

MULTIMEDIA RESEARCH

33 BROWNS LANE • BELLPORT, NY 11713 • (631) 286-8925

Summative Evaluation of  
*Stormchasers*  
with an Adult Audience

Report for  
Museum Film Network  
NOVA/WGBH

by

Barbara N. Flagg, Ed.D, Director  
Art Johnson, Ed.D.

with assistance of  
Marilyn Matzko  
Robin Glickstein  
Lisa Rosin

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## EXECUTIVE SUMMARY OF SUMMATIVE EVALUATION OF *STORMCHASERS* (ADULT SAMPLE)

Multimedia Research, May 10, 1996

With major funding from the National Science Foundation, the Museum Film Network and NOVA/WGBH in conjunction with MacGillivray Freeman Films have produced an IMAX/ OMNIMAX film called *Stormchasers*. *Stormchasers* follows scientists as they investigate the dramatic weather effects of monsoons, hurricanes, and tornadoes.

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 239 adults completed a questionnaire and content test prior to viewing *Stormchasers* at the Museum of Science in Boston, MA. A second random sample of 249 adults completed a questionnaire and content test after viewing the OMNIMAX film. The sample was recruited over a period of two non-holiday weeks during 24 weekday shows and 8 weekend shows. Weekend respondents represented 38% 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, number of IMAX films ever seen and reported interest in learning about severe storm systems like hurricanes, monsoons and tornadoes. The two groups did differ significantly with respect to whether occupation was related to science and with respect to reported prior knowledge about severe storm systems.

For the sample as a whole, the classification variables of gender, age group, education, and number of IMAX films ever seen were fairly equally distributed. The sample was overwhelmingly white; over half of the audience claimed to be "very interested" in the program topics; and two-thirds had occupations not related to science.

Each of those who completed a questionnaire was asked if they were willing to be interviewed by phone one week later. More than half agreed, and the first 20 males and 20 females in Massachusetts to be reached successfully by phone constituted the interviewed sample.

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

**Four-fifths of the audience thought the program was either "very" or "moderately" interesting. Viewers particularly liked the photography of the storms, the information about stormchasers and storms and the special effects of the OMNI theater itself. Over 40% of the audience felt that the film met or exceeded their expectations, but 35% felt that the film did not meet their expectations. The audience most often mentioned wanting more storm footage and more action with less of a focus on narration and the chasers themselves. They wanted more OMNI-specific effects and less of a television**

**documentary. On the other hand, the unique look at stormchasers and the qualities of storms surprised the audience.**

After seeing the film, respondents were asked to rate how interesting or boring *Stormchasers* was. More than half of the sample rated the program as "very interesting" (53.8%); one-quarter (28.1%) felt the program was "moderately interesting," 13.3% rated the film as "okay" and fewer than 5% thought the program was "moderately" or "very" boring. The following categories describe what the audience liked about the film:

- 39.2% The photography of the storms
- 36.6% The information about stormchasers and storms - their formation, their prediction, and the methods used to look at them
- 30.0% The special effects of the OMNI Theater with its large screen, surround sound, and "you are there" feeling
- 6.5% The excitement
- 4.0% Seeing power of storms

When asked in an open-ended question what they did not like about the film, respondents' answers focused on the following concerns:

- 31.5% Wanted more storm footage and more action with less focus on narration and the chasers themselves
- 19.2% Wanted more OMNI effects typical of other OMNI films and less filming indoors or in rotation around static people; some felt the film was too similar to television
- 13.0% Wanted more information
- 4.4% Boring
- 3.2% Too loud
- 2.8% Too much information, too technical
- 2.4% Problems with the theater itself in terms of picture distortion, distracting screen seams, and viewing discomfort
- 2.0% Too short

Post-viewing respondents were asked to explain in an open-ended question how the film did or did not meet their expectations. Over 40% of the audience felt that the film met or exceeded their expectations, but 35% felt that the film did not meet their expectations:

- 3.6% Exceeded Expectations
- 29.4% Met Expectations
- 7.3% Met Expectations But . . . they wanted more storm action.
- 4.0% Did Not Meet Expectations
- 30.6% Expected More . . . more action, more OMNI-unique effects, more storm footage, or more information.
- 25.1% No Expectations or Gave No Response

Visitors were asked to complete the sentence, "I was surprised . . .". One-quarter (24.2%) of the sample were either not surprised or wrote no answer to the question. The remaining responses were sorted into the following mutually exclusive categories:

- 28.0% Surprised by the stormchasers themselves -- that people fly into storms or chase storms, by how close these people get to storms and by the risks they take.
- 14.8% Surprised by the qualities of storms -- their power, their destruction, and the

- hurricane eye and wall.
- 13.6% Surprised by the film's information concerning prediction, tracking, tornadoes, monsoons and storm research.
- 12.8% Surprised by the positive production qualities of the film itself; they liked the realism, the image size, the photography, sound and graphics.
- 5.6% Surprised by the poor production quality of the film.
- 1.2% Surprised by the personal connections they made to the film.

Visitors also completed the sentence stem: "I was most disappointed . . . ." Over one-third (35.2%) of the sample were either not disappointed or wrote no answer to the question. Two-thirds of the audience were disappointed as follows:

- 37.2% Disappointed by the lack of action footage presenting more storms.
- 18.0% Disappointed by the coverage or focus of the film: the focus on tornado chasers and death and destruction, the lack of focus on other storms, too much or too little coverage of facts, and the abrupt conclusion of the tornado sequence.
- 6.4% Disappointment at lack of OMNI-unique effects.
- 1.6% Disappointment at feeling sick.
- 0.8% Disappointment at sitting in front.
- 0.8% Disappointment with the sound.

- **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 youngest age groups and those who professed less interest in the film's topics prior to viewing the film appeared to benefit more from seeing the film than the oldest age group (48+) and those more interested in the content. Viewers of *Stormchasers* came away knowing more about the elements responsible for our weather patterns, the methods and tools used by scientists to study, track and predict severe weather, and the relative predictability of storm systems.**

There was a statistically significant difference between audience knowledge of the film's content before viewing the film ( $M = 5.12$ ) and knowledge after viewing ( $M = 6.90$ ).

A significant interaction was found between Viewing Group (Pre, Post) and Age Group (18-27 years; 28-37; 38-47; 48+). The pre and post viewing means were significantly different for each of the three youngest age groups but not for the oldest group (48+ years). Prior to the program, the oldest members of the audience had the highest mean test score, but after the program, the oldest group had the lowest mean test score, although the post-viewing scores did not differ significantly among the age groups.

A significant interaction was found also between Viewing Group (Pre, Post) and Interest Group (Very Interested, Moderately Interested, A Little or No Interest). Each of the three interest groups showed a significant increase in knowledge in the post-viewing test versus the pre-viewing test; however, prior to seeing the film, the less interested viewers scored the lowest and after seeing the film, the less interested viewers scored the highest.

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

**The film had the most impact on what the audience perceived they learned about how storms are studied, how storms are formed and specific details of the three types of storm systems covered. Over half of the audience felt that they learned something new about scientists from the film. Over half of the audience felt that they had connected or associated the film with previous knowledge or experience, mainly informal learning experiences (TV, movies) and personal experiences with storms.**

When asked about the ideas and facts that they learned from the film, one-quarter learned how storms are studied, one-quarter learned specific facts about the types of storms (tornadoes, hurricanes, monsoons), 15% learned about the formation of storms, 7% learned about the power and destructive nature of the storm systems, and 1.4% learned that the activities of the stormchasers protect people.

Over half of the audience (53%) felt that they had learned something about scientists that they did not know before viewing the film. These ideas included that scientists get actively involved with the storms themselves; that they are dedicated to their work; that they track and predict storms; that they take risks; that they fly into hurricanes; that there are careers associated with storms; that the work is complex; that scientists are human and are responsible for making decisions that affect people's lives.

