Radiolab: What Curiosity Sounds Like

This report summarizes evaluative findings from a project titled "What Curiosity Sounds Like: Discovering, Challenging, and Sharing Scientific Ideas" (a.k.a.: "Discovery Dialogues"). The project, a Full-Scale development project funded by the National Science Foundation as part of its Advancing Informal Science Learning (AISL) program, explored new ways to actively engage both lay and professional audiences, and foster meaningful communication between scientists and the general public.

Summative Evaluation Report

Rockman Et Al

October 2014

About Rockman Et Al:
Rockman Et Al is an innovative research, evaluation, and consulting company that specializes in examining critical issues in formal and informal education. The Rockman team includes evaluators with diverse backgrounds and skill sets who help clients answer critical questions in clear, direct, and honest ways. Rockman Et Al has served as the lead evaluation firm for numerous projects funded by the National Science Foundation as well as several other public and private funding agencies.

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Introduction

Radiolab's "What Curiosity Sounds Like: Discovering, Challenging, and Sharing Scientific Ideas" project (or "Discovery Dialogues" for short), sought to develop a new model for public engagement with scientific content that included opportunities for audience members to actively participate in scientific activities and have meaningful interactions with scientists. The summative evaluation conducted by Rockman Et Al closely examined experiences and outcomes from both the perspective of audience members and event participants from the general public as well as the perspective of scientists and other professional audiences.

Project Overview

The Discovery Dialogues project incorporates the Public Engagement with Science (PES) model outlined in a 2009 report from the Center for Advancement of Informal Science Education (CAISE), entitled "Many Experts, Many Audiences: Public Engagement with Science and Informal Science Education." The PES model is a strategic and purposeful evolution from the earlier Public Understanding of Science (PUS) model that takes a more top-down approach to disseminating scientific information to lay audiences. In contrast to the PUS model, the PES model purports that audiences and scientists have a great deal to learn from each other and seeks to enable listeners and science professionals to drive coverage that matters most to them. Additionally, the PES model seeks to elevate the importance of lay people as contributors of ideas, knowledge, and first-hand experiences with science in the everyday world.

Radiolab has finely honed its unique brand of captivating audio programming that hooks listeners in with narrative stories, chock-full of science, but never short on humor and wit. Offerings under the Radiolab brand include an hour-long radio program (broadcast on more than 450 NPR member stations), podcasts of varying lengths, live outreach programming both on and offline, a comprehensive website with links to audio programming and original content in the form of blog posts from various contributors, an innovative mobile application that prompts users to contribute audio clips, comments or images, and a rich social media presence that further seeks to engage audience members in a variety of activities and opportunities to provide feedback about topics discussed in the program and on the website.

Specifically, the Discovery Dialogues effort capitalizes on the inherent capabilities of the Radiolab program and online content that seeks to make science a part of the everyday lives of its listeners and fans. Additionally, the Discovery Dialogues project sought to draw on contributors' personal experiences and listeners' natural curiosity to foster greater emotional connections with the process of scientific discovery.

To accomplish its stated goals, and to test the PES model, the Discovery Dialogues project sought to facilitate an environment that supported multi-directional engagement including direct interactions between scientists and lay audiences as well as motivating listeners to become active creators of content rather than passive recipients of information.

Evaluation Methodology

Rockman Et Al (REA), an evaluation firm specializing in the evaluation of informal science learning programs, conducted a summative evaluation during the final year of the Discovery Dialogues project. The summative evaluation employed a mixed methods approach to study the impacts and outcomes of Discovery Dialogues initiatives, while also paying careful attention to feedback about specific elements that contributed to success. The research methods and activities included as part of the summative evaluation effort are summarized below.

Review existing formative data, instruments and findings. The summative evaluation team reviewed all instruments developed and all data collected during the formative evaluation period. A summary of findings and recommendations resulting from the REA analysis of formative evaluation data were presented in a comprehensive formative evaluation report in the spring of 2014. Selected excerpts from the formative evaluation report are included as part of this summative evaluation report in instances where findings are more broadly applicable to programming and outreach initiatives in general, and in instances where they provide evidence of outcomes that were investigated as part of the summative evaluation effort as well.

Live event participation surveys. Surveys were sent to audience members who attended the two Radiolab live shows (i.e., "Radiolab: In the Dark" in 2011-2012 and "Apocalyptical" in 2013). A small sample of Apocalyptical audience members were also interviewed in 2013.

Social Media and online participation monitoring. A series of quarterly media reports were delivered to stakeholders involved with the Discovery Dialogues project. These social media reports tracked trends and participation patterns on the Radiolab website, Facebook and

Twitter, in addition to more modest coverage of Instagram, Flickr and Tumblr.

Public audience and scientist surveys. In the Fall of 2014, the evaluation team gathered feedback from Radiolab listeners and contributors through an online survey. The survey invitation was sent to audience members who had participated in a variety of outreach events and online activities and to professionals who had contributed to online articles or broadcast episodes. Links to the survey were also posted on the Radiolab website and promoted via Facebook and Twitter. In addition to a series of open-ended questions that were presented to respondents who said they were scientists, the survey also included a general set of questions designed to facilitate comparisons between scientists, people employed in technology,engineering or mathematical (TEM) fields, and all other survey respondents. Ultimately, nearly 10,000 survey responses were collected as part of this evaluation effort.

Evaluation Questions

The REA summative evaluation was designed to address the following evaluation questions:

✦ To what extent do Radiolab audience members and event participants gain greater knowledge of, and exposure to, STEM topics and current scientific research?

✦ To what extent and with what outcomes do audience members and event participants engage in participatory learning experiences?

✦ What are the most popular topics and techniques for engaging audiences as evidenced by higher numbers of questions, comments in response to Radiolab episodes and blog posts and comments, questions, re-posts and "likes" via social media?

✦ To what extent do audience members and event participants come to have long-term interest in the STEM topics with which they are engaged via Radiolab?

✦ In what ways has Radiolab led or encouraged people to pursue careers in science?

✦ How do STEM professionals benefit from more extensive and more meaningful interactions with lay people?

✦ What techniques and formats best stimulate and support meaningful interactions between professional and lay audiences?

Radiolab Audience & Scientist Survey

In August of 2014, members of the Radiolab audience were invited to respond to an online survey about Radiolab and various outcomes related to science knowledge, interest and engagement. Additional questions were asked of scientists—both professional scientists and those who considered themselves to be lay scientists—as well as other technology, engineering, and mathematics professionals, to gauge the impact that Radiolab has had on career-related interests and professional aspirations.

Respondent Demographics

During a week-long period in August 2014, more than 9000 survey responses were submitted (N=9474 including partial responses). A select number of science contributors and recent event participants who were personally invited to respond to the survey and all other responses were solicited via online invitations though the Radiolab website and social media posts.

STEM Professionals and Lay-Scientists

Respondents were asked to indicate if they worked in a STEM-related career, or considered themselves to be lay-scientists; they were encouraged to select multiple responses if applicable. The majority of respondents were not employed within STEM fields (i.e., those identified as "General Audience" in the figure below), however 14.4% of respondents (N=1303) identified themselves as "lay-scientists," and 12.3% (N=1111) identified themselves as professional scientists.

Figure 1: Percentage of Respondents by Occupation Category Type

Category	Percentage
Mathematics	5.6%
Engineering	6.4%
Scientists	12.3%
Lay-Scientists	14.4%
Student	21.2%
Technology	21.9%
General Aud.	44.1%
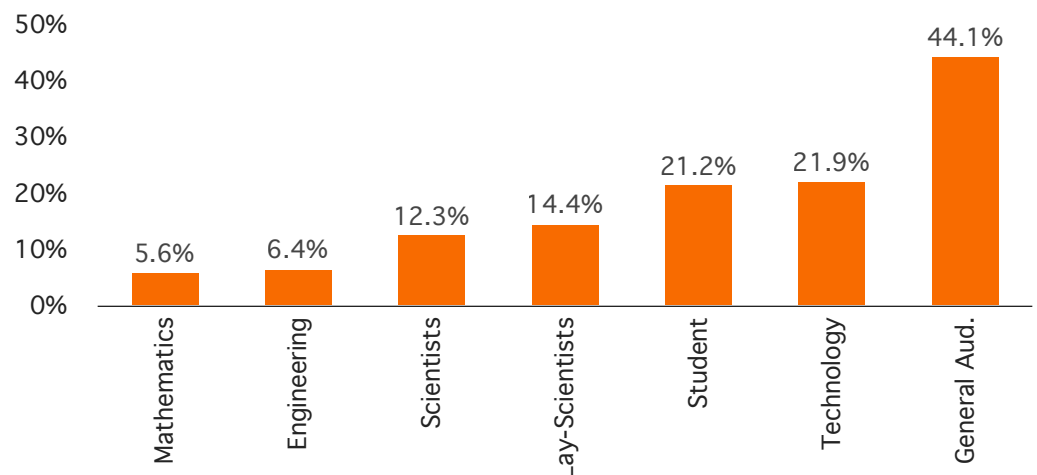
For analysis purposes, responses were separated into the following categories: "scientists" (including "professional" and "non-professional" sub-categories), "TEM professionals" (i.e., those who indicated that they were employed in one or more of the following fields: Technology, Engineering, or Math), and "non-STEM" (including those who indicated they were students but did not check any other response option, those who were retired, and those who selected "none-of-the above - i.e., members of the general public not employed in scientific fields).

Figure 2: Percentage of Respondents by STEM-Affiliation Category
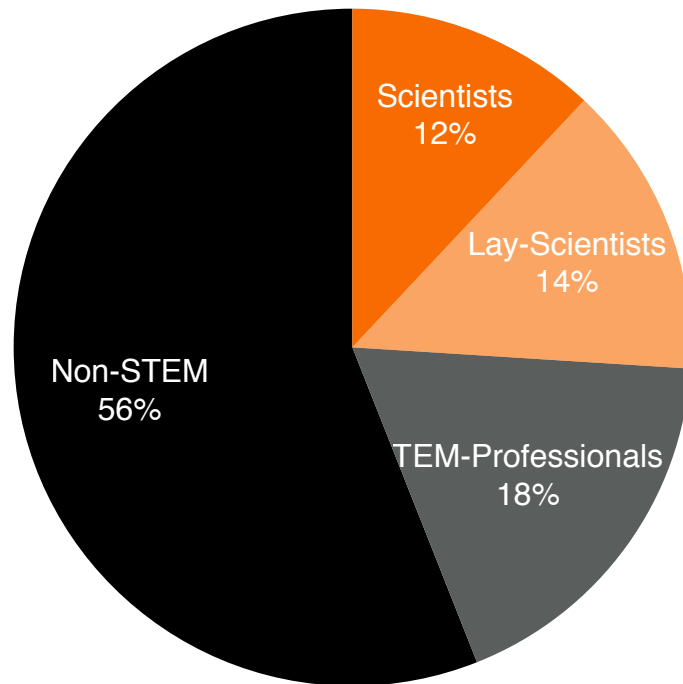
Scientists: N=1111, Lay-Scientists: N=1227, TEM-Professionals (who did not also identify as Scientists or Lay-Scientists): N=1671, and Non-STEM, N=5042.

Engagement in Science

Respondents were asked to rate their level of personal and/or professional engagement with nine different scientific fields of study. Their responses are summarized in Figure 3 and suggest that interest levels were highest for Nanoscience, Chemistry and Engineering and tended to be lower for Astronomy and Space and Earth and Environmental science. Among STEM professionals, the greatest percentage of respondents noted engagement with Biology and Life Sciences and Computing.

Figure 3: Percentages of Respondents by Personal and Professional Levels of Engagement with Various Sciences

Legend:
- Not Engaged at All
- Low-to-Moderate Interest (as lay person)
- High interest (as lay person)
- I work in this field

Field	Not Engaged	Low-to-Moderate	High interest	I work
Astronomy and Space	51%	35%	13%	
Biology/Life Sciences	50%	29%	9%	12%
Biotechnology	39%	41%	17%	3%
Chemistry	25%	47%	25%	3%
Computing	29%	42%	18%	11%
Earth and Environmental Science	54%	31%	10%	5%
Engineering	26%	43%	25%	6%
Physics	39%	39%	20%	2
Nanoscience	32%	41%	26%	

Radiolab Contributors

Participants who had identified themselves as scientists (including professionals and non-professionals, or lay-scientists) were also asked to indicate in what ways, if any, they had worked with Radiolab in their capacity as a scientist. Four individuals stated that they had been interviewed for an online Radiolab article, and twenty-three others said that they had been interviewed for a broadcast/podcast episode of Radiolab.

Special Event Participation
All respondents were asked if they had participated in any special events hosted by Radiolab. Individuals were considered "special event participants" if they attended one or more of the events listed in the survey, and they were considered "non-participants" if they did not indicate having participated in one or more of the special events listed on the survey. A majority of the respondents did not attend a special event (81.6%, N=7311), however 18.4% of respondents did indicate that they had participated in one or more special event (N=1649). The figure below shows the percentage of participation by special-event category among the respondents who attended at least one special event. Starred items indicate those for which admission was charged.

Figure 4: Percentage of Participation by Special Event Type
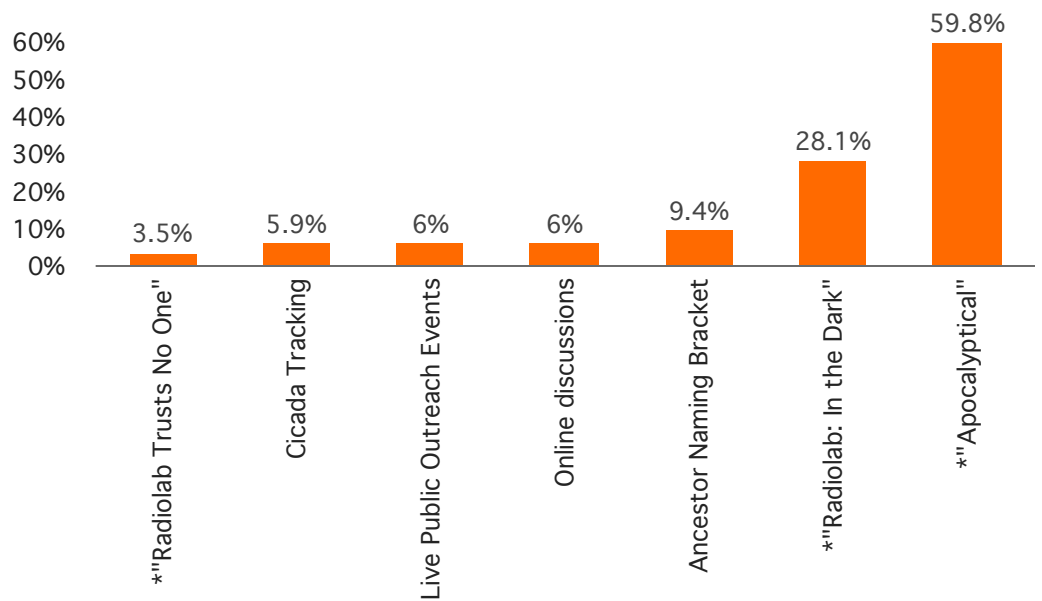
There were also a handful of special events listed on the survey for which fewer than fifty respondents said they participated, including the Mars Rover Watching party in 2013 (N=49, 3%), the "Diagnosis" Google Hangout in 2012 (N=11, 0.7%) and the "Cellular Surgeons" live chat in 2013 (N=10, 0.6%).

A majority of special event participants attended only one special event (77.0%, N=1270). Smaller numbers of special event participants attended two (17.7%, N=292) or "three or more" events (5.3%, N=87). The vast majority of the respondents who attended a special event indicated that they attended one of the two live shows, i.e., "In the Dark," and "Apocalyptical," indicating the popularity of those offerings even in light of the fact an admission fee was charged for attendance.

Levels and Types of Engagement

To determine the effect of differing levels of engagement with Radiolab programming, survey respondents were grouped according to types and levels of engagement. There were three main types of engagement that ranged from more passive to more active types of activities, including "listening" (e.g., simply listening to the radio show or podcasts), "reading" (e.g., reading online blog posts and articles), and "interacting" (e.g., participating in online discussions, doing activities, taking polls, etc.). We also sought to classify respondents by their frequency of engagement in each type of activity, including: "low" (i.e., "rarely" doing something"), "medium" (i.e., "occasionally" doing something), and "high," (i.e., "regularly" doing something).

The following table and figure show the number and percentage of respondents who fell into each category. Results indicate that the majority of respondents listened regularly, read occasionally, and interacted rarely.

Survey results indicate that respondents listen to Radiolab frequently, read Radiolab content occasionally and participate less frequently in more interactive ways.

