pre- and Post-viewing Samples
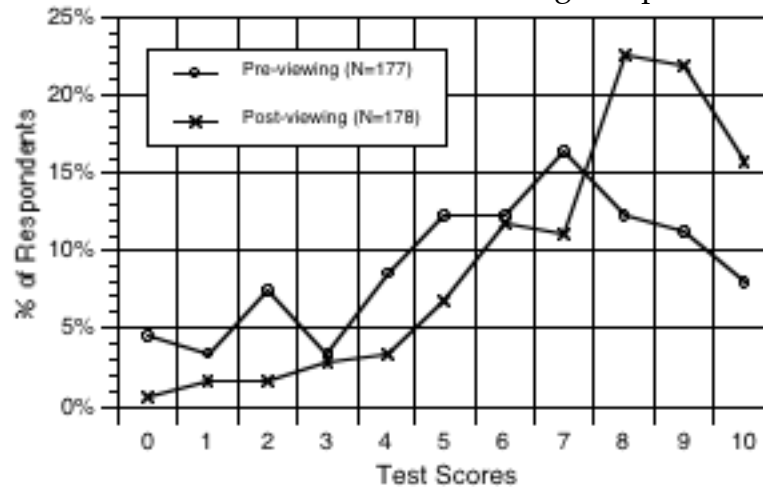
The mean achievement score for the pre-viewing group was 5.94 and for the post-viewing group, 7.45. The analysis of variance indicated that the means were significantly different, F(1, 353) = 33.04, p = .0001.

With an interest in interaction effects, separate two-way ANOVAs on the scores were calculated for Viewing Group (Pre, Post) and individual demographic and background variables of Gender, Age Group, Education, Occupation, and Saw Films Prior. None of the interactions were statistically significant.

Ideas or facts learned. Prior to completing the test section mentioned above, the questionnaire asked viewers to describe one idea or fact that they learned from the film. The majority of respondents (89.3%) provided one idea or fact. A small group (2.3%) said they had learned nothing new and the remaining respondents (8.4%) did not answer the question at all. The facts were sorted with keywords, and percentages of each mutually exclusive categories are shown in Table 10 below.

Approximately 14.6% of the viewers learned something about how the appearance of motion can be created by moving the camera. Another 9.0% indicated that they learned about how small-scale explosions filmed in slow motion appear realistic. An understanding of some of the techniques used by filmmakers to make non-real animals appear realistic was gained by 8.4%. Other respondents (6.7%) reported that they learned how composite scenes are made. Similarly, 6.7% of the respondents learned that special effects can appear to be very realistic. An equal percentage of respondents (5.6%) learned how computers are used to produce special effects, that creating special effects is a very complex process, ways that a filmmaker makes an object appear to be larger than it actually is, and information about human perception. About 5.1% of the responses were labeled miscellaneous information about special effects because they

did not clearly fit into the previous categories. An equal percentage of respondents (4.5%) obtained information <u>about the history of special effects in the movies</u> and about <u>the filming of Star Wars</u>. A small percentage of respondents (3.9%) learned how <u>burning models are sometimes tilted on their side to create a realistic appearing fire</u>. Finally, 3.4% of respondents were surprised to <u>how frequently models are used in films</u>.