Over half of the audience (55%) explained how they connected or associated the film with previous knowledge or experiences. One-fifth of the audience associated *Stormchasers* with other informal learning experiences including television programs, movies, exhibits, and discussions with people who have experienced hurricanes or tornadoes. One-fifth connected the film with their own personal experience with storms. Less than 5% of the sample associated the film with their personal interests, previous knowledge, or school science classes.

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

**Forty of the respondents were interviewed by phone about one week following their museum visit. Three-fifths reported that they had spoken with other people about the film since seeing it; most recalled positive conversations but one-fifth indicated in the conversation that the OMNI film was too much like TV. Two-fifths of the interviewees said that they had recommended the film to others. Slightly less than half of the group felt that seeing *Stormchasers* had affected what they had thought about or done in the previous week, and slightly more than half felt that they had recently read or seen something on television that made them think of the movie. The film appeared to have a positive post-viewing effect on half of the audience.**

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## INTRODUCTION

With funding from the National Science Foundation, the Museum Film Network and NOVA/WGBH in conjunction with MacGillivray Freeman Films have produced an IMAX/OMNIMAX film called *Stormchasers*. *Stormchasers* follows scientists as they investigate dramatic weather effects of monsoons, hurricanes, and tornadoes.

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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 two weeks 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 not 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 same 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 37 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. The possibility of also posttesting the group that was pretested was considered but piloting this procedure quickly showed problems with obtaining respondent cooperation, and the idea was dropped.

## METHOD

### Sample

The population from which the sample was randomly chosen was comprised of audience members over 18 years of age who stood in the waiting line to view *Stormchasers* during a period of two non-holiday weeks in the late winter. 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 523 adults who were randomly selected to participate in the evaluation, 4 people (1%) declined responding to the post-viewing questionnaire because of prior commitments. Another 22 adults (4%) initially agreed to participate but did not carry through after viewing; two of these respondents needed to attend to a child; three were pressured by others in their party to move on to another activity; and the remaining 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 5% of the adults who were approached did not participate in the evaluation.

Of the 497 questionnaires collected, 9 (2%) 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 included 239 pre-viewing questionnaires and 249 post-viewing questionnaires.

Researchers recruited over a period of two non-holiday weeks on 10 weekdays and 4 weekend days, eliciting questionnaires during 24 weekday shows and 8 weekend shows. Weekend respondents represented 38% 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, number of IMAX films ever seen and reported interest in learning about severe storm systems like hurricanes, monsoons and tornadoes. 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, education, and number of films seen were fairly equally distributed across the categories. The sample was overwhelmingly white, so ethnicity was not analyzed further in the data analyses. Over half of the sample attending the program claimed to be "very interested" in the program topics, which would be expected of a group that purchased tickets for an event such as the IMAX film. Because only three pre and three post-viewing respondents fell into the category of "not at all interested," this category was combined with "a little interested" in further data analyses.

Table 1. Non-significant Demographic and Background Variables

<i>Variable</i>	<i>N</i>	<i>Categories</i>	<i>Percent</i>
Gender	487	Female	51.5%
		Male	48.5%
Ethnicity	488	White	98.6%
		Minority	1.4%
Age Group	482	18-27	20.7%
		28-37	29.3%
		38-47	33.2%
		48+	16.8%
Education	486	Some college or less	32.5%
		College graduate	39.3%
		Post graduate	28.2%
Number of IMAX Films Ever Seen	488	This is my first film.	28.7%
		One other film.	17.8%
		Three films.	26.8%
		Four or more films.	26.0%
Interest in Learning about Severe Storm Systems like Hurricanes, Monsoons, and Tornadoes	488	Very interested	50.8%
		Moderately interested	37.7%
		A little interested	10.2%
		Not at all interested	0.1%

In contrast, chi-square analyses revealed that the Viewing Groups (pre, post) did differ significantly with respect to whether occupation was related to science and with respect to reported prior knowledge about severe storm systems. Table 2 presents the distribution of the sample on these classification variables.

Occupations were related to science for 38% of the pre-viewing group and 24% of the post-viewing group. More than half (59.5%) of the pre-viewing group felt that they knew a little or nothing of the film's topics, whereas more than half (59.4%) of the post-viewing group estimated that they knew a lot or a moderate amount about the topics prior to seeing the film. Note that the difference between the two groups may be due to the fact that the post-viewing group made their estimation of pre-viewing knowledge retrospectively after seeing the film, whereas the pre-viewing group estimated their pre-viewing knowledge before seeing the film. Additionally, the variables, occupation and prior knowledge, were not independent for either the pre-viewing sample ( $\chi^2(3) = 11.01, p = .01$ ) or the post-viewing sample ( $\chi^2(3) = 7.67, p = .053$ ). As estimation of prior knowledge decreased from "know a lot" to "know nothing," the percentage of the sample reporting occupations related to science decreased also. The calculation of phi as a measure of association indicated a moderate association for the pre-viewing data ( $\phi = .22$ ) and a weak association for the post-viewing data ( $\phi = .18$ ).

Table 2. Significant Demographic and Background Variables

Variable	N	Categories	Pre %	Post %	$\chi^2$
Occupation	486	Related to science	38.0%	24.1%	10.96***
		Not related to science	62.0%	75.9%	
Prior Knowledge	488	I know a lot	5.4%	11.2%	19.18***
		I know a moderate amount	35.1%	48.2%	
		I know a little	53.6%	37.8%	
		I know nothing	5.9%	2.8%	

\*\*\*  $p < .001$

*Interviewed sample.* Each of the pre and post-viewing respondents were asked if they were willing to be interviewed by phone one week later. More than half of the total sample (53.4%) provided their names, telephone numbers and suggested times for a followup interview; this group included 49.1% of the pre-viewing sample and 44.2% of the post-viewing sample. Only those with telephone numbers in Massachusetts were called about one week after their museum visit. The first 20 males and 20 females to be reached successfully by phone 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 *Stormchasers* 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 *Stormchasers* 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 five 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 11 of the 32 shows surveyed and two researchers collected data at all other shows, mostly evenings and weekends. On average, researchers collected 13 questionnaires per show during the weekday and 23 questionnaires per show during the weekend. The audience would tend to line up earlier during a weekend show, allowing more time for pre-viewing questionnaires and for making arrangements for post-viewing questionnaires.

For the followup telephone interview one week later, only those respondents available in Massachusetts were called at their suggested times. One researcher handled the phone interviews and tried each number at least three times before dropping an individual from the list. The first 20 males and 20 females to be reached successfully were interviewed. The phone interviews were approximately five 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, ethnicity, education and occupation) and three background classification variables (number of IMAX films ever seen, pre-viewing interest in and pre-viewing knowledge of the film's topics). Post-viewing respondents were asked to estimate their pre-viewing interest and knowledge, after seeing the film.

*Program Appeal.* Post-viewing respondents chose one of five scaled statements to indicate how interesting or boring they found *Stormchasers*. Viewers also explained what they liked and did not like about the film and why. Further, viewers were asked to explain how the film did or did not meet their expectations. Finally, an attempt was made to capture unintended effects by utilizing two sentence completion items: "I was surprised . . ." and "I was most disappointed . . . ."

*Science knowledge.* Both the pre-viewing and post-viewing questionnaires included a knowledge test to assess understanding of the viewing goals. Multiple-choice items and three short answer questions comprised a 10-point test about the following topics covered in the 37 minute film:

- Five major elements are responsible for the constantly changing weather patterns of our atmosphere: heat of the sun; land formations; water; wind; earth's rotation and tilt.
- Scientists use many methods and tools to study severe weather.
- The smaller storm systems are, the more difficult they are to predict.
- Prediction of severe storms begins with field study, collecting data through physical observation and measurement to form hypotheses about how storms form.