Table 1: Engagement Types and Levels

	Listen		Read		Interact	
	N	%	N	%	N	%
LOW (i.e., Rarely)	58	0.6	2301	28.1	5450	73.4
MEDIUM (i.e., Occasionally)	1557	16.8	4574	55.9	1715	23.1
HIGH (i.e., Regularly)	7672	82.6	1303	15.9	262	3.5

Figure 5: Percentage of Respondents in Each Engagement Category
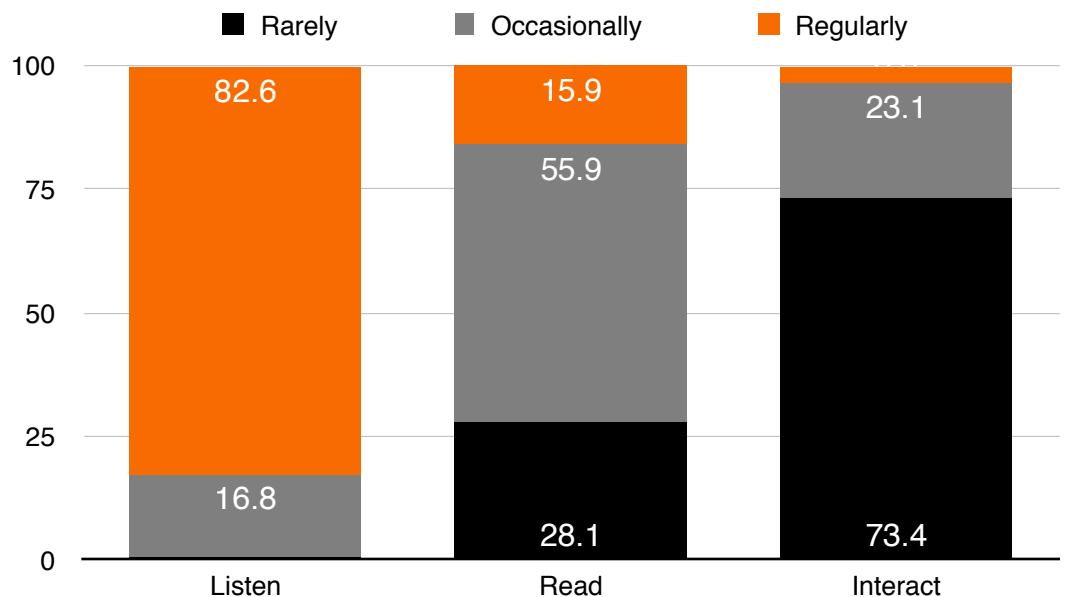
Impact of Personal and Professional Affiliations with STEM
The types and frequency of participation were analyzed based on respondents' affiliation (or non-affiliation) with STEM career fields. Specifically, the following categories of respondents were compared to one another: "scientists" (also divided into "professional" and "non-professional" subcategories for further analysis), "TEM-professionals" (i.e, respondents who indicated they were employed in a technology, engineering or mathematics-related career field), and "non-STEM" (i.e., those who were not professionally employed in a STEM field).

There were no differences between the three categories of respondents (i.e., scientists, TEM-professionals, and non-STEM) in levels of engagement with listening or interacting but we did find significant differences in scientists' levels of engagement in <u>reading</u> Radiolab content.[1] Scientists were more likely to indicate reading Radiolab content "regularly" (18.7%), in comparison with TEM-professionals (14.6%) and non-STEM respondents (15.1%). Even though these differences were small, they were found to be statistically significant.

Scientists were more likely to indicate reading Radiolab content more regularly than other respondents.

Figure 6: Radiolab Content <u>Reading</u> Frequency (Percentages of Respondents by Personal and Professional Affiliation Groups)

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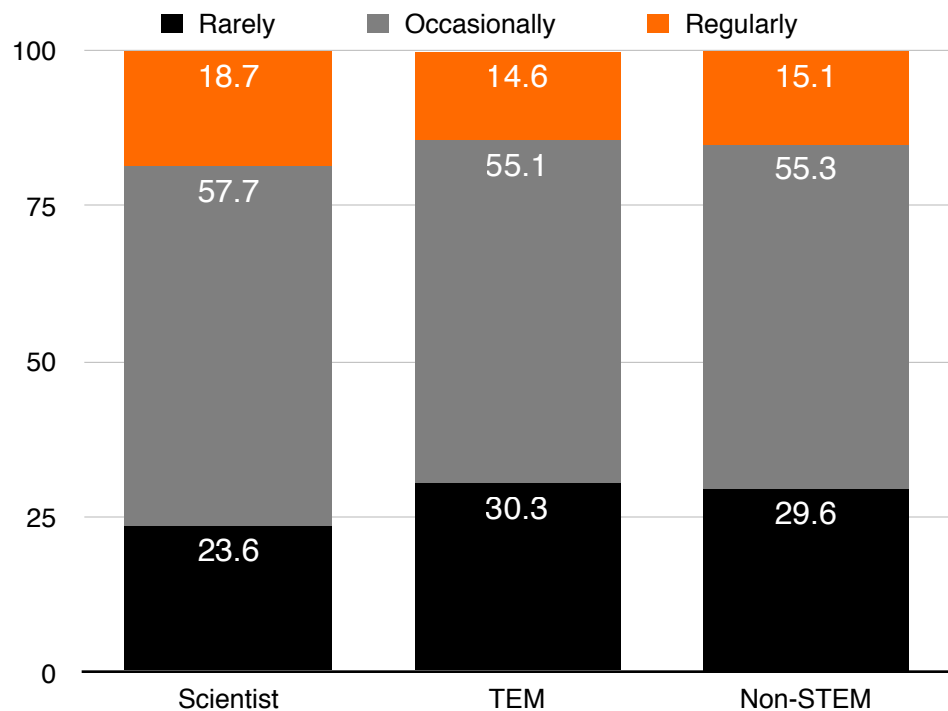
[1] χ^2 (4) = 36.255, p <.001, Cramer's V = .048

Lay scientists (i.e., those actively engaged and perhaps contributing to the sciences in a lay capacity rather than a professional capacity) tended to listen, read and interact with Radiolab content more frequently.

Differences Between Scientists and Lay-Scientists

We also examined differences in the frequency with which scientists and lay-scientists listened, read, and interacted with Radiolab content and found statistically significant differences between the two groups for all three types of activities.[2] Specifically, we found that lay-scientists tended to listen and read and interact more frequently than scientists. This finding may suggest that lay-scientists find Radiolab content and experiences to be at an appropriate and accessible level, whereas professional scientists likely have additional means and sources for accessing more advanced scientific content to further fuel their professional interests in science.

Figure 7: Differences Between Scientists and Lay-Scientists by Engagement Type and Frequency
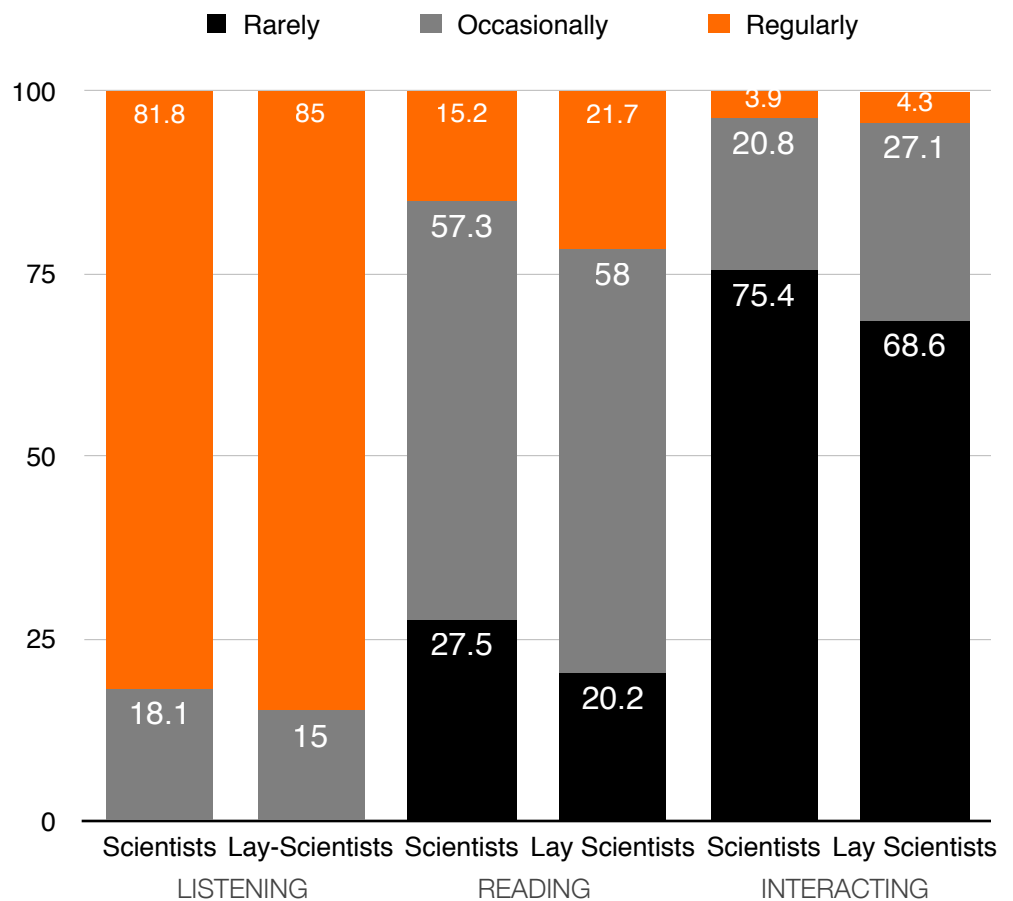
Note: since there were few respondents who said they listened to Radiolab rarely, we combined responses for those who said they listened "rarely" or "occasionally."

[2] Listen: χ^2 [1] = 4.226, p =.04, Cramer's V = .043 Read: χ^2 [2] = 23.414, p <.001, Cramer's V = .106 and Interact: χ^2 [2] = 11.172, p <.004, Cramer's V = .077

People who listen, read, and interact with Radiolab content more frequently were more likely to attend special events hosted by Radiolab.

More frequent Radiolab listeners were more likely to attend paid events, however, those who read online content and participated in interactive experiences <u>less</u> frequently were more likely to attend paid events than those who read and interacted more frequently.

Special Event Attendance

Individuals who listen, read, and interact with Radiolab content most frequently were also more likely to participate in special events hosted by Radiolab.[3] This finding suggests that people who are more engaged with various types of Radiolab content are also more likely to attend special events hosted by Radiolab. None-the-less, it also seems to confirm a desire among Radiolab's fans to engage more deeply with the content they have come to enjoy and appreciate.

Not surprisingly, the most regular listeners were also more likely to attend special events that required admission fees than those who do not listen regularly (81.1% vs 71.1%, respectively). However, as shown in Figure 8 below, the opposite trend was true among those who read and interacted with Radiolab more regularly. Those who read and interacted less often (i.e., rarely and occasionally) were more likely to attend paid special events than those who read or interacted more often.[4]

Figure 8: Percentage of Respondents who Attended Events that Charged Admission Fees by Engagement Type and Level
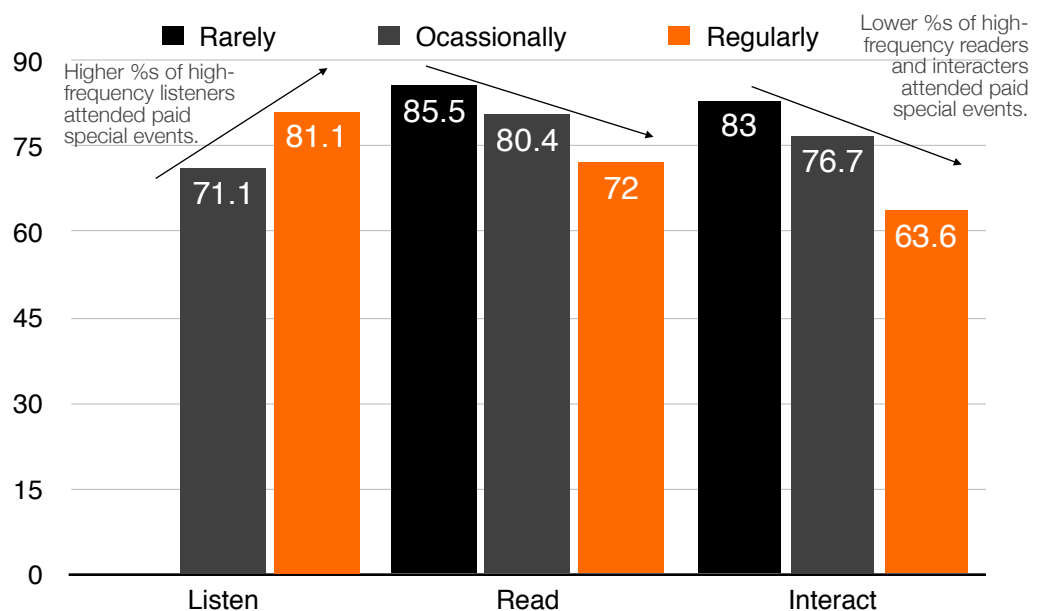
Note: since there were few respondents who listened to Radiolab rarely, we combined responses for those who said they listened "rarely" or "occasionally." See Appendix F, Table 18. for Ns.

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[3] Listen: $\chi^2(1) = 31.969$, $p < .001$, Kendall's tau-b = .060 Read: $\chi^2(2) = 30.582$, $p < .001$, Kendall's tau-c = .051 and Interact: $\chi^2(2) = 59.120$, $p < .001$, Kendall's tau-c = .064

[4] Listen: $\chi^2(1) = 10.868$, $p = .001$, Kendall's tau-b = .081, Read: $\chi^2(2) = 18.854$, $p < .001$, Kendall's tau-c = .089 and Interact: $\chi^2(2) = 21.386$, $p < .001$, Kendall's tau-c = -.083 (See Appendix F: Table 18)

Survey data suggests the appeal of Radiolab programming among those with high levels of interest in science but non-scientists were more likely than scientists to attend programs that charged admission fees.

One possible explanation for this trend stems from the fact that the live shows were only presented in certain cities, so Radiolab fans who weren't located near those cities may have been more eager to participate in online activities hosted by Radiolab to satisfy their desire for more interactive experiences. Another possible explanation is that Radiolab fans who could not afford to attend paid events were seeking out free, and amply-available opportunities for engagement online. While there are several possible reasons for this finding, more research would be necessary to fully understand the driving forces behind this trend.

Respondents with greater personal and professional interests in science (i.e., scientists and lay-scientists) were also more likely to attend special events hosted by Radiolab than other respondents.[5] However, TEM-professionals and those not employed in STEM career fields were more likely to attend special events that had admission fees. The later finding suggests the broad and general appeal of the live shows and their ability to attract large numbers of lay audiences.

Paid Events Have a Big Impact on Attendees

These examples of comments shared via social media about Radiolab Apocalyptical shows in various cities indicate a high level of excitement and engagement - clearly, well-worth the price of admission to these Radiolab fans.

6 Nov
I'm just going to listen to @**Radiolab** all day, because after seeing the live show there's no way anything else will be satisfactory.
Expand

6 Nov
Endless thanks to @**Radiolab** for your pursuit of ART + SCIENCE. The performance last night in ATX will remain with me.
Expand

6 Nov
#**Radiolab**. The ultimate nerd date night.
instagram.com/p/gYRuBur9Aq/
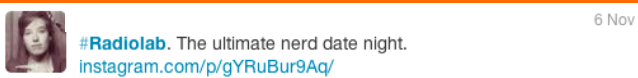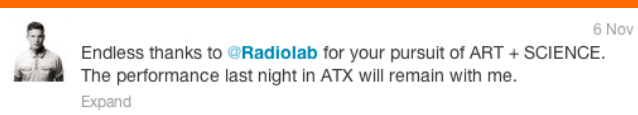
At the @Radiolab show live in #denver #colorado at the #paramounttheater! #omg #beyondexcited @JadAbumrad pic.twitter.com/V4kM6fT1Ow

← Reply   ↻ Retweet   ★ Favorite   ••• More

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[5] $\chi^2(2) = 17.546$, $p < .001$, Kendall's tau-c = -.035 (See Appendix F: Table 17)

Individuals who listened to, read info provided by, and interacted with content provided by Radiolab more frequently were more likely to indicate that their engagement with Radiolab had increased over time in comparison to those who engaged less frequently with Radiolab content.

Engagement Over Time

Respondents were asked whether their level of engagement with Radiolab had changed over the past three years. Chi-square analyses were conducted and differences in patterns of engagement over time between respondents with more and less frequent levels of Radiolab listening, reading, and interacting were found to be statistically significant (p < .05). Individuals who listened, read, or interacted <u>regularly</u> were more likely to indicate that their engagement had increased over time compared to those who listened, read or interacted rarely or occasionally.[6] None-the-less, it is important to note that only a small percentage of respondents (i.e., less than 10% of all respondents) indicated that their engagement had decreased over time.

Figure 9: Percentage of Respondents Engagement Over Time by Listening, Reading and Interacting Frequency
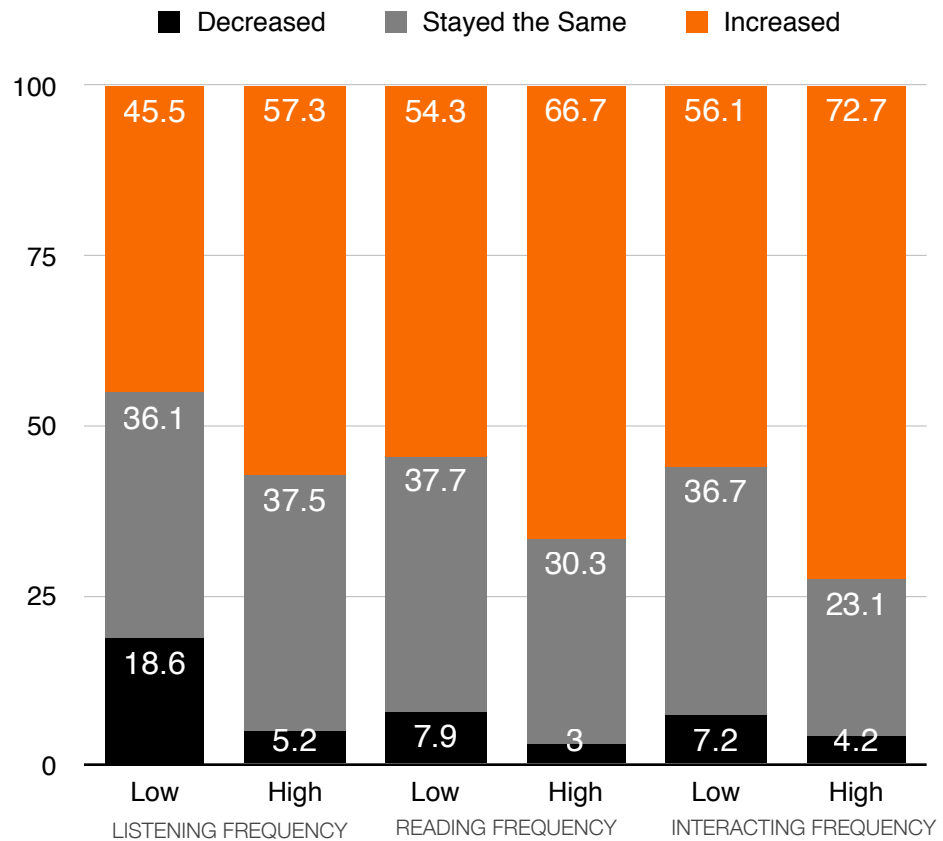
Note: In the figure above, those who indicated they engaged with Radiolab content "rarely" or "occasionally" are coded as "Low." Those who indicated they engaged with Radiolab content "regularly" are coded as "High." See Appendix F, Table 3 for Ns.