Table 10. Ideas and Facts Viewers Learned From the Film

Categories of What was Learned	%	Examples of Responses
How the appearance of motion can be created by moving the camera	14.6%	"Moving the camera creates the illusion of an object moving." "The use of moving cameras to give the illusion of vehicle motion." "That the camera is moved and not the models to show motion."
How small-scale explosions filmed in slow motion appear realistic	9.0%	"I learned that explosions were miniature and in slow motion (in film making)." "How they build models and blow them up with controlled explosions and film them in slow motion."
Techniques that filmmakers use to make non-real animals appear to be realistic	8.4%	"Animatronics involves having people actually placed inside the models." "How animals are animated by use of humans and machines." "I learned how they made the animals in Jumanji."
How composite scenes are made	6.7%	"Blue background used and then real background superimposed." "The idea of the blue backgrounds to be later filled in with scenery."
That special effects can appear to be realistic	6.7%	"Anything that may be fake, can be made to look real or come alive." "It's hard to tell what's real anymore."
How computers are used to produce special effects	5.6%	"I learned all about the computer imaging." "The use of computers to allow objects to appear trampled or destroyed."
The complexity of creating special effects	5.6%	"The images that are on the screen are much more complicated than what we think." "That such a brief moment of special effects can take along time, many people and skills to create."
Ways that a filmmaker makes an object appear to be larger	5.6%	"Use of models to simulate large objects." "Smaller objects are used to make bigger objects look really big."
Information about human perception	5.6%	"That the mind fills in the blanks that the film leaves." "How the brain and vision work to deceive me."
Miscellaneous info. about special effects	5.1%	"Air pressure was used to flip cars in ID4." "The size of the actual sets used for the movies."
Information about the history of special effects in the movies	4.5%	"The science of special effects was first used in films by a French magician." "The evolution of the special effects themselves."
Information about Star Wars	4.5%	"Learned how the footprints were made in the sand in Star Wars." "Star Wars [re-release] changed special effects."
How burning models are tilted on their side to create realistic fires	3.9%	"That the city in Independence Day was filmed sideways so that the flames seemed to shoot between the buildings." "Buildings are tilted sideways when filmmaker wants flames to appear to move down the street."
How frequently models are used in films	3.4%	"How frequently models are used." "That so many small models are used."
Learned nothing	2.3%	
No response	8.4%	

Awareness about how science and/or math are used in producing special effects. Because knowledge of science and math play a large role in producing special effects, we were interested to find out if viewers learned anything new about the application of these domains. Of the 177 pre-viewing respondents, 97 (54.8%) provided an example of how science and/or math is used in producing special effects. Of the 178 post-viewing respondents, a larger number, 157 (88.2%), provided such an example. There were significantly more respondents giving examples for this question for the post-viewing sample than for the pre-viewing sample ($\chi^2 = 47.01$, p < .001). The responses were sorted with keywords, and percentages of each mutually exclusive category are shown in Table 11 below.

Chi-square analyses of the pre- and post-viewing responses for each category indicate that three of the eleven categories show significant differences between the groups. Those who had seen the film were significantly more likely to explain how science and/or math are used in producing special effects by referring to Explosions ($\chi^2 = 27.21$, p< .001), Perspective ($\chi^2 = 17.38$, p < .001) or Lighting ($\chi^2 = 4.21$, p < .05). Although the post-viewing sample also gave more responses for the categories of Human Perception, Animatronics and Motion Camera, these were not beyond chance differences.

Table 11. Awareness about how science and/or math are used to produce special effects

Special Effect/Application	% of Pre-viewing responses (N=177)	% of Post-viewing responses (N=178)	χ^2	p <
Explosions	6.2%	27.5%	27.21	.001
"To properly and safely film explosions on film, a knowledge of chemistry and physics is needed."				
Perspective	0.6%	11.8%	17.38	.001
"In desert town scene, camera height and angle had to be calculated in filming inhabitants of town to match perspective of shot of model desert town."				
Lighting	0.0%	3.4%	4.21	.05
"The use of light and how it is refracted through glass." "Use of color and shadow effects." "Measuring the lighting."				
Human Perception	1.7%	6.2%	3.60	ns
"You need to know about visual perception and the mechanisms of sight."				
Animatronics	0.6%	3.9%	3.17	ns
"Animatronics requires [knowledge about] the physics of motion."				
Motion Camera	0.0%	1.7%	1.33	ns
"Moving the camera creates motion instead of the object moving."				

Computer generated special effects "Science and math are used when creating computer-generated images (size, dimensions, etc.)."	7.9%	7.9%	0.03	ns
Timing of events "I'm sure both [science and math] are invaluable to special effects, such as timing scientifically."	6.2%	5.6%	0.00	ns
Miscellaneous general responses "Who cares? How about all the art used in effects." "Knowledge is used to understand physical properties of an effect." "It's all science."	18.1%	14.6%	0.55	ns
Scaling of models "A good working knowledge of physics and math are needed to determine scales and motion and how they will apply themselves."	7.9%	3.9%	1.86	ns
Physical placement of objects "To figure out how and where to place objects."	5.6%	1.7%	2.91	ns
No response	45.2%	11.8%	47.01	.001