Those who viewed the film responded to additional open-ended content questions: (a) describe two ideas or facts learned from the film; (b) what, if anything, was learned about scientists that was not known before the film; and (c) what, if any, connections or associations were made between the film and anything previously known or experienced.

*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 *Stormchasers* 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.

## RESULTS

### Appeal of *Stormchasers*

After seeing the film, respondents were asked to rate how interesting or boring *Stormchasers* was (see Table 3). More than half of the sample rated the program as "very interesting" (53.8%); fewer than 5% thought the program was boring.

Table 3. Rating of Appeal of *Stormchasers* by Post-viewing Sample

<i>Variable</i>	<i>N</i>	<i>Categories</i>	<i>Percent</i>
Appeal	249	Very interesting	53.8%
		Moderately interesting	28.1%
		Okay	13.3%
		Moderately boring	4.0%
		Very boring	0.8%

Expected frequencies for chi-square analyses were increased beyond 1 per cell by combining the appeal categories of "moderately boring" and "very boring." Appeal ratings were found to be independent of gender, age, education, occupation, number of films ever seen, and prior interest in the film's topics. Estimated prior knowledge of the film's topics was significantly related to appeal ratings ( $\chi^2(9) = 25.87, p = .002$ ). However, instead of finding a systematic relationship between knowledge and appeal, examination of the chi-square residuals revealed that two cells appeared to be driving the relationship: fewer viewers were expected to fall into the two Knowledge / Appeal category cells of "Knew a Lot" / "Okay" and "Knew Nothing" / "Boring."

*What viewers liked.* After viewing the film, visitors were asked what they liked about *Stormchasers* and why. Almost all of the viewers (96%) provided an answer to this question, and responses were sorted into the categories presented in Table 4 below. The percents add up to over 100% because respondents sometimes wrote more than one thing they liked. More than one-third of the audience (39.2%) liked *Stormchasers* because of the photography of the storms. Also one-third of the audience (36.6%) liked *Stormchasers* because it was informative about stormchasers and storms - their formation, their prediction, and the methods used to look at them. The special effect of the OMNI Theater with its large screen, surround sound, and "you are there" feeling was most appealing to 30% of the viewers. Another 6.5% liked the film simply because it was exciting, and 4% enjoyed seeing the power of the storms.

One man thought "it was great to see women involved in the technical scenes. Little girls need to see role models." Two women said they enjoyed the film because they knew their children had liked it: "I liked it because I knew my teenage son was enjoying it. He is very interested in weather."

Table 4. What Viewers Liked about *Stormchasers*

<i>Categories</i>	<i>%</i>	<i>Examples of Responses</i>
Footage of storms, hurricanes or tornadoes	11.7%	"Action photography of storms." "Liked actual hurricane footage." "Fun to see shots of things like tornadoes and hurricanes that I'd never see in real life." "The tornado footage at the end was GREAT."
Photography, generally	10.5%	"Brilliant photography." "Excellent filming." "Good first person camera shots."
Plane footage, mostly going into eye	10.1%	"Good plane footage - inside clouds; eye wall fly through - shaking of plane." "I liked when the plane went into the eye. It was interesting to see the contrast between the chaotic outside and the calm inside."
Aerial Photography	6.9%	"Aerial photography from planes and shuttle. It justifies OMNIMAX process." "Footage of eye of the hurricane; something you just don't see on the news."
<b>Photography, Total</b>	<b>39.2%</b>	
Informative, generally	15.3%	"Informative." "Not too technical but highly informative." "It brought science and nature together and made it understandable."
Informative about storm formation and prediction	10.1%	"Found out about how storms are formed and how people try to predict them." "It gave me more insight in how difficult it is to predict a storm." "Learning about how storms are created and different ways of tracking and predicting the storms."
Informative about methods	4.4%	"Description of methods used in collecting storm data." "Liked coverage of how data is gathered and analyzed scientifically."
Informative about storms/ hurricanes/ tornadoes	4.4%	"Learning about individual kinds of storms." "I found it very educational, especially about Midwestern tornadoes; coming from the Northeast, I haven't seen much about these types of storms." "I did not know much about hurricanes - informative."
Informative about people	2.4%	"Learned how these people worked as a team." "I liked getting to know the people who make it their job to literally get inside storms and study them."
<b>Informative, Total</b>	<b>36.6%</b>	
Realistic "you were there" feeling	12.9%	"Pictures and sound were intense - you were there." "The storm and cloud scenes were very effective because they made you feel like you were actually there - almost hot or cold or windblown." "I liked the effects of feeling like I was actually there."
Sound effects, Music	8.5%	"I liked the sound." "Good music." "The sound effects made it seem like you were really in the storm."
OMNIMAX screen effect	4.4%	"In IMAX, I liked the actual storms, especially being close. The office scenes and interviews were not exciting, could be seen on any screen." "I liked the views of the storms best. These show the panoramic view of OMNI at its best." "Sailplane sequence - switched to IMAX format."
Tornado animation	4.4%	"Animation made understanding easy." "Computer simulation of thunderhead - good 3-D simulation."
<b>Effects, Total</b>	<b>30.2%</b>	
<b>Exciting</b>	<b>6.5%</b>	"Exciting and suspenseful." "Intense, held my interest." "Visually exciting." "Constant action."
<b>Power of storms</b>	<b>4.0%</b>	"I liked the parts that showed the destructive power of the storms." "Images of the storms gave a good idea of how powerful the storms were." "I can relate to the power of storms, being a professional pilot."

*What viewers did not like.* After the film, visitors were asked also what they did not like about *Stormchasers* and why. Three-quarters (74%) of the sample responded to this question. Responses were sorted into categories presented in Table 5. Almost one-third (31.5%) of the audience wanted more storm footage and more action with less focus on narration and the chasers themselves. One-fifth (19.2%) wanted to see more OMNI effects typical of other OMNI films and less filming indoors or in rotation around static people; some felt the film was too similar to television. Another 13% wanted more information, but 2.8% said the information was too much and too technical. Small groups of viewers simply felt the show was "boring" (4.4%), "too loud" (3.2%), or "too short" (2.0%). A few (2.4%) complained about the theater itself in terms of picture distortion, distracting screen seams, and viewing discomfort.

Table 5. What Viewers Did Not Like about *Stormchasers*

<i>Categories</i>	<i>%</i>	<i>Examples of Responses</i>
Wanted less about chasers; more on storms	11.3%	"Show less of the tornado chasers and more tornadoes." "Too much time was given to the actual people chasing the storm. I would have preferred to see more on the storms themselves." "Wish had more storms and less showing of weather people."
Need more storm footage	10.9%	"Did not show enough during storm, tornadoes or hurricane." "I was hoping for more storm footage." "The clips of the actual hurricanes/tornadoes were pathetically short."
Too much talking and/or narration; not enough action and/or storm	9.3%	"I expected more action." "Not enough action." "I felt there was much rhetoric and not enough coverage of storms." "I thought there would be less dialogue because the first OMNI show I saw was mostly action." "Too much narrative without visual stimulation. Not enough action."
<b>Balance, Total</b>	<b>31.5%</b>	
Disliked camera rotating around people	6.0%	"Many times the camera rotated around the people speaking. I knew this was done to make not so exciting moments interesting, but it made me dizzy and seasick." "Effects inside weather center seemed gratuitous. Why make people dizzy inside going around people's desks?"
Not much use of OMNI's unique features; too much like TV	4.8%	"Not as exciting as most OMNIs. I expected more 'pizazz' and 'butterflies.'" "This didn't make good use of Omni's panoramic view." "It was a show I could see on any movie channel. My friends and I thought of getting our money back, if possible." "Saw some of the same footage on Nova. Too much video, not enough original IMAX footage."
Too much film indoors	3.6%	"Maybe too much scenes in the labs, offices, off CRT screens. almost a waste of the picture and sound capacity."
Disliked feeling dizzy	2.8%	"I felt dizzy at times." "Motion sickness feeling."
Little sensation of movement or speed	1.2%	"This film did not have the segments that give the sensation of speed that some other films have had." "Too little sensation of movement."
Not pretty	0.8%	"It wasn't as beautiful as some others have been, like <i>Yellowstone</i> ." "It wasn't as pretty as <i>Yellowstone</i> ."
<b>OMNI Techniques, Total</b>	<b>19.2%</b>	