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[6] Listen: χ^2 (2) = 347.089, p < .001, Kendall's tau-c = .097 Read: χ^2 (4) = 117.751, p < .001, Kendall's tau-b = .108 **Interact:** χ^2 (4) = 49.582, p < .001, Kendall's tau-b = .071 However, Kendall's tau (b or c) indicated that the strength of the relationships were weak (from 0 to .19).

Scientists' Levels of Engagement Over Time
We also examined differences in levels of engagement over time based on whether or not respondents identified themselves as scientists (including lay-scientists) or other TEM-professionals. Respondents employed in technology, engineering or mathematics-related fields were more likely to say their engagement with Radiolab had stayed the same (40.5% vs 35.3% and 36.8% compared to Scientists and Non-STEM, respectively), whereas all other respondents were more likely to indicate that their engagement had increased over time.[7] This finding could simply be a statistical anomaly, however, it could also suggest an opportunity to increase engagement among technology, engineering mathematics professionals by seeking to include more programming that uniquely appeals to people in those career fields.

Attitudes Toward Science

One of the main goals of the survey was to assess differences in respondents' attitudes toward science based on varying levels of engagement with Radiolab content and whether or not they had personal or professional connections with science. Specifically, respondents were asked to rate their agreement with six statements using a five-point scale where 1="strongly disagree," 2="disagree," 3="neither agree nor disagree," 4="agree," and 5="strongly agree." ANOVAs were conducted to examine group differences.

Statements about Respondents' Attitudes toward Science

✦ Radiolab programming and content appeals to people with a scientific background. (Appeal)

✦ Radiolab programming and content helps to expand the public's interest in science. (Interest)

✦ Radiolab programming and content helps to expand the public's understanding of science. (Understand)

✦ Radiolab communicates information in ways that are engaging for scientists. (Communicate)

✦ Radiolab values the input of members of the scientific community. (Value Input)

✦ Radiolab provides engaging ways for scientists to interact with the general public. (Interact)

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[7] χ^2 (4) = 11.804, p = .019, Kendall's tau-b = -.004. See Appendix F: Table 9a for all percentages and Ns.

Survey respondents strongly agreed that Radiolab programming and content helps to expand the public's interest in, and understanding of science - agreement levels tended to be highest among those who listened to Radiolab more frequently.

Differences Based on <u>Listening</u> Frequency

Across the board, respondents who said they listened regularly tended to agree more with each of the statements above than those who indicated that they listened occasionally or rarely. The mixed-model ANOVA suggests that all differences are statistically significant ($p < .05$), however, average agreement levels were high for each statement (i.e., most were 4.00 or higher).[8] Agreement was highest for statements about Radiolab's ability to expand public interest in science and public understanding of science.

Figure 10: Mean Agreement Rating for Each Statement by <u>Listening</u> Frequency Level

Low: Rarely/Occasionally — High: Regularly

Statement	Low	High
Appeal	4.02	4.08
Interest	4.59	4.71
Understand	4.5	4.61
Communicate	3.93	4.02
Value Input	4.23	4.42
Interact	4.24	4.39

Respondents who read and interact with Radiolab content more frequently are more likely to believe that Radiolab is engaging for scientists.
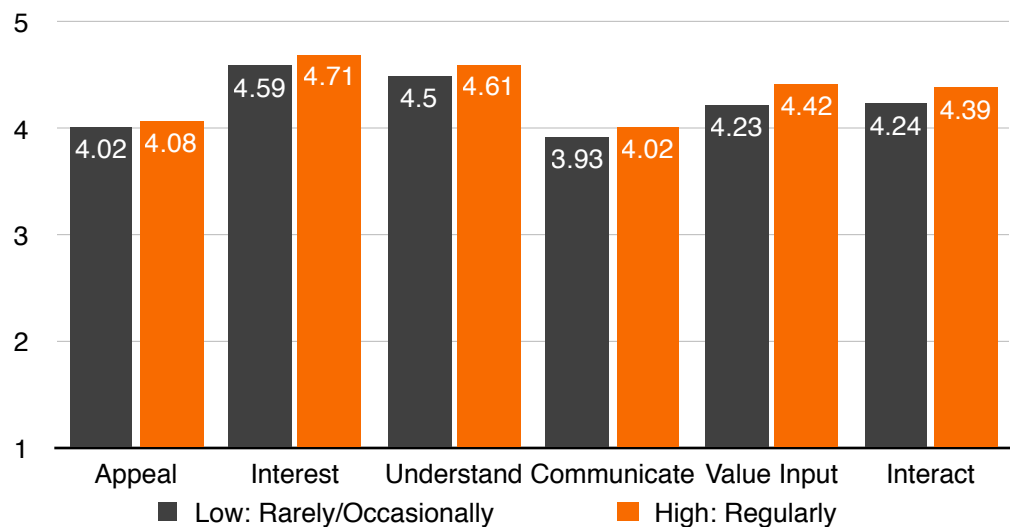
Differences Based on <u>Reading</u> and <u>Interacting</u> Frequency

Findings followed a similar pattern in analyses based on frequency of reading and interacting with Radiolab content. Again, average agreement ratings for nearly every statement were four or higher,[9] indicating a high level of agreement across all respondents. Additionally, there were significant differences between more frequent readers and people who interact with Radiolab content more frequently in terms of their agreement with the statement "Radiolab communicates information in ways that are engaging for scientists." These findings suggest that respondents who read and interact more frequently are more likely to believe that Radiolab is engaging for scientists, perhaps because they see more evidence of scientists reading (e.g., posting comments in response to blog posts), and through other modes of interaction.

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[8] See Appendix F: Table 4a.

[9] See Appendix F: Tables 4b and 4c.

Though responses were high overall, scientists tended to agree more than all other respondents with a series of statements about attitudes toward science, especially with statements about the appeal of Radiolab programming to people with a scientific background and a belief that Radiolab communicates information in ways that are engaging for scientists.

Impact of Personal and Professional Affiliations with STEM
Scientists (including professional scientists and lay-scientists) agreed more strongly with each of the six "attitudes toward science" statements than other respondents. A mixed-model ANOVA indicated that scientists' responses were significantly higher than other respondents (i.e., TEM-professionals and all other respondents who were not employed in STEM career fields) for all but one statement, i.e., "Radiolab programming and content helps to expand the public's understanding of science." The later finding is promising because it indicates that scientists and non-scientists alike see the value of Radiolab programming as a way to help expand public understanding of science.

Additionally, scientists' and lay-scientists' agreement with the statements "Radiolab programming and content appeals to people with a scientific background" and "Radiolab communicates information in ways that are engaging for scientists" were significantly higher than both Non-STEM and TEM-professionals' responses (Scientists > Non-STEM > TEM), lending support to the assertion that members of the scientific community, in both professional and lay capacities, find Radiolab content to be highly engaging. Despite these statistical differences, average ratings across all groups were at least four on a five-point scale, indicating that all respondents tended to have high levels of agreement with the statements.[10]

Differences Between Scientists and Lay-Scientists
There were only two statements for which the differences in mean levels of agreement between scientists and lay-scientists were statistically significant, i.e., "Radiolab programming and content appeals to people with a scientific background" and "Radiolab communicates information in ways that are engaging to scientists" ($p < .001$).[11] In both cases, scientists were more likely than lay-scientists to feel that Radiolab programming is both appealing and engagingly portrayed to those with scientific backgrounds.

[10] See Appendix F: Table 10a for Ns, Means and Standard Deviations.

[11] See Appendix F: Table 10b for Ns, Means and Standard Deviations.

Knowledge of Science

Respondents were asked to indicate how knowledgeable the Radiolab audience is about science (on average). Response options included: 1="not knowledgeable at all," 2="less knowledgeable than the population in general," 3="about as knowledgeable as the population in general," 4="somewhat more knowledgeable than the population in general," and 5="extremely more knowledgeable than the population in general."

Respondents feel that Radiolab listeners are more knowledgeable about science than the general population - these feelings were highest among those who listen to and read content from Radiolab most frequently.

Impact of Types and Frequency of Engagement with Radiolab
ANOVAs were conducted to see whether there were differences by types and level of engagement with Radiolab content (listening, reading and interacting). Statistically significant differences were found between more and less frequent Radiolab listeners,[12] and more and less frequent readers of Radiolab content.[13] Specifically, those who listened and read more frequently rated Radiolab's audience's knowledge of science more highly than those who listened to Radiolab and read Radiolab content less frequently. Despite the fact that these differences were found to be statistically significant, the average ratings (ranging from 3.97 to 4.10) differed by less than .1, suggesting that all respondents believe Radiolab's audience to be somewhat more knowledgeable about science than the general population.[14]

Impact of Personal and Professional Affiliations with STEM
Mixed-model ANOVAs indicated that there were differences in responses among scientists, TEM-professionals, and Non-STEM respondents.[15] Compared to the non-STEM group, scientists and TEM-professionals felt that Radiolab audiences were more knowledgeable than the general population. Once again, despite statistically significant differences, the average ratings only differed by less than .1 and all means were approximately 4.00 suggesting that all respondents tended to believe that the Radiolab audience was somewhat more knowledgeable about science than the general population. The slight difference between scientists and lay-scientists was not found to be statistically significant.[16]

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[12] $F_{(1, 8144)}$ = 4.149, $p < .001$. See Appendix F: Table 5 for Ns, Means and Standard Deviations.

[13] $F_{(2, 7184)}$ = 5.571, $p < .001$. See Appendix F: Table 5 for Ns, Means and Standard Deviations.

[14] See Appendix F: Table 5.

[15] $F_{(2, 816)}$ = 13.421, $p < .001.$ Scientists: 4.09, TEM-Professionals: 4.07 and Non-STEM: 3.97. See Appendix F: Table 11a.

[16] See Appendix F: Table 11b.

STEM Awareness, Knowledge & Interest

The survey sought to determine the extent to which Radiolab audiences believed that the programming had had an impact on their awareness, knowledge, and interest in science. All participants were asked to rate their level of agreement with six statements about Radiolab's impact on their STEM awareness, knowledge, and interest using the following five-point scale, 1="strongly disagree," 2="disagree," 3="neither agree nor disagree," 4="agree," and 5="strongly agree."

Statements About Radiolab's Impact on Awareness, Knowledge of Current Scientific Research and Interest in STEM

✦ Radiolab has increased my <u>awareness</u> of current scientific research.

✦ Radiolab has increased my <u>knowledge</u> of current scientific research.

✦ Radiolab has increased my long-term interest in <u>science</u>.

✦ Radiolab has increased my long-term interest in <u>technology</u>.

✦ Radiolab has increased my long-term interest in <u>engineering</u>.

✦ Radiolab has increased my long-term interest in <u>mathematics</u>.

Among respondents less likely to be less aware and knowledgeable about current scientific research (i.e, those not employed in STEM fields) there is stronger agreement that Radiolab is raising levels of awareness and knowledge.

Impact of Personal and Professional Affiliations with STEM
Between scientists, TEM-professionals, and respondents who did not have personal or professional affiliations with STEM, there were significant differences in levels of agreement with the statements above. Those in the Non-STEM category tended to have higher levels of agreement than scientists and TEM-professionals with Radiolab's ability to increase awareness and knowledge of current scientific research.[17] These findings are likely the result of a ceiling effect wherein STEM professionals already feel that they have high levels of awareness and knowledge of current scientific research and there is subsequently less room for improvement. This finding also suggests that among those less likely to be as aware and as knowledgeable about current scientific research, Radiolab is raising levels of awareness and knowledge.

ANOVAs also revealed statistically significant differences ($p < .001$), between the responses of scientists and lay-scientists, with lay-scientists exhibiting higher levels of agreement with the statements than scientists.[18] Again, these findings are likely the result of a ceiling effect for professional scientists, but also speak highly of the impact that Radiolab has had on audience members who consider themselves to be lay-scientists.

[17] See Appendix F: Table 13a.

[18] See Appendix F: Table 13b.

Other Effects on Scientists

Additional questions were posed to respondents who indicated that they were scientists. The following is a brief summary of responses to these additional questions.

Decision to Become a Scientist

Scientists were asked to indicate whether Radiolab had an impact on their decision to become a scientist. Among the scientists who respondent to this question (N=885), a majority (i.e., 84%, N=743) suggested that they had made their career decision before being exposed to Radiolab. However, 5% of survey respondents (N=42) indicated that Radiolab had had an impact on their decision to go into the field of science.

Respondents who indicated that Radiolab had an impact on their decision to become a scientist were asked to provide additional details on the nature of the impact that Radiolab had on their interest in science. The following are examples of their responses:

Radiolab played a significant role in some scientists' decision to pursue a professional career in science.

✦ *Sometimes when you study a specific topic, you get carried away in the science but Radiolab always offers a very intriguing perspective that helps you realize why you loved science in the first place!*

✦ *I was a music performance major in undergrad and started listening to Radiolab my sophomore year and it made me realize how much I missed science. The more I listened to episodes, the more I realized that I could still be an artist but integrate science into that. It also helped me when I wrote my undergraduate thesis because I took the approach that Radiolab does in looking at all the different factors involved in the topic I was researching.*

✦ *I was hearing scientists chatting about their work, and it became easier and easier for me to imagine myself as a scientist.*

Additional examples of statements shared by scientists are included at the end of Appendix F.

Impact of Other Media

More than half of the scientists who responded to our survey indicated that media may have had an impact on their decision to become a scientist.

Since it was presumed that many scientists would have already made career decisions before they were exposed to Radiolab, we also sought to determine the impact of media on scientists' decision to pursue careers in science in a more general way. Among the respondents who answered this question (N=881), 22% indicated that other media may have had an impact on their interest in science, 23% said media probably had an impact, and 11% said media definitely had an impact. In other words, more than half of the scientists we surveyed indicated that media may have, or did have, an impact on their decision to pursue a career in science.

What Scientists Find Engaging About Radiolab...

It "brings a human/emotional angle to science and everyday life."

It "communicates stories that, as a scientist and human, I relate to and understand."

Radiolab is "not afraid to say (and let scientists say) 'we don't know.'"

"Subjects that I do work on are discussed in an entertaining and informative manner, making complicated scientific issues understandable and interesting for a lay audience."

Among those who said that other media programs had an impact on their decision to become scientists, respondents specifically referenced the following programs and people: Cosmos, NOVA, Magic School Bus, Mr. Wizard's World, Bill Nye, and David Attenborough. The following sources of science programming were also cited as sources of inspiration: NPR/PBS, Discovery Channel, National Geographic, and Animal Planet.

Elements of Radiolab that Scientists Find Engaging
Out of a total of 1112 participants who identified themselves as a scientists or lay-scientists, 731 provided responses to at least one of the open-ended survey questions. A sample of 200 responses were coded for each of the following questions: "What does Radiolab currently do well when it comes to engaging you as a scientist?" and "What does Radiolab currently do well in terms of engaging the general public in science?" Examples of respondents' quotes in response to these questions are presented along the left-hand side of the page and a summary of thematic codes and their frequency within the sample of data that was analyzed are presented in the table below.

Table 2. Elements of Radiolab that Engage Scientists and General-Audiences

	Scientists	General Audience
1. Hosts (personalities & conversations)	3	14
2. Guests and Experts (knowledgeable & well-respected)	23	5
3. Topics (diversity, clear-coverage, and specific examples)	91	46
4. Narrative style (stories humanize scientific concepts)	79	63
5. Humor	4	3
6. Balance (different perspectives, problems & solutions)	5	2
7. Scientific Integrity	30	13
8. Novelty (new ideas, perspectives and interests)	39	9
9. Personal Connection (related to real-life experience)	25	9
10. Accessibility (understandable for non-experts)	32	111
11. Emotion (shows emotional connections with science)	6	1
12. Audio (sound effects & audio editing)	15	22

Overall, scientists find the range of topics to be engaging both for listeners who are highly engaged in science as well as general

audiences. Furthermore, responses indicate that Radiolab presents information in such a way that it is enjoyable and comprehensible to science professionals and enthusiasts as well as general audience members.

Ways to Engage Scientists & Public Audiences More Effectively
Respondents were also asked "What could Radiolab do to more effectively involve and/or collaborate with scientists?" and "What could Radiolab do to more effectively engage public audiences in science?" Responses to these questions varied greatly within the sample of 200 responses that were coded for each question. None-the-less, a summary of thematic codes and their frequencies are presented in the table below.