Influences Beyond the Museum Visit

Fifteen men and fifteen women participated in a telephone interview 10 days after viewing *Special Effects*. All but two of the 30 respondents (93%) reported that they had discussed the film with their co-viewers immediately after the viewing. Without reservations, 21 interviewees said their discussion was positive. They spoke about how intense, interesting, and entertaining *Special Effects* was (n=13), how they related it to movies with special effects they had seen (n=2), how they especially enjoyed the scenes from *Independence Day* (n=2) and *King Kong* (n=2), that it was the best OMNI film they had seen to date (n=2), and that they were excited about the *Star Wars* segments (n=2). The remaining seven respondents reported positive post-viewing discussions as well but were disappointed with the inclusion of *Kazaam* (n=1), the film's short length (n=1), the omission of the Boston feature at the beginning (n=1), the lack of motion in the film (n=1), and the feeling that they enjoyed *Yellowstone* more (n=3). Other interviewees felt that the film was too technical (n=1), too loud (n=1), or contained too much information (n=1).

About three-fourths (76%) of the phoned audience reported that they had spoken with other people about the film in the previous week. Typically, the conversations were with relatives, friends or colleagues at work. Twenty of 23 adults were positive about the film in their conversations, saying that it was "great," "fun," "really good" and "interesting." The remaining three were less positive; two indicated in their conversations with others that they had seen similar material on television, and one person wanted to experience vertigo more often during the film.

When asked if they had recommended to anyone to see *Special Effects*, twenty-five (83%) said that they had. In their recommendation, the interviewees reported saying that the film was
- "interesting" (n=4),
- "fun" (n=2),
- "worth the price of admission – especially the *Star Wars* remake" (n=2),
- "that they would enjoy it" (n=2),
- "really terrific" (n=1),
- "a great insight into film making" (n=1),
- "very intense" (n=1),
- "an experience worth seeing" (n=1),
- "that the role of a computer is very important" (n=1),
- "great science" (n=1),
- "you won't feel sick like in other OMNI films" (n=1),
- "I liked it" (n=1),
- "great" (n=1),
- "fun and informative" (n=1),
- "impressive" (n=1),
- "fabulous" (n=1),
- "good, you'll see special effects from movies you've seen" (n=1),
- "amazing and unbelievable" (n=1),
- " a good time" (n=1), and
- "see it if you get a chance" (n=1).

Ten respondents (33%) reported buying something from the Museum of Science store after seeing the film; however, no one reported making any store purchases related to the film.

Those interviewed by telephone were also asked if seeing *Special Effects* had affected anything they had thought about or done in the previous week. Slightly more than half (53%) of the 30 respondents answered affirmatively. Seven observed that they "pay closer attention" or "look more" for special effects in movies or television programs they watch. Going or wanting to go to a movie mentioned in *Special Effects* was described by five respondents. Two computer professionals reported that they think about their work in new ways since viewing the film. Two respondents have been very excited about the *Star Wars* remake.

The interviewed sample was asked whether they had read or seen anything on television that made them think of *Special Effects*. More than half (60%) agreed that they had. Of this group, 78% reported looking more closely at television shows and commercials for special effects. Two respondents watched shows on how to create effects in the movies. Finally, when watching a commercial for *Independence Day* on television, one respondent explained the special effects to his friends.

Lastly, of the twenty-six respondents who were asked if, since seeing the OMNI film, they had seen the films featured in *Special Effects*, 58% reported that they had not. In contrast, 42% indicated that they had seen one or more of the featured films. Four of these respondents had seen *Star Wars*, three saw *Jumanji*, one saw *Independence Day*, two saw both *Independence Day* and *Jumanji*, and one saw both *Star Wars* and *Jumanji*.

Viewing of *Independence Day* after seeing *Special Effects* is perhaps partially attributable to its having been released shortly before this study was conducted.

DISCUSSION

• *To what extent did the program appeal to adult viewers?*

Nearly the entire sample (97.8%) thought *Special Effects* was either "very" or "moderately" interesting. To put this very positive quantitative result in perspective, we can compare *Special Effects'* appeal ratings to Boston viewers' reactions in a similar evaluation of the OMNIMAX film *Stormchasers* (Flagg & Johnson, 1996). The rating of "very interesting" was given to *Special Effects* by 76.4% of the audience and to *Stormchasers* by 53.8%. The rating of "moderately interesting" was given to *Special Effects* by 21.4% of the audience and to *Stormchasers* by 28.1%. *Special Effects* was received more positively by viewers, although both films were appealing to a large majority of their audiences.