Need more science information	5.4%	"I wanted more in-depth information on scientific causes of storms." "It wasn't scientific enough." "Not enough existing models of hurricane and tornado generation and evolution, not enough on instrumentation." "No explanation of tornado monitoring experiments."
Need more on lightning	4.0%	"I really would have liked to have seen more lightning footage and information."
Need more info on other kinds of storms	3.6%	"Thought it would show more storm coverage, perhaps in another geographical area (e.g., Nor'easter)." "It could be possible to show more storms and their effects on us." "Show more different storms (typhoons, blizzards)."
<b>Need more info, Total</b>	<b>13.0%</b>	
<b>Boring</b>	<b>4.4%</b>	"Boring." "Not enough surprise." "Too much standing around."
<b>Too loud</b>	<b>3.2%</b>	"Too loud at some points."
<b>Too much info, too technical</b>	<b>2.8%</b>	"Too much info above a normal person's understanding. Less science, more noise." "Too technical - the info is very high tech."
<b>Complaints of theater itself</b>	<b>2.4%</b>	"Blurry on sides." "This was too much field of view; it is very distorted." "Need to try to do something re: seams in the screen - distracting from overall experience." "I'm tall. I had trouble getting comfortable (neck)."
<b>Too short</b>	<b>2.0%</b>	"Too short." "Too brief." "The film could be longer."

*How film did or did not meet expectations.* Post-viewing respondents were asked to explain in an open-ended question how the film did or did not meet their expectations. Using keyword sorts, the responses were divided into six mutually exclusive categories of Exceeded Expectations, Met Expectations, Met Expectations But, Expected More, Did Not Meet Expectations, and No Expectations or No Response Given. Table 6 on the next page presents the major categories, the percent of respondents in each and subsets of the major categories where appropriate.

One-third (33.0%) of the audience felt that the film met or exceeded their expectations. Another 7.3% reported that the film met their expectations but they wanted to see more storm action. Almost one-third (30.6%) expected more of the film: expected more storm footage, more OMNI-unique effects, more action, or more information. Another 4.0% felt that the film did not meet their expectations; it was boring or not as good as other OMNI films they had seen. One-quarter (25.1%) of the sample said they had no expectations or gave no response to this question.



Table 6. How *Stormchasers* did or did not meet viewer expectations

<i>Categories</i>	<i>%</i>	<i>Examples of Responses</i>
<b>Exceeded Expectations</b>	<b>3.6%</b>	"Detail and photography exceeded expectations." "It had more variety and it was fast-paced." "It was above my expectations."
<b>Met Expectations</b>	<b>29.4%</b>	"Film was very cool. Met my expectation." "Explained topic well." "Exciting." "It met my expectation going into the film by informing me of the scientific procedures of obtaining info."
<b>Met Expectations But . . .</b>	<b>7.3%</b>	"Educational but wanted more storm action." "Great visuals but too much van/restaurant/countryside." "The feeling of flying through clouds and over land met expectations, but I hoped for more storm experiences and less of watching others watch storms."
Expected More Storm Footage	11.3%	"Not enough storm footage." "I wanted to see more up close footage of storms." "I expected more tornado footage."
Expected More OMNI-unique Effects	9.3%	"I expected more effects that only IMAX films can provide, i.e., realism. For example, I think more could have been shown from the USDOC plane." "In other shows, you really feel as though you are IN the attraction; with this one I just felt like a viewer only." "I was disappointed with use of features particular to an OMNI theater vs. a regular camera." "Felt like a movie vs. 'feel like in it' show." "Seen most of the same type of footage on Discovery Channel or National Geographic."
Expected More Action	6.0%	"I expected to see a lot more action with less time spent with the scientists." "I thought it would be more exciting." "Not enough action shots."
Expected More Information	4.0%	"Either need more technical detail (or science per se) like that excellent computer generated tornado or more storms." "I wish it had gone more in depth into lightning." "Not enough hard data - wind speeds, direction of rotation, high vs. low pressure info, etc." "Would have liked more detail and discussion of typhoon."
<b>Expected More, Total</b>	<b>30.6%</b>	
Boring	2.4%	"I just did not find it very interesting." "Boring."
Not As Good As Other OMNI	1.6%	"It wasn't as good as others I've seen." "It wasn't as good (spectacular) as the first Omni film I saw."
<b>Did Not Meet Expectations</b>	<b>4.0%</b>	
<b>No Expectations or No Response Given</b>	<b>25.1%</b>	"I did not know what to expect." "I didn't have any expectations."

*What surprised viewers.* In order to capture unplanned appeal effects, visitors were asked to complete the sentence, "I was surprised . . ." Again, responses were sorted with keywords and the percentages of each mutually exclusive category are presented in Table 7 on the next page. One-quarter (24.2%) of the sample were either not surprised or wrote no answer to the question. About 28% of the audience were surprised by the stormchasers themselves: surprised that people fly into storms or chase storms, by how close these people get to storms and by the risks they take. Another 14.8% of the sample were surprised by the qualities of storms: surprised by their power, their destruction, and the hurricane eye and wall. The film's information surprised 13.6% of the respondents; they were surprised about information concerning prediction, tracking, tornadoes, monsoons and storm research. The positive production qualities of the film itself surprised 12.8% of the viewers; they liked the realism, the image size, the photography, sound and graphics. A small group of people (5.6%) were surprised by the poor production quality of the film, and another small group (1.2%) were surprised by the personal connections they made to the film.

*What most disappointed viewers.* Visitors 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 8 on page 14. Over one-third (35.2%) of the sample were either not disappointed or wrote no answer to the question. About one-third (37.2%) of those who were disappointed mentioned the lack of action footage presenting more storms, tornadoes and hurricanes. Another 18% of the sample were disappointed by the coverage or focus of the film: The audience was bothered by the focus on tornado chasers and death and destruction, the lack of focus on other storms, too much or too little coverage of facts, and the abrupt conclusion of the tornado sequence. Other disappointing aspects of the film experience included the lack of OMNI-unique effects (6.4%), feeling sick (1.6%), sitting in front (0.8%), and the sound (0.8%).