What Scientists Perceive to be Engaging For General Audience…

"You don't have to think too hard to follow along."

"Having scientists communicate with the public through scientifically literate non-experts makes the sciences feel more accessible and not as scary."

"They do a great job of tying science and scientific concepts to real world issues and ideas that naturally engage the general public."

Table 3. Scientists' Suggestions for How to More Effectively Engage with Scientists and General Audiences

	Scientists	General Audience
1. Online Resources (references, extras, contact info)	11	11
2. Social Media (esp. to reach younger audiences)	5	23
3. Fund crowd-sourced/citizen science projects	10	15
4. Scientist interviews (background, broadcast & follow-up)	10	11
5. Diversity (diverse scientists/lesser known sciences)	33	-
6. Solicit ideas (at universities, from audience)	20	11
7. Address misconceptions (or scientific mess-ups)	6	-
8. Maintain scientific rigor (facts vs. fluff, scientific process)	16	12
9. Explore new/relevant areas of science	27	20
10. Do educational outreach with schools	11	19
11. Hold more live events	12	27
12. Attend conferences	7	-
13. Advertise	-	17
14. Expand into visual forms (videos, illustrations, TV)	-	7
15. Create partnerships with like-minded people/groups	-	12
16. Keep up the good work/Do more of the same	48	44
17. Nothing (fine as is)	21	23

Scientists indicated an interest in hearing more about topics from their personal fields of study (and many indicated a desire to help contribute information and examples from their own work). In terms of engaging general audiences, scientists feel that Radiolab should continue doing much of what it has already been doing to increase audience engagement. Other prevalent responses included addressing topics relevant to a broad audience and holding more live or in-person events.

Examples of suggestions for enhancing Radiolab's ability to engage scientists more effectively:

✦ *"I am actually very impressed with how many experts and analysts are involved in each show. What is important to me is that the stories are honest and not exaggerated, that they convey a part of honest scientific research that may generate more interest in the scientific community."*

✦ *"It would be cool to have some opportunities for follow up with scientists. Many of your shows feature stories that have added bonuses (videos you can look up online, stories you can read, etc). It would be nice to have something like that featuring some of the guests on the show, particularly those whose contribution was that of an expert in the field."*

✦ *"Involve younger scientist (graduate students and post docs), as they not only do the bulk of the bench work that appears in the literature but also can provide fresh perspectives."*

Examples of suggestions for enhancing Radiolab's ability to engage general audiences more effectively:

✦ *"Radiolab could provide opportunities for the general public to interact directly with scientists."*

✦ *"Spend four months touring and giving talks would be amazing. I had never heard of Radiolab until six months ago when my friend mentioned your podcast."*

✦ *"Make it relevant to their everyday lives, and how the topics matter or influence the way they are living currently."*

✦ *"Maybe take user requests? For example, there are some really interesting out-of-the-box questions that get asked in Reddit's subreddit: /r/AskScience. Some things that at first you think should be obvious, but realize that you can't actually explain it."*

Interestingly, many of the suggestions listed above, and several other responses that were coded, seem to recommend things that Radiolab is already seeking to do, e.g., taking listener suggestions, holding live public outreach events, and providing resources and additional information online. The lack of awareness of these initiatives suggests the challenging nature of getting audiences to be aware of all the different things Radiolab is doing to engage scientists and general audiences.

Audience members gather in Berkely California on November 4th, 2011 before a Radiolab Live event.

Photo by Carlos Gomez

Impact of Live Shows

The evaluation team studied the outcomes of two live shows that were part of the Discovery Dialogues project. These evaluation efforts included surveys of attendees for "Radiolab: In the Dark" and "Apocalyptical" and interviews of a small sample of "Apocalyptical" attendees. Both shows were live, theatrical-style events held in multiple venues around the United States.

Radiolab: "In the Dark" Findings

The first Radiolab live show, "Radiolab: In the Dark," took place in cities around the United States, starting with New York, Los Angeles, and San Francisco in 2011, and many more sites in 2012 including Miami Beach, Florida; Salt Lake City, Utah; Portland, Oregon; Philadelphia, Pennsylvania; Brooklyn, New York; Seattle, Washington; Chicago, Illinois; and Milwaukee and Madison, Wisconsin.

A survey was administered to "In the Dark" attendees by RMC Research. The data from more than 1000 survey responses were analyzed by the summative evaluator, Rockman Et Al. The summative evaluation effort also included review and analysis of related articles and reviews of the show.

Photo by Jared Kelly (April 1, 2011) Taken during a Radiolab Live Event in Seattle

Respondent Demographics

"In the Dark" survey respondents included a mix of 41% males and 59% females. Additional demographic details about "In the Dark" survey respondents are summarized below.

Figure 11: Distribution of "In the Dark" Survey Respondents' Ages

● 24&Under   ● 25-34   ● 35-44   ● 45-54   ● 55+
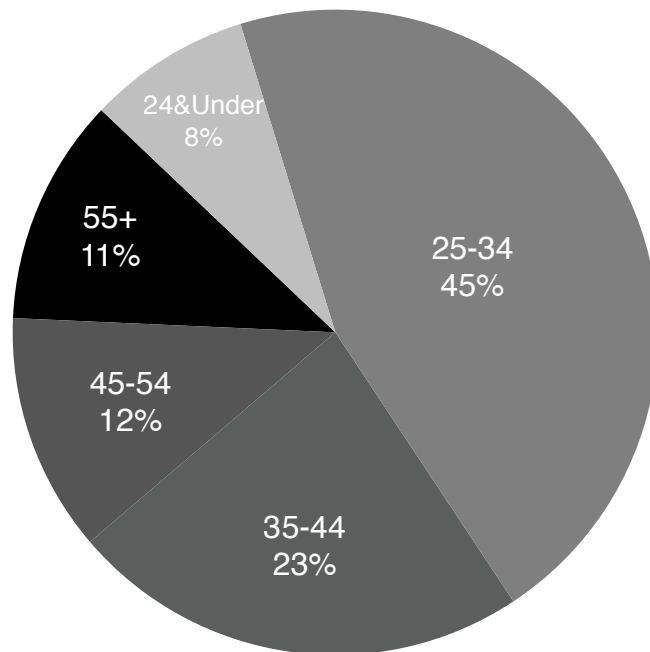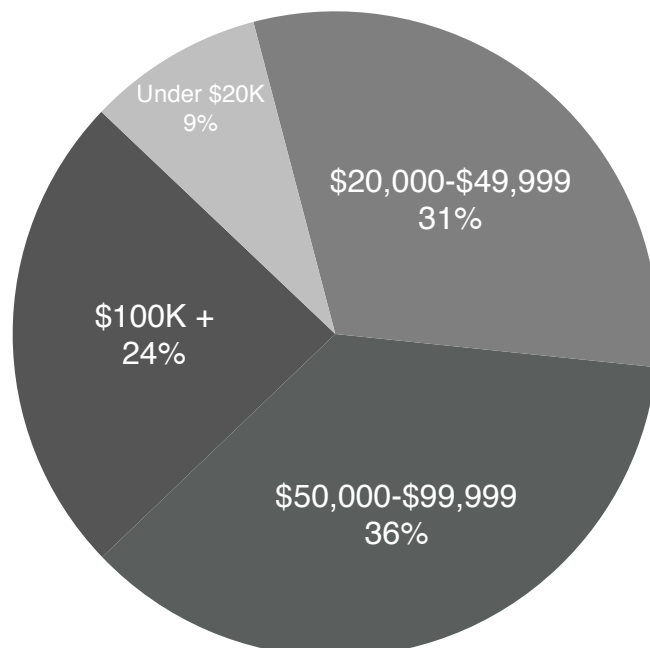
24&Under
8%

55+
11%

25-34
45%

45-54
12%

35-44
23%

Figure 12: Distribution of "In the Dark" Survey Respondents' Income

● Under $20K   ● $20,000-$49,999   ● $50,000-$99,999   ● $100K +

Under $20K
9%

$20,000-$49,999
31%

$100K +
24%

$50,000-$99,999
36%

98% of respondents said they enjoyed the show and 92% said they would see another Radiolab live show.

Program Enjoyment

Audience enjoyment of the "In the Dark" show was high. Out of more than a thousand respondents, 98% (n=1057) said that they enjoyed the show and 92% said they would see another Radiolab live show (n=1083). Open-ended responses suggest that two key reasons underlie audience members' enjoyment of the program: the unique mix of audio and visual storytelling and the ability to see the hosts interact with one another in a live fashion. More information about each of these findings is presented below.

Mix of audio and visual storytelling

Attendees appreciated the multi-modal nature of storytelling within the "In the Dark" program. Furthermore, they delighted in the opportunity to experience what was usually just an auditory experience (i.e., listening to an episode of Radiolab), in a visually rich way that included dance sequences and a variety of visual elements. The following are examples of related comments shared by survey respondents:

✦ *"I loved it! The mixture of stories, dance and music was exactly what I thought Radiolab would "look" like."*

✦ *"Imaginative! I liked the melding of audio (always great w. Radiolab) and the visual acrobatics."*

✦ *The conversations, and visual and musical expressions of ideas presented in the show went way "outside of the box," and took me far away."*

✦ *"I loved being "edutained!" The dancing was so perfectly matched to content."*

✦ *"I love the radio show and am used to using my ears to absorb it but getting to see a visual show accompanying it was a sensory experience. It was really cool seeing a visual show (especially one having to do with the topic of vision)."*

Seeing the hosts and their dynamic interactions with one another

Getting to see the hosts of Radiolab was clearly another perk for "In the Dark" audience members. In addition to voicing appreciation for being able to see them, respondents also voiced qualities about the duo that they find to be so compelling. Examples of related responses include the following:

✦ *"It was wonderful to put faces to the infamous voices I listen to with such great pleasure. The interaction between Robert and Jad is synergistic, better than either one alone!"*

✦ *"I am an instructor in laboratory medicine for a healthcare institution and state college. We listen during our microscopy work a few times a month. I was so excited to see Robert and Jad in person to see their relationship and nuances maybe not seen from the radio."*

The pros and cons of being in a live audience
For some audience members, the opportunity to be surrounded by other fans of the show was exciting and engaging in its own right. However, other attendees found the live viewing experience to be less engaging than listening to an audio broadcast of the show. For example, respondents commented on the realization that one of the things that makes the broadcast/podcast version of the show so magical was the relative isolation and deprivation of visual stimuli to detract from the information being presented in an auditory fashion. Likewise, for many fans, the listening experience tends to be more intimate. Examples of audience members' comments include the following:

- *I felt very in tune with other audience members, all excited to be listening.*
- *I really enjoyed the show, but it was funny to share what is usually such a quiet and personal experience (me listening by myself or with one other person in a quiet room or car) with such a large audience. It took me a few minutes to adjust, but once I did I had a great time!*
- *I realized that the magic of the radio show is how one's imagination is engaged with just the audio. The mood the music sets, the pauses, and the sound effect create a huge mental picture that is lost when you actually have visuals to focus on.*

How Well "In the Dark" Met Audience Members' Expectations
Survey responses indicate that "In the Dark" was "as good" or "better" than what audience members expected. The distribution of their responses to a question that asked how the show measured up to their expectations are presented in the figure below.

Figure 13: Extent to which "In the Dark" Met Audience Members' Expectations
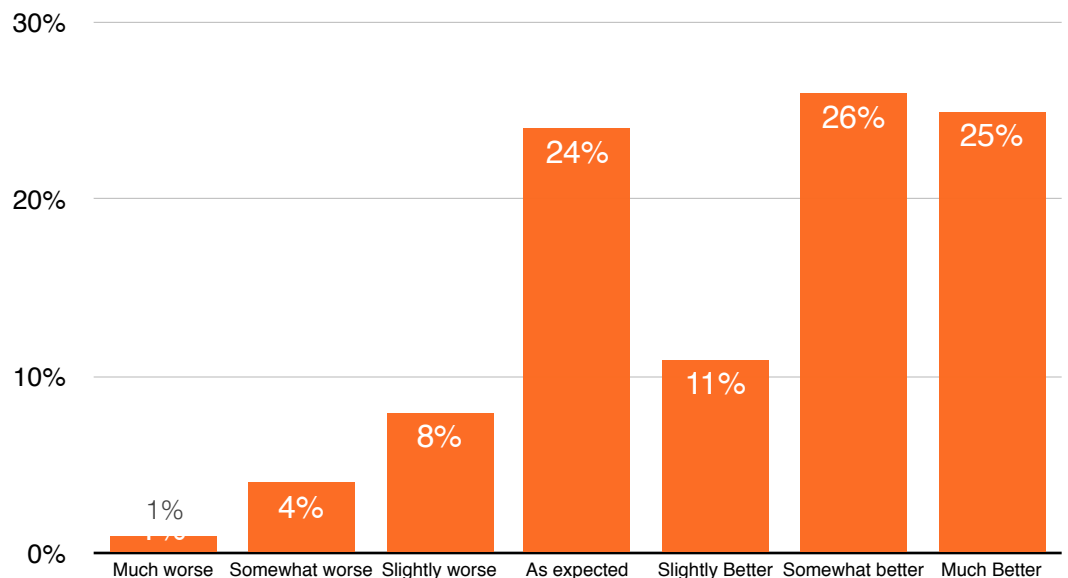
"In the Dark" exceeded the expectations of 62% of survey respondents and met the expectations of another quarter of the respondents.

Category	Value
Much worse	1%
Somewhat worse	4%
Slightly worse	8%
As expected	24%
Slightly Better	11%
Somewhat better	26%
Much Better	25%

Recommendations

More than 500 respondents provided suggestions for ways to make improvements to future live shows like "In the Dark." The formative evaluation report included a comprehensive summary of these recommendations, but a few of the more broadly applicable recommendations are shared below.

✦ Go beyond the constraints of the broadcast medium to deliver content that is uniquely different from that which can be shared on the radio.

✦ Do not let a desire to be entertaining trump the focus on real science. Members of the "In the Dark" audience clearly embraced the science and appreciated the fact that the scientific content was not watered down during the live performance.

✦ Audience members appreciate elements that deliver a "wow factor," i.e., extravagant production qualities that are consistent with other theatrical performances.

✦ Comedic elements of the show were appreciated by most audience members, but producers should consider the range of humor that attendees might consider to be appealing and/or appropriate.

Media Coverage of "In the Dark"

As part of our evaluation of the first live show, Rockman Et Al also searched for reviews of the show from journalists, bloggers, and fans. The following is a brief collection of the reflections and comments about the show that were uncovered in this search.

Whitney Matheson, a reporter for USA Today who pens articles for "Pop Candy," a blog about pop culture, saw the show in the summer of 2012. Matheson wrote that the show "exceeded my expectations, offering treats for all senses."[19]

Jessica Smith, a graduate student at UC Berkley, saw the live show as part of the 2011 Bay Area Science Festival. In her blog post, Smith reflects on the different things that she and her friends took away from the show.[20] A brief excerpt from her post is shared below.

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[19]http://content.usatoday.com/communities/popcandy/post/2012/06/radiolab-live-spending-an-evening-in-the-dark/1#.UzCXjK1dWWs

[20]http://sciencereview.berkeley.edu/radiolab-and-the-philosophical-origins-of-scientific-inquiry/

"After experiencing Radiolab: Live, I can safely say that understanding the nuts and bolts of science doesn't need to exclude a connection to something greater."

"My friends — historians, artists, librarians, and waiters who previously knew very little about the science of the eye — loved the segment for very different reasons. For them, the intrigue came from the way that Jad and Robert connected a series of scientific discoveries back to a fundamental idea: the validity of evolution itself. Their experience reminded me that science makes important contributions to greater understanding of "existence, knowledge, values, reason, mind, and language." As a graduate student, it is easy to lose sight of the big picture, but Radiolab made the connection obvious again"

Another student, Daniel Peel, wrote about his experience with "In the Dark" and shared quotes that he gathered from fellow audience members after the show on the UCLA campus in 2012.[21] Peel quotes, audience member Claire Kennedy, who said that "it makes topics of science accessible and emotional." Peel also quoted Eason Wang, an audience member who felt that the visual elements of the show helped to simplify complex subjects: "Adding the dancers humanizes the experience…they don't dull (the concepts), they amplify them. Radiolab makes knowledge digestible."

Fans also shared photos and original works of art about their "In the Dark" experience, like the one shown to the left drawn by Wendy McNaughton.[22] Examples of these fan-submitted works indicate a high level of interest and engagement.

Overall, media posts about "In the Dark" were overwhelmingly positive and speak to many of the same features that survey respondents found to be appealing about the program. These findings clearly suggest the value and desire for this type of live programming.

[21]http://dailybruin.com/2012/05/13 radiolab039s_quotin_the_darkquot_show_explores_evolution_of_the_eye/

[22]http://wendymacnaughton.blogspot.com/2011_11_01_archive.html

"Apocalyptical" Live Show Findings

The Radiolab "Apocalyptical" tour took place in 2013 and included nearly thirty performances around the United States (See Appendix C, Table 5 for a listing of all shows). "Apocalyptical" included segments on the dinosaurs' mass extinction, Bismuth, and Parkinsons Disease and included a mix of live story narration, video, music, and various other onstage performances.

Survey Respondent Demographics
Following each show, a survey link was emailed to audience members who provided an email address when they purchased their ticket. The survey also included a prompt for respondents to provide the email addresses of others who attended the show with them so that the survey could be sent to those audience members as well. A total of 6166 survey responses were received. The number of responses for each show ranged from 41 to 319 and there was an average of 183.3 responses per show.