About two-thirds of the audience reported that *Special Effects* met or exceeded expectations, whereas one-third of the *Stormchasers* audience felt that way. Over half of the *Special Effects* audience focused on the effects aspect as what they liked best about the film: the entertainment quality (21%); OMNI effects (12%); visual effects (10%); new *Star Wars* scenes (5%); and animal special effects (3%).

More than one-third of the *Special Effects* sample (37%) liked the informative qualities of the film, and another 9% liked the inclusion of an historical context. These findings counteract a superficial impression that the film is almost all entertaining effects, without substance. In fact, nearly one-quarter of the sample said they were surprised by the information contained in *Special Effects,* and another 16% were surprised by the complexity of producing the effects. Again, to put these results in perspective, we found a similar result for *Stormchasers*, that 37% of the audience liked the informative quality of *Stormchasers*.

When the *Special Effects* audience was polled about how the film did not meet expectations, about what they did not like or what disappointed them about the film, about one-quarter of the audience mentioned discomfort with the OMNI format and accommodations: they experienced motion sickness; disliked the unfocused screen or the screen curvature; thought that film sequences were not maximized for the theater format; or felt the sound was too loud. A similar percentage of *Stormchasers* viewers reported similar problems with the OMNI format. We also found small proportions of the *Special Effects* audience who requested a longer film, more information, more action, more examples, or who felt that the film presented disillusioning information that might take some of the magic out of future film viewing.

- *To what extent did the program achieve its intended viewing goals?*

  Viewing the film significantly increased science knowledge, as measured by a 10-point content test on the intended viewing goals. The test covered why an audience perceives continuous movement in a film; why explosions look more realistic when filmed in slow motion; how filmmakers can make an object appear larger than it actually is, appear farther away than it actually is or appear to be moving; and finally, how computers play a role in special effects and what filmmakers must consider to make computer-generated images look realistic. Viewers of *Special Effects* came away knowing more about how filmmakers produce effects of movement, scale, three-dimensionality, explosions and realistic computer images. The previewing mean test score was 5.94 out of 10 points compared with the significantly higher post-viewing mean score of 7.45. These scores did not show interactions with any of the demographic or background variables measured. Significant knowledge change was also found for viewers of *Stormchasers*.

- *What did viewers perceive that they learned from the program, if anything?*

  When asked what they had learned from the film, most viewers (74%) focused on specific techniques of producing special effects (motion camera, slow motion filming, composite scenes, computers, models, etc.). Another 5.6% learned about the complexity of creating special effects; 5.6% learned information about human perception; and 4.5% learned about the history of special effects.

  Additionally, significantly more viewers than non-viewers were able to provide examples of ways that knowledge of science and/or math is used in producing special effects. Viewers provided more examples than non-viewers in the categories of Explosions, Perspective, Lighting, Human Perception, Animatronics, and Motion Camera. Those who had seen the film were significantly more likely than non-viewers to refer to Explosions, Perspective or Lighting to explain how science and math are used in producing special effects. It is clear that viewers were affected by the long segments on explosions in *Independence Day* and on perspective in *Star Wars*.

- *Did viewing the program influence the audience beyond the museum visit?*

  Our telephone interviews indicated that 93% of the interviewees discussed the film with their co-viewers immediately after seeing it, 76% discussed the film with others in the week following their visit, and 83% had recommended to others that they see *Special Effects*. A little more than half of the respondents agreed that seeing *Special Effects* had affected something that they had thought about during the week after the viewing, and half agreed that something they had read or seen on television had made them think of the film. Of those questioned, almost half reported seeing at least one of the films featured in *Special Effects* following the viewing. Although it is difficult to assess reliably the impact of a program beyond its real-time frame, it appears that half of the audience felt that they were still influenced by the film one week later. The *Stormchasers* evaluation also reported that approximately half of the interviewed audience felt a subsequent influence of the film.

In conclusion, *Special Effects* was interesting to 98% of the audience, made a significant impact on their knowledge of special effects in film and continued to influence half of the audience after their museum visit.

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