Table 7. Respondents' Completion of "I was surprised . . . "

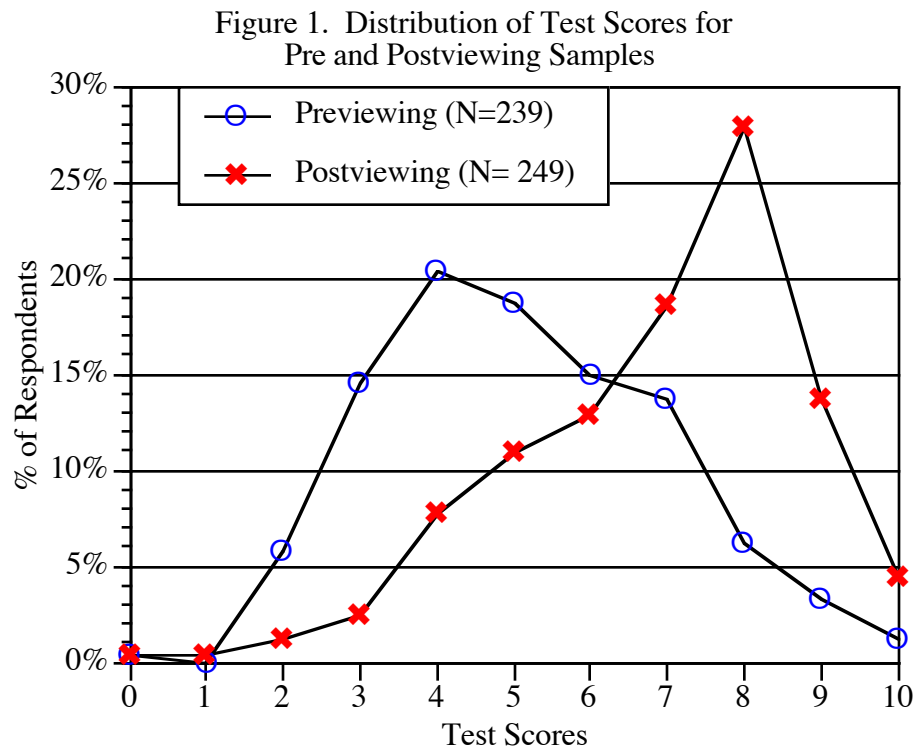
<i>Categories of Surprise</i>	<i>%</i>	<i>Examples of Responses</i>	<i>"I was surprised . . . "</i>
People/Plane Flies into Hurricane	13.3%	"by the fact that planes and people could go into the eye of a hurricane." "that people enjoy flying inside storms."	
People Chase Storms	6.5%	"with the hurricane chasers." "that tornado chasers existed."	
How Close People Get to Storms	4.8%	"at how close that team got to the tornado!" "to learn how close the stormchasers get to storms."	
Danger/Risks Taken	2.0%	"at the risks stormchasers take." "by the danger encountered by the stormchasers."	
People/Glider Flies into Storm	1.2%	"that someone would fly a sailplane into the storm."	
<b>Stormchasers, Total</b>	<b>27.8%</b>		
Power of Storms	6.0%	"at how powerful tornadoes were." "how powerful hurricanes can be."	
Damage/Destruction of Storms	5.2%	"at how much damage a tornado could do." "at how devastating coastal storms can be."	
Eye of Hurricane	2.0%	"at how calm the eye of a hurricane was." "how quietly wind dropped at eye of hurricane."	
Wall of Hurricane	1.6%	"how violent the hurricane wall was."	
<b>Qualities of Storms, Total</b>	<b>14.8%</b>		
Activity Involved in Prediction and Tracking	6.0%	"at the amount of work in predicting a storm." "by the difficulty of tracking tornadoes."	
General Information	2.4%	"by the information I learned." "how it was put into terms average people could understand."	
Information about Tornadoes	2.0%	"by how wide the base of a tornado is." "by the anvil shape of tornado."	
Information about Monsoons	1.6%	"it rains for months during the Great Summer Monsoon." "at the jubilant atmosphere at the onset of monsoon season."	
Amount of Research in Field	1.6%	"at the amount of research done in this field."	
<b>Information, Total</b>	<b>13.6%</b>		
Realistic	3.6%	"at how real it felt." "how realistic it was."	
Size of Images	2.8%	"at the size of the images." "how large the sensation of big screen viewing."	
Photography	2.0%	"at the beautiful photography." "at the visual photography."	
Generally Good Quality	2.0%	"to see how impressive it was." "at how well it was presented."	
Sound	1.6%	"by the acoustics of the film." "by the sound effects."	
Graphics	0.8%	"at the graphics."	
<b>Positive Film Qualities, Total</b>	<b>12.8%</b>		
Lack of action or storm footage	4.4%	"there wasn't more action." "there wasn't more storm footage."	
Generally Poor Quality	1.2%	"at how repetitive it seemed." "how boring it was." "that it was written so poorly."	
<b>Negative Film Qualities, Total</b>	<b>5.6%</b>		
<b>Personal Connection</b>	<b>1.2%</b>	"by reliving emotions from the past." "that I still enjoy the sensation of flight." "to see a hurricane that was experienced by my aunt."	
<b>Not Surprised or No Response</b>	<b>24.2%</b>	"not surprised."	

Table 8. Respondents' Completion of "I was most disappointed . . ."

<i>Categories of Disappointment</i>	<i>%</i>	<i>Examples of Responses</i>	<i>"I was most disappointed . . ."</i>
Lack of Action/Destruction or Storm Footage	19.0%	"by lack of more action." "when we didn't see tornadoes destroy everything." "that there wasn't more storm footage."	
Lack of Tornado Footage	8.5%	"at the 10 second tornado footage." "by not seeing more footage of tornadoes."	
Short Length	7.7%	"by the brevity of the film."	"should have been longer."
Lack of Hurricane Footage	2.0%	"in how few hurricane scenes there were." "with the lack of hurricane footage."	
<b>Lack of Footage, Total</b>	<b>37.2%</b>		
Focus on Tornado Chasers	4.0%	"watching them set up their equipment 20 times." "in tornadoes, too boring with people chasing them." "when the camera kept showing the roads and cars."	
Lack of Information	4.0%	"by the lack of hard info about the storms." "not to learn more about monsoons." "research on lightning (glider)"	
Abrupt Conclusion of Tornado Sequence	3.6%	"at the sudden end of tornado story." "when the tornado came to abrupt end."	
Lack of Coverage of Other Storms	3.2%	"nothing was said about storms we have in New England." "that there was no focus on snow/ice storms." "would like more (dust storms, etc.)"	
Too Much Information	2.0%	"because the facts were kind of too much."	
Focus on Death/Destruction	1.2%	"about all the fatalities." "at the destruction caused by natural disasters."	
<b>Coverage/Focus, Total</b>	<b>18.0%</b>		
<b>Lack of OMNI-unique Effects</b>	<b>6.4%</b>	"in the lack of typical Omni effects." "by not getting motion feeling." "I didn't feel like I was in storm." "that there wasn't more 'format appropriate' footage." "by the lack of beauty."	
<b>Feeling Sick</b>	<b>1.6%</b>	"I was queasy a lot."	
<b>Sitting in Front</b>	<b>0.8%</b>	"to be sitting way down in the first row."	
<b>Sound</b>	<b>0.8%</b>	"noise level."	
<b>Not Disappointed or No Response</b>	<b>35.2%</b>		

## Science Knowledge

Achievement. Understanding of the intended viewing goals was assessed via a 10-point test with multiple-choice and short answer items. Figure 1 shows the distribution of the test scores for both the pre-viewing and post-viewing samples.



The mean achievement score for the pre-viewing group was 5.12 and for the post-viewing group, 6.90. The analysis of variance indicated that means were significantly different,  $F(1, 486) = 110.04, p = .0001$ .

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, Education, Occupation, Prior Interest in Topics, and Prior Knowledge of Topics. Two interactions were significant: Viewing Group by Age,  $F(3, 474) = 3.13, p = .026$  and Viewing Group by Prior Interest,  $F(2, 482) = 8.57, p = .0002$ .

To examine the interaction, Viewing Group by Age Group, Figure 2 presents the mean scores for the pre and post-viewing groups by the four age categories. The youngest two groups show parallel lines crossed by the oldest two groups. Scheffé post hoc tests between the pre and post-viewing means indicated significant differences at below the .000001 level for each of the three youngest age groups but not for the oldest group, 48+ years. Prior to viewing the program, the mean pretest score of the oldest group, 48+ years, was the highest mean ( $M = 5.67$ ), significantly higher than the mean pretest score of the 18-27 year old group ( $M = 4.37$ ; Scheffé,  $p = .012$ ). After viewing the program, the oldest group yielded the lowest mean score ( $M = 6.42$ ), but the post viewing scores did not differ among the groups according to Scheffé post hoc comparisons.