Respondent Demographics
Among the respondents who indicated their gender (N=5084) there was a mix of 45.2% males and 54.8% females. Additional demographic details for "Apocalyptical" survey respondents are presented below.

Survey response suggest that Apocalyptical audiences were heavily skewed toward the 25-34 age bracket, with 48% of all survey respondents falling in this age range.

Figure 14: Distribution of "Apocalyptical" Survey Respondents' Ages

● Under 25   ● 25-34   ● 35-49   ● 50+

Under 25 7%
25-34 48%
35-49 30%
50+ 15%
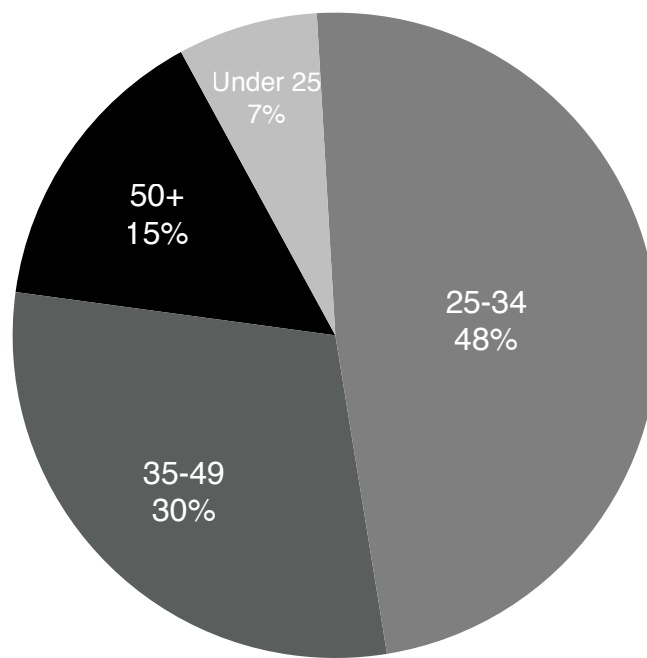
Only 12.5% of respondents (N=771) indicated that they had seen more than one show, all others indicated that they had attended only one performance of "Apocalyptical." Most attendees (79.4%) indicated that the attended with someone else or part of a larger group (14%). Additional demographic details can be found in Appendix C.

Science Knowledge, Understanding, and Interest

Science Knowledge

Survey respondents were asked to rate their levels of scientific knowledge using a five-point scale where 1="low, I wouldn't consider myself to be particularly knowledgeable in science," 2="below average," 3="average," 4="above average," and 5="high, I work/have worked professionally in a scientific field." The average response for all respondents (N=5118) was 3.70, indicating a general level of scientific knowledge between "average" and "above average."[23]

Not surprisingly, "Apocalyptical" audience members tended to have fairly high levels of science interest and knowledge.

Responses were further subdivided into two science knowledge sub-categories. Respondents who rated their science knowledge as "low," "below average," or "average," (i.e., 1-3), were coded as "low." Respondents who rated their science knowledge as "above average" or "high," (i.e., 4-5), were coded as "high." A total of 2077 respondents (40.6%) were in the "low" science knowledge sub-category and 3041 respondents (59.4%) were in the "high" science knowledge sub-category.[24] Respondents in the "high"science knowledge sub-category also tended to be more regular Radiolab listeners.[25]

Science Interest

For respondents' self-ratings of interest in science, the following five-point rating scale was used: 1="low, I am not really interested in science at all" 2="below average," 3="average," 4="above average," and 5="high, I am extremely interested in science." The average response for all respondents (N=5116) was 4.10, indicating that large numbers of respondents rated their interest in science as "above average" or "high."[26]

Responses were further subdivided into two science interest sub-categories. Respondents who rated their interest in science as being "low," "below average," or "average," (i.e., 1-3), were coded as "low."

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[23] See Table 9 in Appendix C.

[24] See Appendix C: Table 1 for a complete breakdown of science knowledge and science interest sub-categories.

[25] A Chi-Square test showed that there were statistically significant differences for regular Radiolab listening between those with low levels of science knowledge (74.7% were regular listeners) and high levels of science knowledge (79.4% were regular listeners). See Appendix C, Table 23.

[26] See Table 10 in Appendix C.

Respondents who rated their science interest as being "above average" or "high," (i.e., 4-5), were coded as "high." A total of 1065 respondents (20.8%) were in the "low" science interest sub-category and 4051 respondents (79.2%) were in the "high" science interest sub-category.[27] Not surprisingly, respondents in the "high" science interest sub-category also tended to be more regular Radiolab listeners.[28]

Knowledge and Interest Outcomes

The survey also included a series of questions about respondents' knowledge and understanding of science and interest in science. Specifically, respondents were asked to indicate their level of agreement with the following statements using a five-point scale where 1="strongly disagree," 2="disagree," 3="neither agree nor disagree," 4="Agree," and 5="strongly agree."

✦ The program exposed me to new scientific concepts. (Exposed)

✦ The program helped me understand scientific concepts more clearly. (Understand)

✦ The program made me feel more knowledgeable about the scientific topics that were discussed. (Know-specific)

✦ The program made me feel more knowledgeable about science in general. (Know-general)

✦ The program raised my level of interest in science. (Interest-general)

✦ The program raised my level of interest in specific types of current scientific research. (Interest-current)

Average responses are shown in Figure 15, and suggest generally high levels of agreement with each statement, and the highest agreement with statements about the extent to which the program exposed audience members to new scientific concepts and the extent to which it made audience members feel more knowledgeable about the specific scientific topics that were presented in the show.[29]

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[27] See footnote number 21.

[28] A Chi-Square test showed that there were statistically significant differences for regular Radiolab listening between those with low levels of science interest (68.6% were regular listeners) and high levels of science knowledge (79.8% were regular listeners). See Appendix C, Table 24.

[29] See Appendix C: Table 6 for response frequencies, Ns, and standard Deviations.

Figure 15: Average Agreement with Statements about Science Knowledge, Understanding and Interest
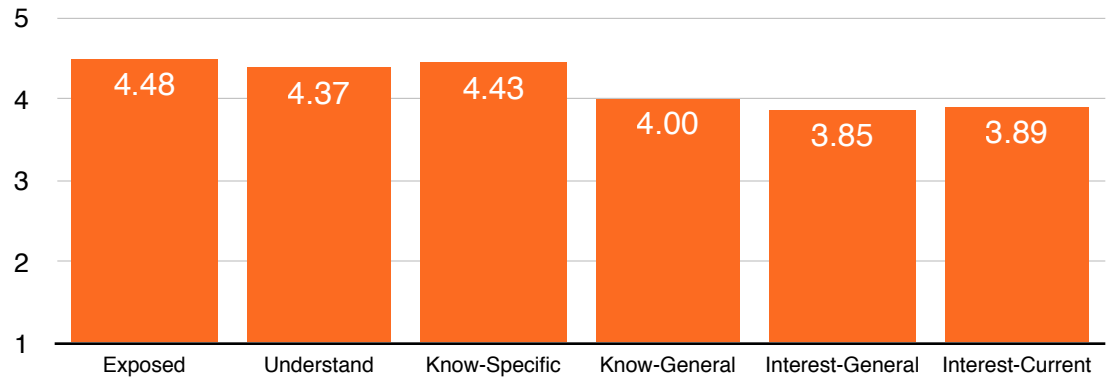
Female respondents tended to agree more with each of these statements than males and ANOVAs revealed that these differences were statistically significant.[30] Younger respondents also tended to agree more with each of these statements.[31]

T-tests were conducted to examine whether there were differences in respondents' agreement with the statements about knowledge, understanding and interest in science. With the exception of the question on resulting interest levels for specific types of current scientific research, all differences between respondents categorized as "low" versus those categorized as "high" in self-rated science knowledge were statistically significant, with those in the "low" category indicating higher levels of agreement than their more knowledgeable counterparts.[32]

These findings indicate either a ceiling effect wherein more knowledgeable respondents felt they had less room for growth as a result of their experience attending "Apocalyptical," or suggest that audience members with low to average levels of science knowledge tend to benefit most from the program. It is important to note, however, that the mean differences between those in the "high" and "low" sub-groups for science knowledge were not big despite being statistically significant—rather, these findings were likely due to the

Members of the "Apocalyptical" audience with lower self-rated science knowledge tended to agree more with statements about Radiolab having exposed them to new scientific concepts, understanding scientific concepts, and feeling more knowledgeable about specific concepts as well as science in general.

[30] $p < .05$. See Appendix C, Table 21 for Ns, means, and standard deviations.

[31] 18-24 year old respondents agreed more with each statement. For "Expose," "Interest-General" and "Interest-Current" 18-24 year olds responses were significantly higher than 25-34, 35-49, 50-65, and 66-74 year olds. For "Understand" and "Know-General" 18-24 year olds gave higher ratings than 25-34, 35-49 and 50-65 year olds. Lastly, for "Know-Specific" the only statistically significant differences were between 18-24 year olds and 50-65 year olds. See Appendix C, Table 22 for more details about the Ns, means, and standard deviations for each statement and each age group.

[32] $p < .05$ See Appendix C, Table 19. Statistically significant differences are underlined.

large sample size. The figure below shows average responses within each science knowledge category for each statement.

Figure 16: Average Agreement with Statements about Science Knowledge, Understanding and Interest by Low and High Levels of Science <u>Knowledge</u>

Respondents with lower self-rated levels of science knowledge thought "Apocalyptical" helped them understand scientific concepts more clearly and felt the show had raised their general level of interest in science. Those with higher levels of self-rated knowledge indicated that the show raised their interest in specific types of current scientific research.
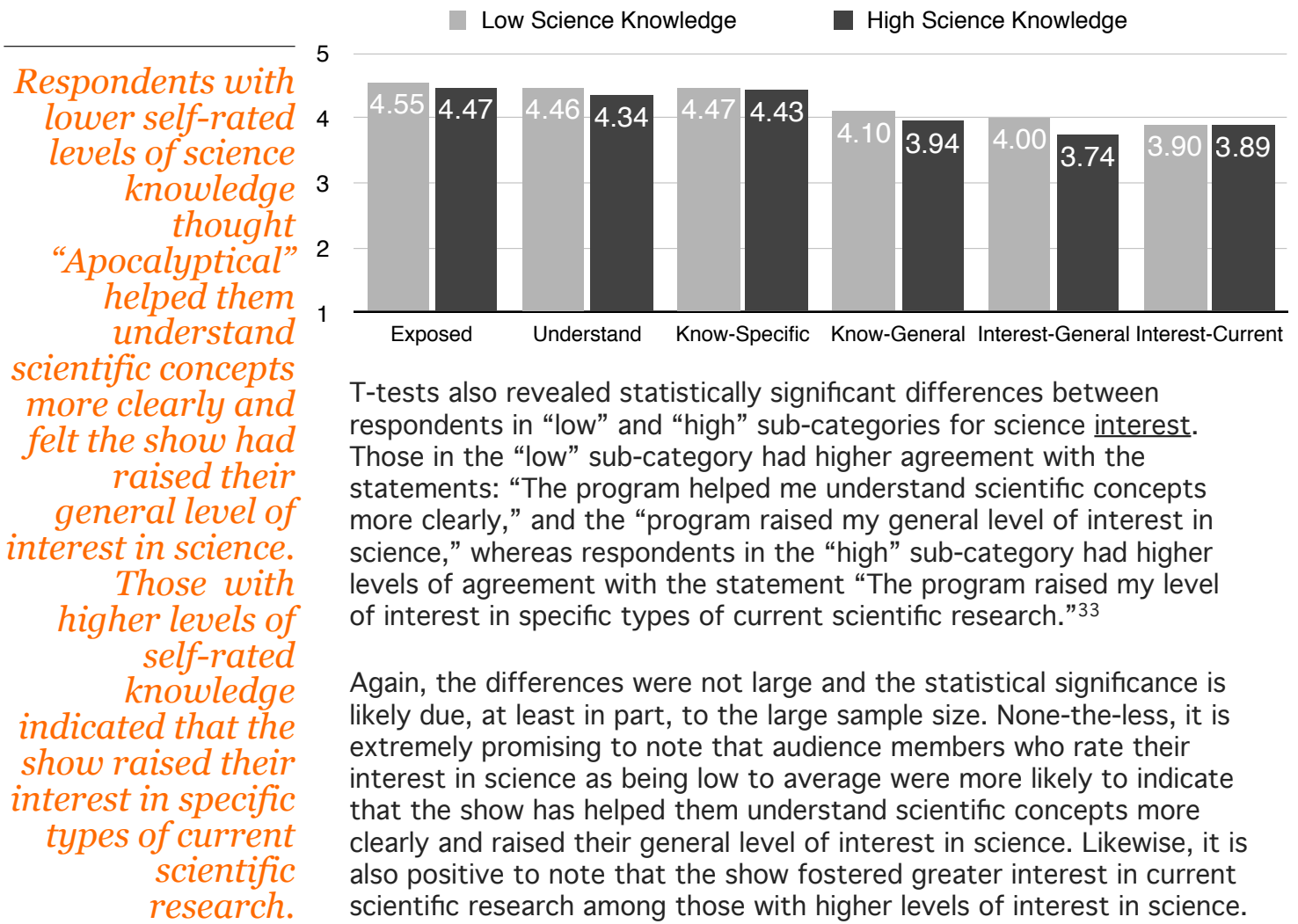
T-tests also revealed statistically significant differences between respondents in "low" and "high" sub-categories for science <u>interest</u>. Those in the "low" sub-category had higher agreement with the statements: "The program helped me understand scientific concepts more clearly," and the "program raised my general level of interest in science," whereas respondents in the "high" sub-category had higher levels of agreement with the statement "The program raised my level of interest in specific types of current scientific research."[33]

Again, the differences were not large and the statistical significance is likely due, at least in part, to the large sample size. None-the-less, it is extremely promising to note that audience members who rate their interest in science as being low to average were more likely to indicate that the show has helped them understand scientific concepts more clearly and raised their general level of interest in science. Likewise, it is also positive to note that the show fostered greater interest in current scientific research among those with higher levels of interest in science. The figure below shows the mean responses within each science interest category for each of the six "science knowledge and interest" statements.

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[33] p < .05 See Appendix C, Table 20. (Statistically significant differences are underlined).

Figure 17: Average Agreement with Statements about Science Knowledge, Understanding and Interest by Low and High Levels of Science <u>Interest</u>
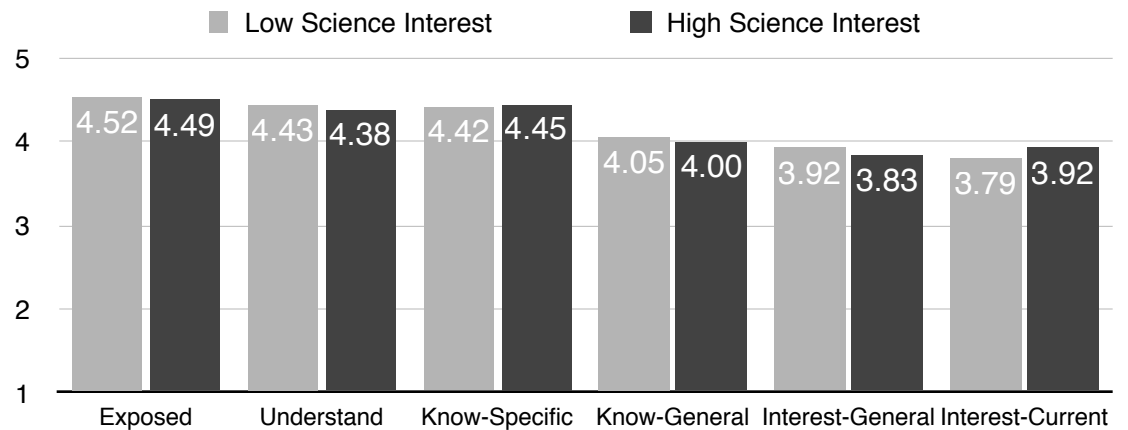

Program Enjoyment

Survey responses also indicate high levels of enjoyment among "Apocalyptical" attendees. To measure levels of enjoyment, respondents were asked to indicate their level of agreement with the statement "I enjoyed this program" using a five-point scale where 1="strongly disagree," 2="disagree," 3="neither agree nor disagree," 4="agree," and 5="strongly agree." Nearly all respondents (i.e., 96%) indicated that they enjoyed the show and 67% of respondents strongly agreed with the statement. The mean agreement score was 4.58, also indicating a high level of agreement with this statement.[34]

Respondents with higher self-ratings for science knowledge and science interest were more likely to enjoy the show and the difference between those with high and low levels of interest in science was found to be statistically significant.[35] ANOVAs revealed statistically significant differences based on respondents' gender and age. Females tended to agree more strongly that they enjoyed the show[36] and younger respondents tended to agree more strongly that they enjoyed the show.[37]

96% of "Apocalyptical" attendees said they enjoyed the show - 67% of those people said they "strongly agreed."

[34] See Appendix C, Table 6 for distribution of responses. (N=5612)

[35] See Appendix C, Tables 19 and 20. p < .05.

[36] See Appendix C, Table 21. Female mean=4.61, Male mean=4.56. p < .05.

[37] 18-24 mean: 4.70, 35-49 mean: 4.56 and 50-60 mean: 4.53. See Appendix C, Table 22. p < .05.

Appeal of Different Components of the Show
Respondents were asked to indicate how they felt about different aspects of the show—specifically pre-recorded content, live comedic performances, live music and interactive components of the show—using a five-point scale where 1="strongly negative," 2="somewhat negative," 3="neutral," 4="somewhat positive" and 5="strongly positive." Data suggest that respondents thought highly of each element with slightly higher ratings for pre-recorded content.[38]

Figure 18: Relative Appeal of Show Features
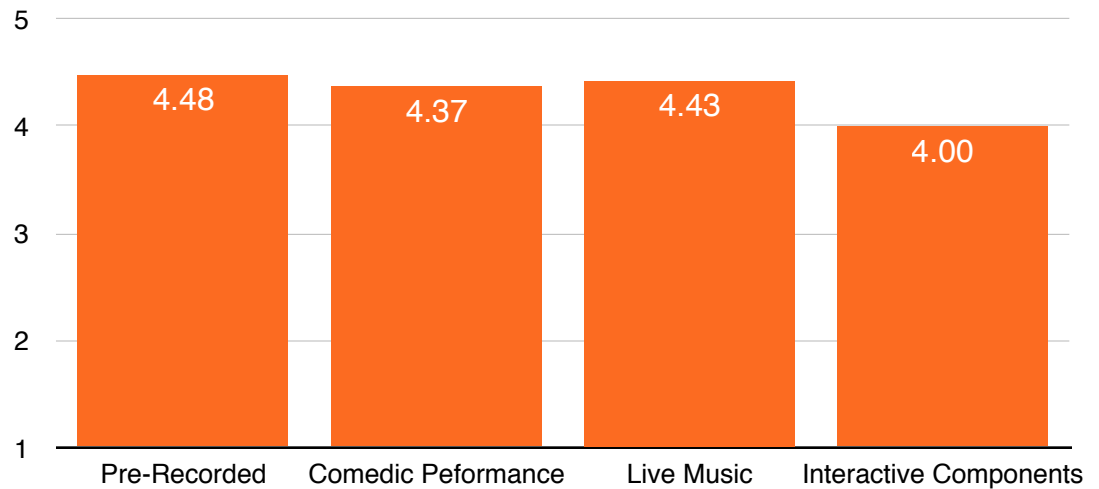
Chi-square analyses were conducted to see if there were differences in the extent to which these show features appealed to different genders and those within different age groups. In general, females tended to rate the show components as "strongly positive" more often then males, especially for pre-recorded content, live comedic performance, and interactive components.[39]

Findings from attendee interviews will be presented at a later point in this report, however it is worth noting that interviews and open-ended survey data also indicated the appeal of the life-sized dinosaur puppets employed during the first segment of "Apocalyptical," as well as the live presentations by hosts, Jad Abumrad and Robert Krulwich.

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[38] See Appendix C: Table 7.

[39] See Appendix C: Table 25.

Intended Behaviors

In addition to learning about the extent to which audience members enjoyed the show, and felt that it increased levels of science knowledge, understanding, and interest, the evaluation team also sought to learn more about the extent to which seeing Apocalyptical prompted certain behaviors. Respondents were asked to indicate their level of agreement with two statements about things they intended to do as a result of their live show experience. Agreement with the following statements was rated using a five-point scale where 1="strongly disagree," 2="disagree," 3="neither agree nor disagree," 4="agree," and 5="strongly agree."

✦ The program sparked a desire to learn more about one or more of the topics. (Learn More)

✦ The program sparked a desire to do something related to one or more of the topics. (Do Something)

The mean for respondents' level of agreement with the first statement (i.e., Learn More) was 3.87 and the mean for respondents' level of agreement with the second statement (i.e., Do Something) was 3.21.[40] Agreement with these statements was somewhat lower than agreement for other statements about program enjoyment and science knowledge, understanding, and interest, but arguably it is easier to impact audiences' interests than behaviors. It may also not have been clear to audience members what they could learn more about or do in relation to the topics that were discussed.

Regular Radiolab listeners were more likely to say that "Apocalyptical" had an impact on their desire to learn more about one or more of the topics presented in the show.

Regular Radiolab listeners were more likely to say the program had sparked a desire to learn more about one or more of the topics. Those with no familiarity with Radiolab had a mean response of 3.68, non-listeners and periodic listeners had a mean response of 3.76, and regular listeners had a mean response of 3.91. In response to the question about doing something related to one or more of the topics respondents who had no familiarity with Radiolab had a mean response rate of 3.12, non-listeners and periodic listeners had a mean response rate of 3.18, and regular listeners had a mean response rate of 3.29.[41]

Respondents were also asked to indicate what they planned to do after seeing "Apocalyptical," including listening to episodes of Radiolab, reading information or doing things on the Radiolab website, following Radiolab via social media, attending other live shows, and looking up more information about something they learned about in the show. Percentages of total respondents who said they would do each type of

[40] See Appendix C, Table 6.

[41] See Appendix C, Table 25.

thing as a follow-up to their live-show experience are summarized in the figure below and in Appendix C, Table 8.

Figure 19: Average Agreement with Statements about Intended Behaviors
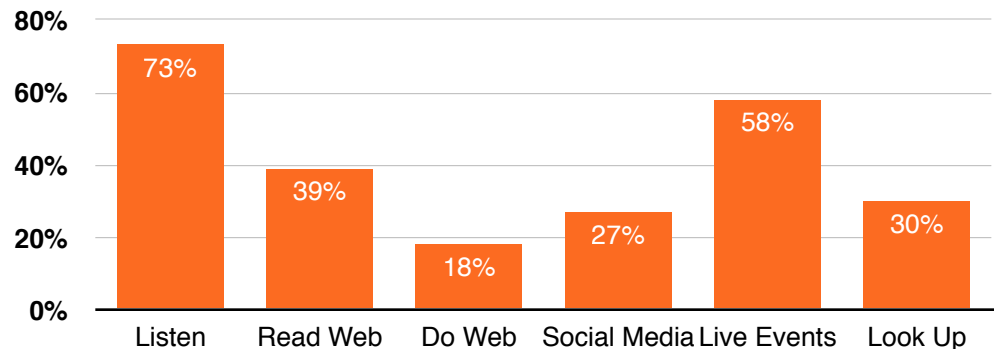
Respondents with higher levels of science interest and science knowledge were more likely to do things as a follow-up to their "Apocalyptical" experience.

High percentages of respondents indicated their intention to listen to Radiolab—though admittedly a large number of these respondents were already regular Radiolab listeners. Those with higher levels of interest in science were more likely than those with lower levels of interest in science to do each of the activities listed above. Chi square tests revealed all these differences to be statistically significant.[42] Those with higher levels of science knowledge were more likely to read content on the Radiolab website (60.1% vs. 39.9%), do more activities on the website (61.9% vs. 38.1%) and look up more information about the topics discussed in the show (63.3% vs. 36.7%). Chi square analyses revealed these differences to be statistically significant as well.[43]

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[42] See Appendix C, Table 28.

[43] See Appendix C, Table 27.

How "Apocalyptical" Attendees Described the Experience

Attendees were asked to list three words that describe the Radiolab Live experience. Responses indicate that audience members found the show to be both entertaining (e.g., funny, smart, exciting, etc.) and educational (e.g., interesting, enlightening, smart, scientific, etc.). Responses also suggest the appeal of visual and audio components of the show (e.g., visual, beautiful, artistic, musical etc.). Lastly, respondents' comments indicate that they found the show to be innovative (e.g., experimental, cutting edge, original, etc.). The word cloud below shows additional words that respondents used to describe their experience.

Figure 20: Words Used by Respondents to Describe Apocalyptical

"Apocalyptical" Interview Results

Ten small-group interviews were conducted with audience members after the November 15th, 2014 "Apocalyptical" live show in Los Angeles. The small groups ranged in size from two to five, and included twenty-two individuals who attended the show. The following are general themes and trends from the interviews.

The dinosaur segment of the show was the most popular. The first segment of "Apocalyptical" explained a new theory about how the dinosaurs became extinct and events that ultimately made way for the rise of mammalian species. It featured life-size dinosaur puppets and a variety of engaging visual segments presented on a large video screen. Audience members found the visual elements of this segment and the underlying scientific concepts within this segment to be the most stimulating and compelling. Several interviewees expressed their intent to look up more info about the theories and concepts that were presented in this segment and there also seemed to be a heightened interest in sharing what they had learned with others. One interviewee indicated that it made her want to be a paleontologist.

"It was incredible, it was amazing. I want to be a paleontologist now!"

✦*"I actually didn't expect to learn anything. I just thought it would be just a series of anecdotes, and it's amazing. It was incredible, it was amazing. I want to be a paleontologist now!"*

✦*"When you're watching it you're just like 'Oh my God, that makes total sense!'"*

✦*"The dinosaur exploration was really fascinating to me. I've been a fan of dinosaurs…any new addition is always super compelling. I become that 10 year old kid again."*

✦*"To actually see a visual actually helps with the sound effects and picturing it."*

Thoughts about the later two segments reinforced an interest in more visual elements in a live, theatrical show. The second segment of Apocalyptical focused on Bismuth, a lesser-known element with a pink hue and perhaps best-known, if known at all, for its presence in Pepto-Bismol. The final segment took an artistic and emotional look at Parkinson's disease. Compared to the first segment, there seemed to be a general consensus among audience members that the visual elements associated with these later two segments were not as compelling. People consistently suggested that the Parkinson's segment in particular may have been better-suited to radio.

✦ *"The second half was an auditory experience and the first half was visual as well. Being live, there's a hope to move past being just an auditory experience into a visual one."*

✦ *"The second half…I didn't think it was apocalyptical. It's something that I could have listened to on my own."*

The program appealed to people with varying levels of familiarity with Radiolab and interest in science. Previous fans of Radiolab felt that their affinity for the program grew as a result of this experience, and those who were unfamiliar or less familiar indicated a desire to seek out more Radiolab content in the future. Specifically, people liked the fact that the live show entertained while it taught about new and interesting topics. Audience members felt that "Apocalyptical" made the science accessible to lay people without dumbing it down. Where the program is concerned, in a more general sense, there was definitely a consensus that Radiolab should keep on doing what it has been doing.

"It's a really easy and fun way to learn about heavy subjects."

"Keep making science fun!"

✦ *"I like the personal stories.I like how they get the scientific part of it and everything, but then they back it up with what is happening in real life."*

✦ *"It's a really easy and fun way to learn about heavy subjects."*

✦ *"You always learn something with Radiolab, that's a given.That's why we're fans."*

✦ *"I thought it was brilliant. A mix of comedy and science, and I just sat back and took it all in."*

✦ *"Keep making science fun!"*

Web & Social Media

In this section of the report we explore trends uncovered through analysis of website usage—including comments on blog posts—and data from Facebook and Twitter.

Analysis of Comments on the Radiolab Website

In an effort to better understand which Discovery Dialogues posts on the Radiolab.org website were most effective at generating audience engagement, a set of data were pulled from more than 100 blog entries posted between July 2012 and September 2014. This set of data included the number of comments that had been submitted as of September 14th, 2014, as well as the number and types of different multimedia elements, including embedded images, audio clips and video clips.

Trends Across Time

The evaluation team examined the number of comments per blog post for three periods of time: July-December 2012, January-June 2013 and July-December 2013. In some cases, we found evidence of comments being posted several months or even a year after an article was posted to the site. Outliers resulting from polls and quizzes were not analyzed.

Figure 21: Average Number of Comments by Time Period

It is important to note that a driving force behind what might otherwise appear to be a decline in the number of average blog posts over time, was a blog entry originally posted on August 30th, 2012 that invited audience members to share questions or topics that interested them. Comments submitted in response to this blog post were used to inspire subsequent blog posts on November 14th, 2012, May 8th, 2013 and November 13th, 2013. Likewise, the average number of responses to blog posts in the second time period, i.e., January through June 2013, were skewed by responses to the "Name Your Ancestor" contest and cicada-themed posts, which often invited a higher level of interactivity. These findings suggest that audience members are engaged by opportunities to share personal opinions and anecdotes and to offer suggestions about science topics that appeal to them.

People were engaged by opportunities to share personal opinions and anecdotes and to offer suggestions about science topics that appeal to them.

**Table 4: Top 25 *Radiolab* Blog Posts Based on Number of Comments
(As of September 14th, 2014)**

Title	Date	Number of comments
How Do You Fall Asleep	4/15/13	1290
Do Bugs Make Your Mouth Water?	4/18/13	664
Have You Heimliched	3/5/13	334
Cabinet of Curiosities	8/30/12	240
The Bugs of History	4/5/13	139
Poop the Magic Gut Cure	1/22/13	87
Lucy and Kanzi	8/6/14	50
Vote Now to Name Your Ancestor	3/25/13	39
First Cicadas Sighted in NJ!	5/1/13	38
House Calls to the Inside of Your Head	11/4/12	28
On Goose Bumps	11/26/12	28
Science Fair Glory	4/26/13	27
Radiolab Remix Winners	7/2/12	26
The Hypnotist	6/22/13	24
Swarmageddon: Join Our DIY Cicada-Tracking Events!	4/1/13	24
An Illustrated History of Heimlich	3/5/13	24
Musical Illusions	5/9/13	23
Mapping the Bilingual Brain	12/12/12	21
Name that Shrew! Round 2	3/15/13	20
Fast Cash Dash Flash Crash Clash	2/6/13	20
Sometimes We Save Each Other	1/1/13	17
Update: Famous Tumors	10/22/13	17
Behind the Goat	7/24/12	16
Argentine Ant Invasion	7/31/12	16
Name Your Ancestor Now: Vote!	3/12/13	16

Trends by Article Length

An in-depth analysis of blog posts between July 2012 and March 2014 did not reveal any consistent trends in the number of comments based on the length of the article—i.e., the word count for each article from the title to the tags included at the end of each post.[44] The two higher columns in the figure presented below seem to stem from the higher-than-average number of comments in response to the "Cabinet of Curiosities" article which had a word count of 327 and 240 comments, and the "Poop the Magic Gut Cure" article that had a word count of 668 and 86 comments as of March 14th, 2014. If you remove these two comment outliers, the average number of comments for all other articles varies no more than four across the six word-count categories.

Figure 22: Average Number of Reader Comments by Article Word-Count
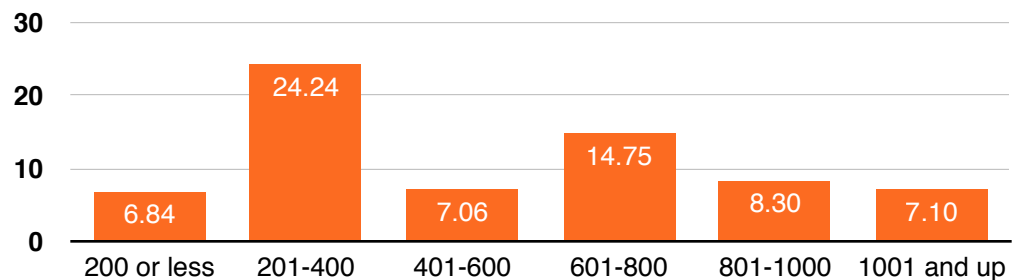
Trends by Article Type

We also sought to determine if the total number of multimedia elements embedded in each article—including images, audio links and video links—had an impact on the resulting number of comments. Again, even after removing outliers, we found no consistent trends in the impact that multimedia elements had on the subsequent number of blog posts.

Figure 23: Average Number of Reader Comments by Number of Multimedia Elements Included in the Post

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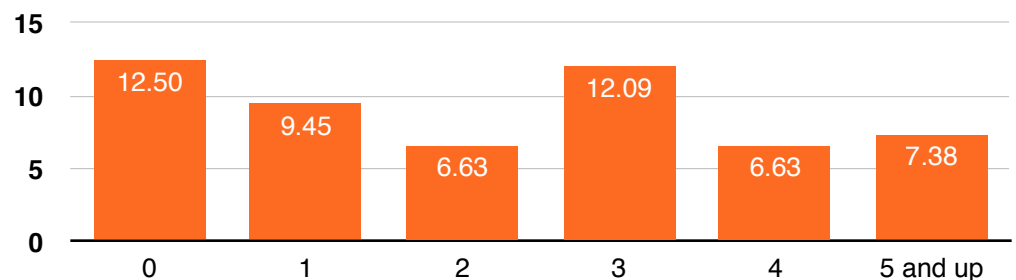
[44] Polls were eliminated from the data set used to produce Figure 22.

Content seems to influence the number of comments more so than article length, the time period during which the article was posted, or the number and type of multimedia elements in the article.

Trends that seem to drive reader engagement

Ultimately, given the seemingly random nature of commenting trends associated with blog posts based on quantifiable elements, we found evidence that suggests that content matters more than the length of the article, the time period in which the article was posted, or the type of multimedia elements an article includes. However, based on our analysis we did discover a few general trends that seemed to be indicators of subsequent reader engagement. These findings are summarized in the paragraphs below.