Figure 2. Previewing and Postviewing Mean Scores for Four Age Groups

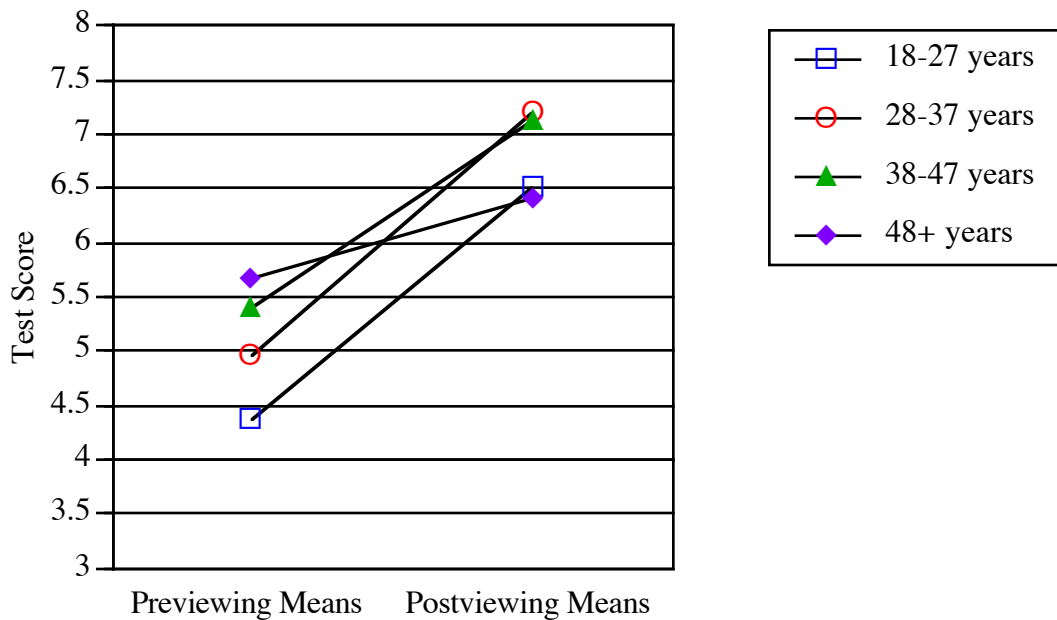
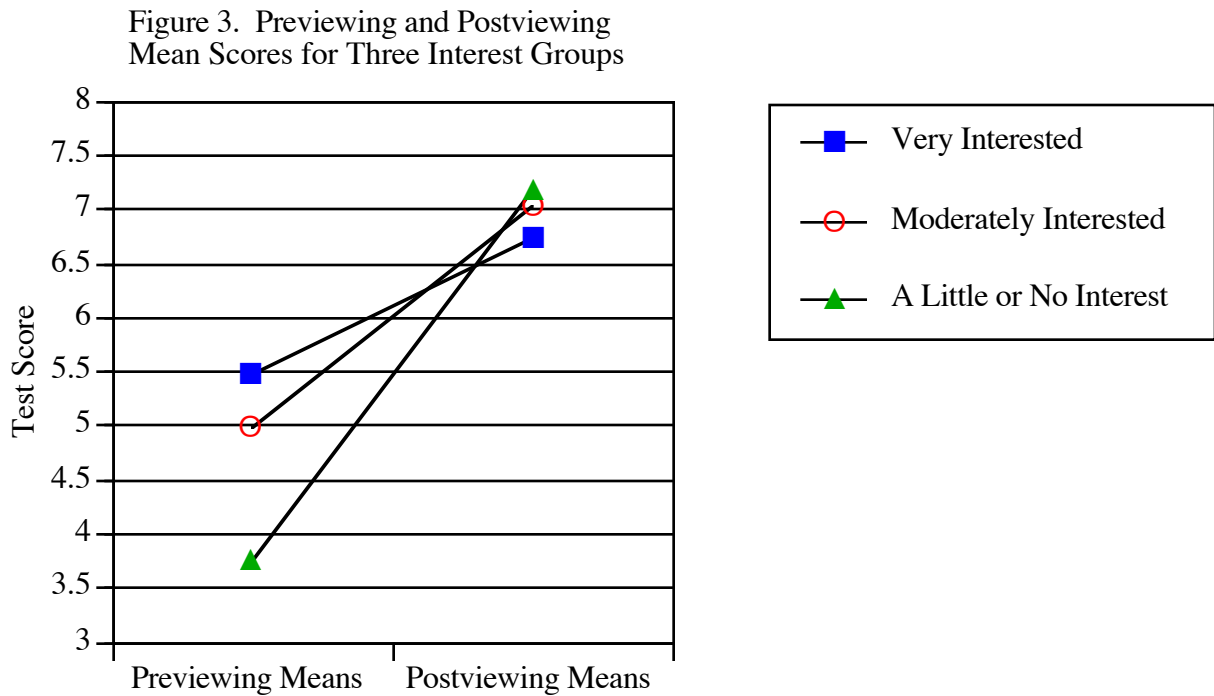


Figure 3 presents the mean scores for the interaction of Viewing Group by Interest Group. Scheffé post hoc tests between the pre and post-viewing means indicated significant differences at below the .000001 level for each of the three interest groups. In addition, the mean pretest score of the "little or no interest" group was the lowest mean ( $M = 3.75$ ), significantly lower than the mean pretest scores of the "moderately interested" group ( $M = 4.99$ , Scheffé,  $p = .000001$ ) and the "very interested" group ( $M = 5.48$ ; Scheffé,  $p = .0002$ ). After viewing the program, the order switched with the less interested viewers scoring better than the more interested, but the post-viewing scores did not differ significantly among the groups according to Scheffé post hoc comparisons.



*Ideas or facts learned.* Prior to completing the test section mentioned above, the questionnaire asked viewers to describe two ideas or facts that they learned from the film. The majority of respondents (71%) provided two ideas or facts; 86% of the sample provided at least one idea or fact. A small group (1.4%) said they had learned nothing new and the remaining respondents (11.6%) did not answer the question at all. The facts were sorted with keywords, and percentages of each mutually exclusive category and sub-categories are shown in Table 9 below. The percentages were calculated based on a possibility of 498 responses (two facts per person).

One-quarter (24.6%) of the viewers learned something about how storms are studied. Another 15% indicated that they learned about the formation of storms. Specific facts about tornadoes were provided by 14.4% of the sample, specific facts about hurricanes by 8.6%, and specific facts about monsoons by 2.4%. An understanding of the power and destructive nature of storm systems was gained by 7%. A small group of 1.4% of respondents learned that stormchasers protect people. Finally, 1.4% of the responses were labeled miscellaneous because they did not clearly fit into the previous categories.