Polls generate high levels of audience engagement. Four of the top five most frequently responded-to posts on the Radiolab.org blog were polls, including: "How do you fall asleep," "Do bugs make your mouth water," "Have you Heimliched?," and "Bugs of History." The following example shows a breakdown of responses along with a visual representation of where people have had a Heimliching experience. The interactive data set also allows users to apply filters based on specific responses or periods of time.[45]

Figure 24: Example of Interactive Poll Results

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[45] http://www.radiolab.org/story/273536-have-you-heimliched/
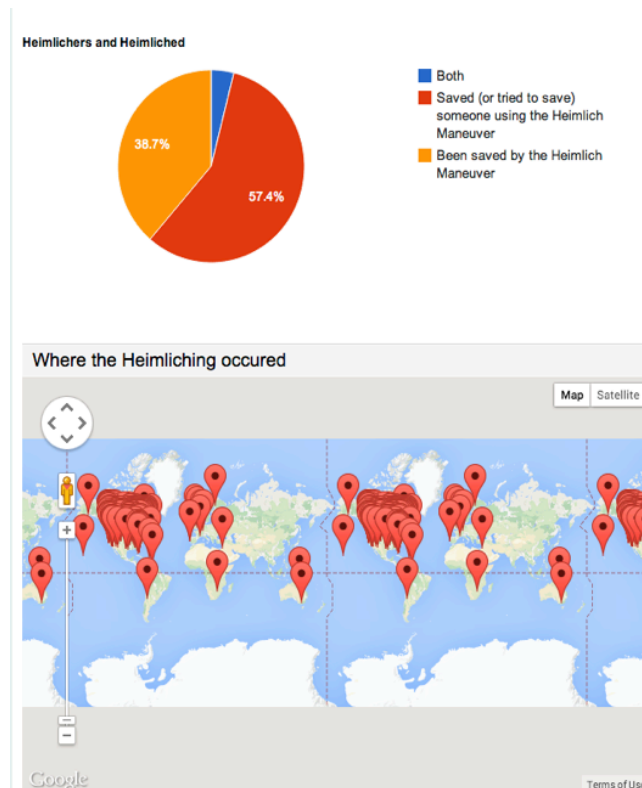
Polls generate high levels of audience engagement by offering an overt invitation to interact, a simple way to do so, and the instant gratification of being able to see and manipulate real-time results.

Based on the large number of responses to blog posts with polls, we posit four informal theories for their popularity; the first being that polls offer a built-in invitation to participate—people instinctively know what to do when they see a poll and there is a basic desire to pick a response when presented with a list of options. The second informal theory for the popularity of polls is the fact that it does not take long to contribute a meaningful response when most of the response options are pre-scripted—polls make it quick and easy for people to respond. Thirdly, polls offer the instant gratification associated with being able to see results and, in some cases the Radiolab website provides opportunities for users to manipulate results in interactive ways to see how their responses compare to those of other respondents. In other words, polls and the data that they generate, create an opportunity for readers to engage and indulge their curiosity.

In contrast to polls that gather information on readers' opinions and experiences, there are also quizzes that test reader's knowledge about different topics. Quizzes provide instant feedback on whether readers' responses are correct or incorrect, and allow respondents to continue choosing answers until they get the correct answer. It is possible that quizzes (e.g., the "Sink your teeth into our rabies quiz," or "Poop quiz") have equally high rates of response, but there is no readily available information on the total number of responses that these quizzes have received. It is therefore uncertain if multiple choice tests of readers' knowledge drive as much engagement as polls wherein there are no correct answers.

Opportunities to suggest topics and questions are welcomed. The non-poll post with the largest number of comments was the "Cabinet of Curiosities" post. While the bulk of responses came within the first few months after the initial post, additional responses have continued to trickle in for more than two years, and show no signs of letting up. The following are examples of listener-submitted questions:

✦ *Considering parenthood, new fathers seem to turn to the new mom to ask how to take care of babies. The moms seem to know 'instinctively' what to do. Is it truly instinctive or do we just have repressed memories from growing up and seeing it modeled? If so, why do men not have the same repressed memories*

✦ *I'm curious to know whether only mammals yawn, or if it's a more universal phenomenon.*

✦ *If our body temperature is supposedly around 98.6 degrees Fahrenheit, why does it feel so unbearable to be in ambient temperatures in the 90's or even 80's?*

✦ *What is fire? No, seriously-- what is it?*

Audiences seem to be engaged in instances where the Radiolab team has actively contributed to online conversations and seem to be closely monitoring posts.

Radiolab website users respond to overt calls to action.

"The Cabinet of Curiosities" post also seems to be popular because the comment section has approximated a discussion wherein respondents are able to comment or gather ideas from things that others have submitted, but also because members of the Radiolab team have actively participated in the ongoing conversation as well—sharing examples of related programming, providing summaries of common trends in the questions that people have submitted, and pulling out questions to serve as inspiration for subsequent blog posts. Comments submitted in response to the "Cabinet of Curiosities" post inspired the "Why we fall into a good book" post on November 14th, 2012, the "Seasons of smell" post on November 7th, 2013 and the "Why cry?" post on May 8th, 2013. Essentially, the "Cabinet of Curiosities" post encapsulates a great deal of what the Discovery Dialogues projects set out to accomplish, and provides evidence that Radiolab was successful in its efforts to invite listeners to contribute suggestions for programs and other blog posts.

Overt invitations to interact drive more submissions. Comments and opinions abounded during the March-Madness-style "Name your Ancestor" event in the spring of 2013. For example, a post on March 25th, 2013, reminding readers to vote for their favorite name received 39 responses. Similarly, calls to share examples of cicada-sightings also drove higher-than-average numbers of comments. For example, there were 38 comments posted in response to the "First Cicada's Sighted in NJ" post on May 1st, 2013. The following are examples of cicada-sightings contributed by readers in May and June of 2013:

✦ *"Saw my first one today at a Costco parking lot, just sitting there, in East Hanover, New Jersey."*

✦ *"Emergence spotted at Tenafly Nature Center. Dozens of ground holes and molts found May 27; second warm day (70-80 degrees fahrenheit) after 2 days of downpours (40-55 degrees fahrenheit). Can't wait to hear them."*

✦ *"In Westfield, New Jersey, especially in neighborhoods and houses surrounded by trees, cicadas are everywhere! It really is unbelievable how many I have seen in this area. It's interesting but I don't enjoy their visit one bit!"*

There were also a handful of articles posted on the Radiolab blog that invited readers to submit photos. For example, a post on June 13th, 2013 entitled "You can't read a dog by it's guilty face," invited Radiolab website users and app users to submit photos of dogs looking guilty. Other posts including, "Playing Hookey" posted on July 16th, 2012, and "Radiolab Halloween Costume Contest" posted on October 17th, 2012, also invited users to submit photos and received several submissions.

Invitations to share personal stories or experiences help produce greater numbers of comments as well.

Invitations to share personal stories receive high numbers of comments. Readers seem to be engaged by opportunities to share information and anecdotes from their own personal experiences. There are many examples throughout the Radiolab blog of people telling personal stories —ranging from humorous to heartfelt (such as those illustrated in the two examples below).

✦ *"A looong time ago I had the opportunity to play ball with a 3 year old dolphin who was born in captivity. Of course he was used to interacting with humans. I would throw the ball, and he would swim after it. Then he would bring it back, and really tease me, swim away with it, splashing water.. Yes, I'll bring it back - no I won't etc. Really teasing, observing me - reacting to me and my body language (stretching my arms to take the ball) and then as a result: darn sweet naughtiness.I know it's subjective, projection, etc. but these sea mammals can communicate in so many complex ways. As we interpret their behaviour - why should they not interpret ours?" (Comment posted in response to "Fin-Bump across the Divide" on February 4th, 2013)*

✦ *"I read this article this morning, and thought it was really interesting. Then just now, I watched the music video for Same Love by Macklemore and Ryan Lewis and got goosebumps during the marriage scene. I think I was just so moved by how special and happy the scene was.The older I get, the more I notice that I get goosebumps from things I find particularly beautiful and moving. Mostly it's songs and movies, but occasionally I find that I get goosebumps when a book or spoken phrase is really moving, too. I don't know if it's because I feel things more deeply now, or that I'm just starting to realize how beauty affects me." (Comment posted in response to "On Goose Bumps" on November 27th, 2012)*

The Radiolab website provides a safe environment for users to share their thoughts and opinions on controversial topics.

Invitations to debate controversial subjects were successful in generating responses. Radiolab is frequently praised for its ability to present controversial topics in balanced and engaging ways. It therefore comes as no surprise that blog posts that also sought to tackle tough issues ultimately provided a safe place for users to share their thoughts and opinions. The following are two examples of posts that included coverage of controversial topics, followed by examples of comments that were contributed in response. The "Poop the Magic Gut Cure" article, posted on January 22nd, 2013 described the science behind fecal transplants being used in some parts of the world to treat intestinal infections. The article goes on to present a call for readers to suggest a better name than "fecal transplant" for the procedure to help make it something that western medical practitioners and patients may be more open to embracing. In another article, "John McCluskey's Brain" posted on December 19th, 2013, readers were invited to weigh in on the story of a man who blamed a brain injury as the cause for his criminal behavior. Examples of readers' comments in response to two controversial topics described above include the following:

✦ *"I think the much broader question here is, are we a direct result of our biology, or do we have some real choice in the matter. If a man is not convicted for "faulty wiring" could there be other predispositions in the brain that could lead us to question why crimes are committed. And beyond that, if we do learn how to mend these thing, is it ethical to 'rewire' a person and possibly destroy who that person once was?" (Posted December 19th, 2013)*

✦ *"I am sure that most horrendous crimes are committed by persons with faulty brain activity on some level. So should these abnormal brain types be allowed to roam free in society to cause more pain and suffering? I think not." (Posted December 18th, 2013)*

Website Usage Trends

Over a year-long period there were more than five and a half million unique visitors to the Radiolab.org website.

In addition to analyzing trends in responses to blog posts, we also examined trends in website usage in general using Google Analytics. Over a year-long period from October 1st, 2013 to September 30th, 2014 there were 5,593,374 unique visitors to the Radiolab.org website, 13,250,317 usage sessions (i.e., usage experiences that could, and often did include visits to more than one page on the Radiolab.org website), and 25,236,746 unique page views. This website data suggests that large numbers of users are engaging with the site in more passive ways (i.e., reading articles or accessing multimedia elements of the site, but not engaging in more active tasks like posting comments in response to articles). None-the-less, they engaged enough by their website usage experiences that they are coming back.

Length of Visit

There is an interesting pattern in site usage such that the largest numbers of sessions are either extremely short (i.e, 10 seconds or less) or extremely long (i.e., 1801+ seconds, or more than 30 minutes). That large numbers of visitors spend a very short amount on the site is not uncommon, however, the fact that such large numbers also spend high amounts of time on the site is a promising finding that suggests high levels of visitor engagement.

Figure 25: Distribution of Session Duration

New vs. Returning Visitors

More than half of the visitors during the year-long period that we analyzed were returning visitors (59%), in comparison with those who were new visitors (41%). This finding suggests sustained engagement of website visitors over time at least in so far as visitors are connecting with other resources like Facebook and Twitter that prompt them to return to the Radiolab website from time to time, and a willingness on the part of visitors to do so.

Trends Over Time

Over the year-long period during which we monitored website usage between October 2013 and September 2014, there were, on average about 36,000 user sessions on the Radiolab.org website each day. There were, however, four outliers during this period of time when the number of sessions exceeded 60,000 in a single day: December 4th, (with 67,779 sessions, more than half of which originated on the "Speedy Beet" blog post with an embedded podcast link), February 3rd, (with 78,310 sessions, for which nearly half originated on the "Hunk of Planet Dissolves Before Our Eyes" blog post), February 11th, (with 88,223 sessions—despite there being two blog posts on this date, the majority of traffic originated on the Radiolab.org homepage), and March24th, (with 74,976 sessions, the majority of which included visits to a story about Lucy the Chimp).

On average, during a year-long period, there were 36,000 user sessions on the Radiolab.org website each day.

Figure 26: Website Statistics Over a Year-Long Period
(October 1, 2013 - September 30, 2014 from Google Analytics)
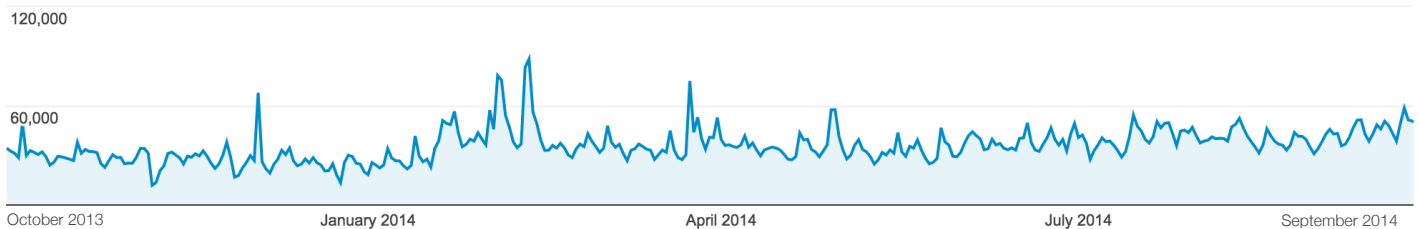
Facebook Usage Trends

Trends for usage and response-rates on Facebook seem similar to those seen on the Radiolab website which is not surprising given that posts on Facebook often direct users to the Radiolab website.

Reach

Facebook provides data on the number of people who saw any given post as well as the number of people who saw posts in their news feed each day. The figure below shows daily post-reach trends, over a period from October 1st, 2013 through September 25th, 2014. Data was actually monitored through the end of September, however a large spike in Radiolab's reach on September 26th (resulting largely from a

cross-posted article from <u>The Oatmeal</u> entitled "If you need more proof that nature is amazing and kinda gross, the Oatmeal has something for you" which reached 2,044,928 people and received 16,232 likes, 1176 comments and 2959 shares), made it more difficult to visually discern trends for the remainder of the year-long monitoring period, so the later part of September 2014 has been omitted from the figures below.

**Figure 27: Facebook Post Reach Statistics Over a Year-Long Period
(October 1, 2013 - September 25, 2014 from Facebook Insights)**
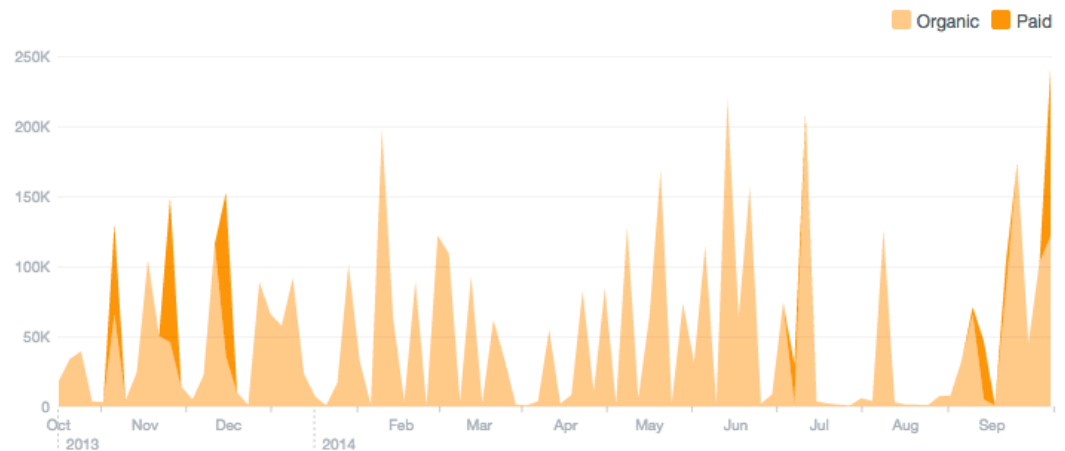
The figure above shows a pattern not unlike the pattern seen in the Google Analytics data for the Radiolab website, with peaks and dips that correspond to different posts and their relative reach and popularity with Facebook users.

Page and Post "Likes"
Popularity and success on Facebook are also measured in part through the number of page fans and "likes," i.e., people actively indicating that they they like your page and/or its content. As of September 30th, 2014, the Radiolab Facebook page had 298,933 "likes." Over a yearlong period, the number of daily page "likes" ranged from 98 on January 1st (arguably a time when many people were not online) to 526 on December 16th (though there were not posts on the Facebook page on this date, it did fall 10 days after a recording of "Apocalyptical" was made available via Facebook and the Radiolab website).

Demographic data for "fans" of the Radiolab page, i.e., Facebook users who have "liked" the Radiolab page suggest that Radiolab has higher percentages of fans ages 25-54 in comparison to the overall population of Facebook users. While Facebook usage skews toward younger users (with the highest percentage in the 18-24 age bracket), Radiolab fans skew slightly older with the highest percentage in the 25-34 age bracket, as seen in Figure 28 below.

Figure 28: Facebook Fans by Age and Gender
(From Facebook Insights as of September 30th 2014)
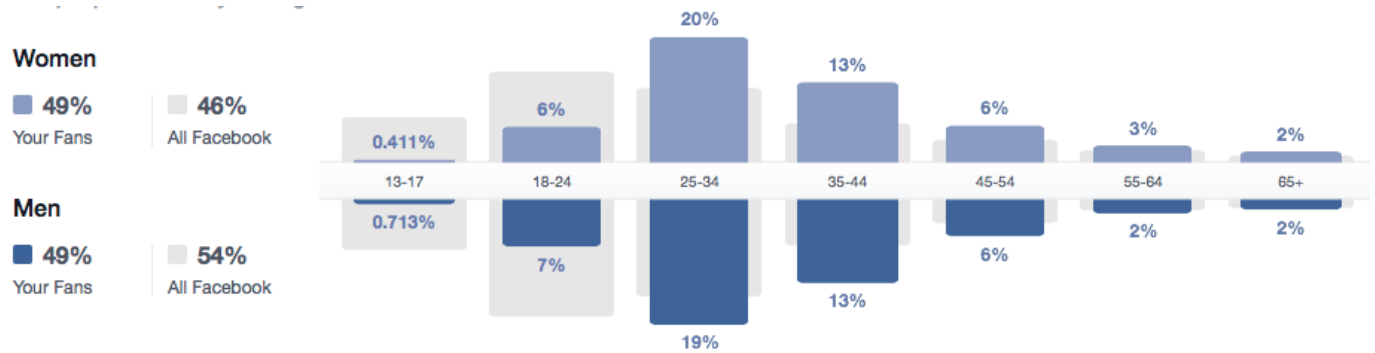
We also tracked patterns and trends in the ways that Facebook users "liked" <u>posts</u>. During the yearlong period that we monitored social media data, there were 5 days when there were spikes over 2500 "likes" including January 25th (this spike seemed to be fueled, at least in part, by a post entitled "Well, how about that?! Radiolab is called out as one of the 30 great achievements made on a mac in the last 30 years." There were 5246 likes on this date and that specific post reached more than 186,000 Facebook users), On June 6th there were 3324 likes, driven at least in part by one of two posts, entitled "Want some background on the Bond v United States decision from SCOTUS? We've got that" which had a reach of nearly 38,000 Facebook users. May 5th with 2878 likes that were largely the result of two posts (i.e., "Colors colors colors and more colors," and "Your blood-is-magic") which had a combined reach of nearly 300,000 Facebook users, February 10th with 2666 likes resulting, in part, from a post showing Lauren McClenachan's photos of Key West over a 50 year period that had a reach of more than a million Facebook users.