Table 9. Ideas and facts viewers learned from the film

<i>Categories of What was Learned</i>	<i>% of 498 Responses</i>	<i>Examples of Responses</i>
People/planes can fly into hurricanes/storms.	8.4%	"Learned that people fly into hurricanes." "That sail planes are used to track storms." "That planes fly into a hurricane to track it."
The process/methods of prediction	6.4%	"I didn't realize all that went into predicting hurricane paths." "How hurricane data are transmitted to NWS." "Making scientific interpretation through data." "That scientists can get close enough to storms to learn info that can help us predict better." "Analytical basis of hurricane path prediction."
The process/methods of tracking	5.4%	"There is a storm tracking system." "How they tracked Hurricane Emily." "How tornadoes are tracked, wind velocity measured."
Studying storms is a career.	2.4%	"People chase storms for a career." "People make a living chasing storms."
People chase tornadoes	2.0%	"That people actually chase tornadoes, 10,000 miles."
<b>Learned How Storms are Studied</b>	<b>24.6%</b>	
How tornadoes form	6.2%	"How tornadoes are formed."
How storms form	4.6%	"How storms are formed."
How hail forms	3.4%	"How hail is formed." "Hail is formed by updrafts that keep the rain from falling." (7 respondents)
Sun/Water/Land/earth's rotation responsible for weather/storms	2.6%	"The sun's warmth fuels the storm." "Weather caused by sun heating water and earth." "Earth's rotation is a factor in storm activity."
How hurricanes form	0.8%	"How hurricanes form."
<b>Learned about Formation of Storms</b>	<b>15.0%</b>	
Unpredictability of tornadoes	2.8%	"Tornado is one of the most unpredictable storms."
Dust makes tornado funnel visible	2.4%	"Tornado funnel shows because of dust."



Tornadoes can form and disappear quickly	2.2%	"How rapidly tornadoes form and fall apart."
Tornado wind speeds of 200 mph	2.0%	"Tornado winds reach speeds of up to 200 mph."
Formation of Tornado Alley	1.4%	"The Rockies hem in clashing wind patterns to form Tornado Alley."
The term 'mesocyclone'	1.4%	"Never heard of a meza cyclone before."
Anvil cloud & thunderstorms.	1.2%	"How a thunder storm formed an anvil."
Anvil cloud & tornadoes.	1.0%	"Tornadoes are formed from an anvil like cloud."
<b>Learned Specifics of Tornadoes</b>	<b>14.4%</b>	
Eye of a hurricane is calm or peaceful.	4.6%	"Calmness in eye of hurricane." "The middle of the hurricane is very peaceful."
Wall of hurricane is strong/powerful	2.8%	"Eye wall is most powerful part of hurricane." "How hurricanes have wall and how strong it is."
Hurricanes begin as storms off Africa and cross to the U.S.	1.2%	"Hurricanes form in Africa and head to U.S."
<b>Learned Specifics of Hurricane</b>	<b>8.6%</b>	
<b>Learned about Power and Destructive Nature of Storms/Hurricanes/Tornadoes</b>	<b>7.0%</b>	"How destructive storms are." "6000 people died in Texas." "The powerfulness of a tornado."
<b>Learned Specifics about Monsoon - importance, length, size, predictability</b>	<b>2.4%</b>	"I didn't know they celebrated the monsoons." "Monsoons last more than 4 months." "Storm system in India is the largest in the world." "Indian weather stations could predict monsoon."
<b>Learned that Stormchasers Protect People</b>	<b>1.4%</b>	"Dedication required to minimize loss of life." "The more we learn, the more we can prevent human tragedy."
<b>Miscellaneous</b>	<b>1.4%</b>	"Sponsorship by WGBH." (2) "Time frame of stormchasers - early spring." "That someone could see a flying cow and live to tell." "Location of Nebraska." "Not to purchase an RV in the southeast." "The hurricane guy's name is Bob."

*Learning about scientists.* Because the scientists themselves played a large role in the film, we were interested to find out if viewers felt they learned anything new about scientists. Of the 249 post-viewing respondents, 53% felt that they had learned something about scientists that they did not know before viewing the film. Of those who said that they had learned something new, 85% went on to describe what they had learned. Those responses were sorted with keywords, and percentages of each mutually exclusive category are shown in Table 10 below.

Viewers felt that they learned that scientists get actively involved with the storms themselves; that they are dedicated to their work; that they track and predict storms; that they take risks; that they fly into hurricanes; that there are careers associated with storms; that the work is complex; that scientists are human and are responsible for making decisions that affect people's lives. Interestingly, only one respondent made note of the "participation of women" as scientists.

Table 10. What viewers learned about scientists that they did not know before the film

<i>Categories of What was Learned about Scientists</i>	<i>% of Total 249 Post-viewing</i>	<i>Examples of Responses</i>
Scientists get actively involved with storms themselves	8.8%	"Did not realize teams actually chased storms." "I did not know they went into storms."
Scientists are dedicated to their work	8.0%	"A lot more dedication than most people realize." "The amount of work/dedication required." "The lots of time they put into their research."
Scientists track and predict storms	7.2%	"How they predict how strong and dangerous a storm is." "About them predicting the monsoons in India."
Scientists take risks	5.2%	"How they take risks for gathering information." "The risk taking amazed me."
Scientists fly into hurricanes	5.2%	"I didn't know that scientists flew into hurricanes." "How they track hurricanes by flying into them."
There are careers associated with storms	5.2%	"Job of stormchaser - didn't know they did that." "That reading storm patterns is a career." "Number of occupations related to weather watching."
The work is complex	2.8%	"I had no idea there was such a complex system set up for tracking of hurricanes." "National Weather Service is huge and very complex and pretty accurate."
Scientists are human	1.2%	"I liked the touch of human nature that the hurricane predictor described."
Scientists are responsible for making decisions that affect people	1.2%	"I didn't know they were under so much pressure deciding whether to evacuate."

*Personal associations with the film.* After viewing the film, respondents were asked if they connected or associated the film with anything they previously knew or experienced.

Over half of the audience (55%) responded positively, and 93% of these respondents explained what the connection or association was for them. The responses were sorted by keyword into mutually exclusive categories, which are presented in Table 11.

One-fifth (20.9%) of the audience associated *Stormchasers* with other informal learning experiences including television programs, movies, exhibits, and discussions with people who have experienced hurricanes or tornadoes. One-fifth (19.3%) of the viewers connected the film with their own personal experience with storms. Small groups of the sample associated the film with their personal interests (4.0%), previous knowledge (3.6%), or school science classes (3.2%).

Table 11. Viewers' connections or associations with the film

<i>Categories of Viewers' Connections or Associations with the Film</i>	<i>% of Total 249 Post-viewing</i>	<i>Examples of Responses</i>
Previously viewed TV shows on PBS, Discovery, Weather Channel, BBC	14.1%	"A program on the Weather Channel recently about storm chasers." "NOVA programming on a similar topic."
Know people who have experienced hurricane or tornado	3.6%	"My father was in a hurricane in Florida." "My grandparents in IN told me about tornadoes."
Previously viewed films	2.4%	"Wizard of Oz - now I know why the house blew away." "Photography from shuttle shown in an IMAX."
Exhibit at Disney	0.8%	"Disney World, E. Kodak show (many years ago)."
<b>Connected to other informal learning experiences</b>	<b>20.9%</b>	
Personally experienced hurricane or tornado or monsoon	14.5%	"I was in a hurricane that hit Cape Cod." "I witnessed a tornado in Arkansas before." "Monsoon reminded me of my time spent overseas."
Personally experienced storm	4.8%	"Have been in a hail storm." "I once was caught in a rainstorm in OK." "Last summer I saw a storm system 'rolling' down the CT Valley." "We had our well struck by lightning."
<b>Connected to personal experience with storms</b>	<b>19.3%</b>	
Career related to weather	1.2%	"5 years weather service USA and Europe WWII." "My degree is in meteorology."
Am/was a pilot	1.6%	"I'm a professional pilot."
Personal interests/hobbies	1.2%	"Personal interest in storm chasing." "Skydiving."
<b>Connected to personal interests</b>	<b>4.0%</b>	
<b>Connected to previous knowledge</b>	<b>3.6%</b>	
<b>Connected to school science classes</b>	<b>3.2%</b>	"College courses in meteorology." "I connected the film with previous information that was learned in various science classes."

## Influences beyond the museum visit

Twenty men and twenty women participated in a phone interview about one to two weeks after viewing *Stormchasers*. All but one of the 40 respondents (98%) reported that they had discussed the film with their co-viewers immediately after the viewing. Without reservations, 16 interviewees said their discussion was positive. They spoke about how intense and exciting the film was (n=7), how informative (5), and how the effects were dizzying (3). One respondent had seen the film *Yellowstone* during the same visit and "liked *Stormchasers* better." Another 8 of the interviewees reported positive post-viewing discussions also, but they had wanted to see more storms (6) and a longer program (2). Eight viewers recalled commenting on the similarity of *Stormchasers* to what one might see on NOVA (3), National Geographic (1), Discovery Channel (1), or other television shows (3). Finally, 9 respondents expressed disappointment with the film; they all wanted more storm footage than they saw.

Three-fifths (60%) 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. Seventeen adults were positive about the film in their conversations, saying that it was "good," "interesting," "well done" and they recommended seeing it. The remaining seven were less positive, indicating in their conversations with others that the OMNI film was "too much like TV."

When asked if they had recommended to anyone to see *Stormchasers*, 40% said that they had. In their recommendation, the interviewees reported saying that the film was "good" (5), "worth seeing" (4), "interesting" (1), and that they "would like it" (5). Two other visitors said that they had recommended going to the OMNI theater but not to *Stormchasers*. Two more interviewees commented that they did not make a recommendation because *Stormchasers* was no longer going to be shown at the museum.

Although the Museum of Science store presented *Stormchasers* t-shirts and three storm-related videos, no one reported making any store purchases related to the film. Two respondents offered their opinion that the videos were too expensive.

Those interviewed by phone were also asked if seeing *Stormchasers* had affected anything they had thought about or done in the previous week. Slightly less than half (45%) of the 40 respondents answered affirmatively. Five observed that they "think differently" or "pay closer attention" when they watch or read about the weather, particularly with respect to recent reports of tornadoes. Five respondents suggested that thinking about storm formation occupied more of their "free-thought time;" one even said she had a dream about a tornado. Remembrance of storms experienced in previous years was described by two respondents. One college student reported relating the film's "accurate" information to her ecology course. One respondent thought in a recent snowstorm "how easy it must be to track a snowstorm versus a hurricane." One viewer felt that seeing the film interested them "in seeing other OMNI movies." One interviewee reported that he "harassed people further about the weather." Finally, one viewer reported being hesitant to make a visit to Missouri in September because of the possibility of tornadoes.

Lastly, the interviewed sample was asked whether they had read or seen anything on television that made them think of *Stormchasers*. More than half (55%) agreed that they

had. Eight felt that viewing the Weather Channel made them "reflect on *Stormchasers*;" specifically mentioning "discussion of tornadoes in Midwest;" "tracking storms around the globe;" "tracking a storm from Florida;" and "tornado clips." Seven interviewees said that storms on the local weather forecast triggered some connection to *Stormchasers*. Five respondents specifically mentioned that they were more sensitive to the recent reporting of tornadoes. Two audience members recalled seeing similar video footage on television since seeing the film.

## DISCUSSION

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

Four-fifths of the audience thought *Stormchasers* was either "very" or "moderately" interesting. On the face of it, the fact that 82% of the audience found the program interesting appears to be a very positive quantitative result. There exists only one other IMAX evaluation with which to compare, that of *Tropical Rainforest*; and it is unfair to make a direct comparison because the questions and scales were different (Minger, 1992). When the audience of *Tropical Rainforest* was asked about agreement with the statement "I enjoyed the film," 73% "strongly agreed," 25% "agreed," 0.8% were "uncertain," and 0.6% "disagreed." Unfortunately, the statement itself tends to bias the respondent, which calls into question the usefulness of comparing *Stormchasers'* appeal results to the *Rainforest* appeal results.

Viewers liked both the entertainment quality of the film - the photography of the storms and the special effects of the OMNI theater itself, and the educational quality of the film - the information about stormchasers and storms. The balance of entertainment and education was at the crux of most of the audience's concerns. Over 40% of the audience felt that the film met or exceeded their expectations but 35% felt that the film did not meet their expectations. The audience most often mentioned wanting more storm footage and more action with less of a focus on narration and the chasers themselves. They wanted more OMNI-specific effects and less of a television documentary. Almost three-quarters of the audience had viewed other OMNI shows, and they anticipated an immersion experience of "I am inside the storm."

On the other hand, the unique look at stormchasers and the qualities of storms surprised the audience. They were surprised that people fly into storms or chase storms, by how close these people get to storms and by the risks they take. They were surprised by the storms' power, their destruction, and the visuals of the hurricane eye and wall. One factor in the appeal results might have been the marketing of the film in the Boston area. Print, radio, and telephone marketing emphasized that the audience would "experience tornadoes, hurricanes and monsoons." Only two of the 249 respondents spontaneously mentioned the discontinuity between the marketing approach and the actual film: "I was disappointed because I was expecting the film to be more about tornadoes from the advertising of the presentation, and not just about the actual chasing of storms." "You call the museum, the taped message sounds exciting, but [the film] is not.

It was more of a documentary. It's misleading." While the impact of the marketing description was not measured directly, one might cautiously assume that those who heard such material came with expectations that the film could not possibly meet, because one cannot realistically put an IMAX camera inside a tornado. Some viewers wanted the new movie *Twister* and got a NOVA style film instead.

- 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. Viewers of *Stormchasers* came away knowing more about the elements responsible for our weather patterns, the methods and tools used by scientists to study, track and predict severe weather, and the relative predictability of storm systems. The youngest age groups and those who professed less interest in the film's topics prior to viewing the film appeared to benefit more from seeing the film than the oldest age group (48+) and those more interested in the content.

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

The film had the most impact on what the audience perceived they learned about how storms are studied, how storms are formed and specific details of the three types of storm systems covered. Over half of the audience felt that they had connected or associated the film with previous knowledge or experience, mainly informal learning experiences (TV, movies) and personal experiences with storms.

Despite the observation that they wanted less coverage of the stormchasers themselves, over half of the audience, including those who had occupations related to science, felt that they learned something new about scientists from the film. Viewers said they learned that scientists get actively involved with the storms themselves; that they are dedicated to their work; that they track and predict storms; that they take risks; that they fly into hurricanes; that there are careers associated with storms; that the work is complex; that scientists are human and are responsible for making decisions that affect people's lives. The resulting image of "scientist" certainly goes against the stereotype of a 'nerdy' lab-based person in a white coat; however, despite an effort by the producers to present a diversity of scientists on screen, only two people noted the women participants and no one spontaneously mentioned minorities.

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

Our telephone interviews indicated that 98% of the interviewees discussed the film with their covievers immediately after seeing it, 60% discussed the film with others in the week following their visit, and 40% had recommended to others that they see *Stormchasers*. About half of the audience agreed that seeing *Stormchasers* 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 *Stormchasers*. Generally, half of the audience reported a heightened sensitivity to issues related to storms, particularly tornadoes, which were in the news at the time of the interviews. 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.

In conclusion, although the audience felt that the entertainment quality of the film could have been higher with the inclusion of more storm footage and more OMNI-unique effects, *Stormchasers* was interesting to 82% of the audience, made a significant impact on the science knowledge of the viewers and continued to influence half of the audience after their museum visit.

## REFERENCES

Campbell, D. T., & Stanley, J. C. (1966). Experimental and quasi-experimental designs for research. Reprinted from N. L. Gage (Ed.), Handbook of Research on Teaching. Chicago, IL: Rand McNally.

Minger, M. A. (1992). The effects of viewing the IMAX/OMNIMAX film *Tropical Rainforest* on attitudes and knowledge. St. Paul, MN: Science Museum of Minnesota.

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