Comments and Shares
With Facebook there is a continuum from less active engagement (e.g., seeing, reading and/or liking posts) to more active modes of engagement (e.g., sharing or commenting on posts). Facebook data indicates fairly high levels of more active modes of engagement including sharing and commenting. Some of Radiolab's posts have been shared thousands of times (e.g., the "colors" post mentioned above had 3927 shares and the "Key West" post also mentioned above had 3623 shares). Likewise, some posts have produced thousands of comments as well, including a post on September 26th, 2014 that promoted an article from The Oatmeal, for which there were 30 comments on the Radiolab Facebook page, and 1146 that were shared on Facebook users' pages when the article was shared on their personal timelines. A June 27th post about brain enhancement procedures called "9-Volt Nirvana" illustrates the challenge of tracking comments

effectively. In the case of this post there have been a total of 118 comments (84 of which were comments on copies of this post that were shared on other Facebook users' timelines, and 34 on the Radiolab Facebook page), however there are also 95 more comments on the Radiolab website page to which the post is linked. Despite the challenges of tracking social media engagement effectively across multiple platforms, there is an abundance of data that suggests that Radiolab is succeeding in engaging users on a variety of social media and web-based platforms.

Twitter

Twitter data for Radiolab was monitored between May 30th 2013 and May 30th 2014. As of the later date, Radiolab had 139,346 followers and had sent 2,393 tweets. During a three-month period in the spring of 2014 (2/26/14-5/31/14), 200 of Radiolab's 285 tweets were re-tweeted by other users (i.e., 70%), and 221(i.e., 78%) were "favorited" by Twitter users. These data suggest that Radiolab's Twitter followers find Radiolab's tweets to be poignant and shareable. In addition to sharing and spreading Radiolab content they found to be interesting, Radiolab fans also shared information about Radiolab—including posts from and about the live shows, and engaged in impromptu discussions such as one that took place on February 19th, 2014 about the fact that Darwin's children had made drawings on his copy of "On the Origin of Species"—an excerpt of which is shown to the left. The example below highlights' a Radiolab listener's use of Twitter to show other followers something they had created.

Radiolab's Tweets have had high percentages of "retweeting" and being marked as "favorites."

Darwin's kids drew all over his On the Origin of Species manuscript: ow.ly/tNKMR

↩ Reply ⇄ Retweet ★ Favorite ••• More

RETWEETS 98 FAVORITES 75

3:38 PM - 19 Feb 2014

Reply to @Radiolab

Feb 19
So great :) "@Radiolab: Darwin's kids drew all over his On the Origin of Species manuscript: ow.ly/tNKMR"
Details   ↩ Reply ⇄ Retweet ★ Favorite ••• More

· Feb 19
'When historical figures become legendary icons, they lose much of the context that makes them human' via @Radiolab ow.ly/tNKMR
Details   ↩ Reply ⇄ Retweet ★ Favorite ••• More

Feb 19
@Radiolab there's a joke in there somewhere about darwin's offspring.
Details   ↩ Reply ⇄ Retweet ★ Favorite ••• More

Feb 19
@Radiolab Were they looking for some kind of award?
Details   ↩ Reply ⇄ Retweet ★ Favorite ••• More

Feb 19
Life is cool. "@Radiolab: Darwin's kids drew all over his On the Origin of Species manuscript: ow.ly/tNKMR"
Details   ↩ Reply ⇄ Retweet ★ Favorite ••• More

· Feb 20
Smashes the loner scientist image; I wonder if there are similar artifacts from others? ow.ly/tNKMR @Radiolab @genevi_ferguson
Details   ↩ Reply ⇄ Retweet ★ Favorite ••• More

Roger Pharr
@rdpharr   ⚙ ★ Follow

I made a taung child skull on my @makerbot from the last @Radiolab podcast. radiolab.org/story/head-you… pic.twitter.com/5XwovvZA5I
San Francisco, CA
↩ Reply ⇄ Retweet ★ Favorite ••• More

RETWEETS 2 FAVORITES 4

9:40 PM - 22 May 2014   Flag media

Radiolab App

The Radiolab App, launched in June of 2012, featured an innovative navigation structure and offered users the ability to listen to Radiolab episodes, read Radiolab articles and contribute content to Radiolab. This section summarizes findings and statistics about usage of the App.

Between the App's launch in June 2012 and October 30th, 2014, the Radiolab App had amassed 628,678 users—the vast majority of whom are iOS users (i.e., 533,667 users using the App on iPhones or iPads), and an additional 95,011 users using the App on Android devices.

The App was used a total of 8,864,704 times from June 2012 until the end of October 2014, and of those usage sessions, a significantly larger number have been by iPhone users (7,801,820 in comparison to 1,061,833 from Android Users).

The average number of monthly page views within the App since its launch in June 2012 is 19,060 on iPhone devices and 3,393 on Android devices. App user and usage statistics are summarized in the table below.

Table 5: Cross-Platform Comparison of App Users and Usage Data

The images above are screen captures from the Radiolab App.

	iOS	Android
USERS	533,667	95,011
USAGE SESSIONS	7,801,820	1,051,833
AVERAGE MONTHLY PAGE VIEWS	19,060	3,393

The App also features a function that allows users to "make" recordings that are shared with the Radiolab producers. Specific text or questions for users to read or respond to are assigned within the App on a regular basis. On average, over more than two years, three to five assignments have been submitted each week and each request receives an average of 15-30 submissions—though response rates are significantly higher (e.g., 45 to more than 100), if Radiolab sends out a push notification to users.

Interactive Events

In addition to live events, Radiolab also hosted several events that allowed greater opportunity for interaction. These interactive events included a variety of face-to-face and online events. In this section we seek to summarize findings and common themes related to peoples' experience with and outcomes from the special events that were evaluated as part of the Discovery Dialogues grant.

Cicada Tracking Events and Activities

Radiolab hosted a series of outreach events that included both real-world and online activities to engage audiences in STEM. The images provided below show participants at a Cicada Tracker Build Party, held on April 13, 2013 at Hack Manhattan.[46]
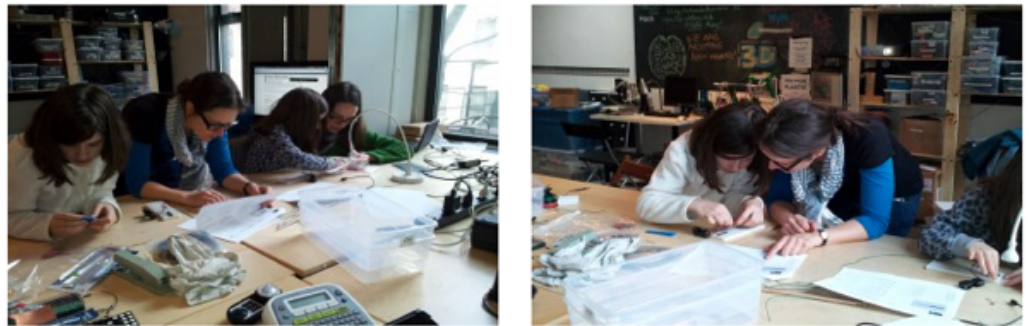
In addition to real-world events offered in and around New York City, the cicada tracking project invited participants throughout the Atlantic coast of the U.S. to build trackers, record temperatures and share cicada-related observations. Thousands of data points were ultimately submitted as part of this project on WNYC's cicada tracking website.[47] Audience members were also invited to respond to a poll and share comments, like the one below and those listed above on page 50, about their personal experiences with past cicada emergences:[48]

✦ *"Well so far I've only seen one. It was a great feeling when I saw it. Not to long ago I had read the articles on cicadas and when I saw it at my garage I was amazed." (Posted June 28th, 2013)*

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[46] Source: https://hackmanhattan.com/2013/04/cicada-party/

[47] http://project.wnyc.org/cicadas.

[48] http://www.radiolab.org/story/278818-cicadas-broods-through-ages/

Ancestral Mammal Naming Bracket

In the spring of 2013, Radiolab paired up with scientists at the American Museum of Natural History to host a contest to name the newly hypothesized "common placental ancestor," i.e., a shrew-like mammal from which all other mammals are now hypothesized to have descended. The resulting "Name Your Ancestor" contest generated more than 1000 name submissions, and ultimately thousands of votes cast in multiple rounds of bracket-style competition. The images below from the Radiolab.com website illustrate the playful way that Radiolab sought to engage its audience around naming this early ancestor of humankind. Likewise, the comments below show audience members' equally playful responses.[49]
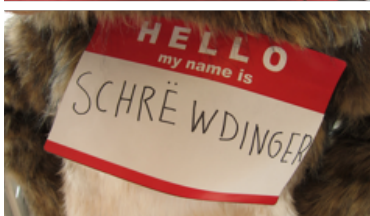
✦*"I'm shallowly outraged that 'Hypotheshrew' beat 'Kate,' which I thought was clearly the best choice of the lot. If this name is supposed to do for the shrew what 'Lucy' did for Australopithecus, it's got to be just as simple and classic - and 'Kate' is."* (Posted March 15th, 2013)

✦*"Mancestor is pretty anthropocentric if you ask me, since this clearly is the ancestor of so many other warm blooded milk-bearing creatures. I'll take Shrewdinger."* (Posted March 28th, 2013)

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49 Source of images above: http://www.radiolab.org/story/279510-and-then-there-were-two-final-round-voting-name-your-ancestor/

Live Chats

Live chats provided Radiolab fans an opportunity to interact with scientists, Radiolab contributors and hosts, and other Radiolab fans. The evaluation included observations of live chats and analysis of chat transcripts and artifacts created by chat participants.

Ringing in the Mars Rover
The first Live Chat held as part of the Discovery Dialogues project was held via Google Hangouts on August 2nd, 2012. This live chat centered around the landing of the Mars Rover, Curiosity. Radio fans expressed excitement about the opportunity to hang out together to discuss and celebrate this event. In response to the announcement about this event, one fan stated: "Space + Radiolab = BEST THING EVER."[50]

Diagnosis Hangout Party
The second live chat, also conducted via Google Hangouts was held on October 11th, 2012, and offered opportunities for audience members to discuss topics from the Radiolab episode: "Diagnosis."

Cellular Surgeons
The third live chat, held on May 30th, 2013, provided members of the Radiolab audience a chance to view the Livestream webcast of a session at the World Science Festival and participate in a concurrent discussion about nanobots and nanosurgery. This experience differed slightly from previous live chats because it incorporated live polls, such as the one shown below. A re-playable transcript of the discussion allows others to also experience the 90-minute program and related conversation, even if they were not able to attend the live chat.[51]

An Example of a Poll From the "Diagnosis" Hangout Party

If your doc said she wanted to send in the nanobots to treat you, what would you say?

Heck yes! (64%)   Nope, no thank you. (0%)
Maybe...how bad is my condition? (35%)
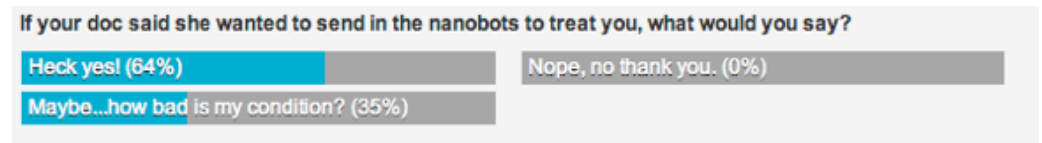
High School Cicada Hangout
A fourth hangout was held with High School students on June 30th, 2013, however no archived information about this event was available for evaluation purposes.

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[50] Posted August 2nd, 2012.

[51] http://www.radiolab.org/story/296107-tonight-live-video-and-chat-celluar-surgeons

Examples of items submitted by NCAA Live-Viewing Party Attendees:
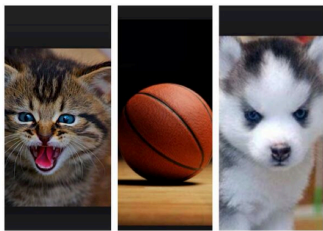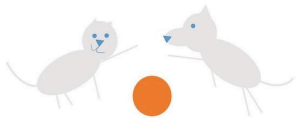
NCAA Live-Viewing Party

Radiolab fans gathered in the Twitterverse on April 7th, 2014 to talk about sports and science while watching the NCAA Men's Basketball Championship. Host, Jad Abumurad was joined by an all-star cast of science contributors and communicators including: Mike Pesca (Slate Podcaster and former NPR sports reporter), Christie Aschwanden (Freelance sport and science of sport writer), Dan Engber (New York Times Columnist and Neuroscientist), David Epstein (Author of "The Sports Gene," and former writer for Sports Illustrated), Ken Pomeroy (NCAA stats expert), Steven Strogatz (Mathmatician), and Soren Wheeler (Senior story editor and producer for Radiolab).

Starting at the game tip off, at precisely 9:23PM Eastern, and throughout the championship game, Radiolab fans raised questions and interacted with guest-experts. Several science related questions were posed and discussed, including the following:

✦*"Does handed-ness matter in basketball?"*

✦*"Why are there a disproportionately high number of twins excelling at basketball and other sports?"*

✦*"What impact do length-of-gaze and other anticipatory skills have?"*[52]

✦*"Do athletes cramp more during big games? Does pressure impact that kind of thing?"*

✦*"How much do coaches matter in basketball?"*[53]

✦*"How important is height?"*

✦*"Are there bigger runs after strong dunks?"*

Experts took the lead on responding to many of the questions that were posed and provided several online references, including those listed in the footnotes below, but all participants were invited to provide feedback and make other contributions to the discussion. The images in the left-hand column are examples of images submitted by listeners.[54]

Interactive Event Summary

Special events provided engaging opportunities for Radiolab fans to interact with experts and other members of the Radiolab audience. In addition to being compelling synchronous events, many of the live events that were studied as part of this evaluation effort were also archived and made available to facilitate asynchronous viewing as well, albeit in a less interactive format.

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[52] The following resource was shared: http://www.sciencedirect.com/science/article/pii/S0001691810002404

[53] The following resource was shared: http://www.suu.edu/faculty/berri/IJSF4-2CoachingPaper.pdf

[54] Image Sources (top to bottom) - Cats vs. Dogs: @katiapiza, @darth, and @bonebreaking, Bottom: two event attendees, submitted by @stevenpage75

Summary

This section of the report seeks to summarize findings from all of the data presented above, with the further goal of assessing the extent to which the Discovery Dialogues project met its goals and has advanced the field of Informal Science Learning in general as well as the Public Engagement with Science model more specifically.

The PES model promotes opportunities for members of the general public to learn alongside or with scientists, participatory activities and expansion of related skills, increased understanding of the role of culture within science, and respect for multiple perspectives with scientific discussions and policy decision-making. The CAISE Inquiry Group Report on Public Engagement with Science within ISE identifies three dimensions within which a program can be positioned along a continuum from Public Understanding of Science (PUS), i.e., top-down communication of information, to Public Engagement with Science (PES), i.e., bottom-up or audience-driven communication. These dimensions include the level and extent of public activity, the level and extent of STEM-expert activity, and the content focus of the activity.[55]

By presenting a wide range of options for public engagement, STEM-professionals' engagement, and different content areas, the Radiolab Discovery Dialogues project provided a unique opportunity to study the varying degrees to which audiences engage within each dimension of the PES model when given a wide range of options.

Level and Extent of Public Engagement with Science

The first dimension in the CAISE Inquiry Group's PES framework focuses on how public audiences are involved. Activities that were part of the Discovery Dialogues project ranged from those that were top-down or producer-driven, (i.e., listening to broadcasts or podcasts, and reading blog posts) to those that were more bottom-up or audience-driven (i.e., public audiences producing suggestions for naming the common ancestral mammal), and a mix of blended activities including opportunities for members of the public to interact with scientists through live/synchronous or asynchronous discussions online or face-to-face, opportunities to contribute their own knowledge, views and experiences, and engage in group problem-solving and decision-making activities.

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[55] McCallie, E., Bell, L., Lohwater, T., Falk, J. H., Lehr, J. L., Lewenstein, B. V., & Wiehe, B. (2009). Many Experts, Many Audiences: Public engagement with science and informal science education. A CAISE Inquiry Group Report, 1.

More sizable public audiences were ultimately engaged in consuming content than in the process of creating content or contributing to active discussions about content. None-the-less, the large number of people engaged in the various interactive experiences that Radiolab made available to its audiences as part of the Discovery Dialogues project demonstrate the appeal of activities that fit more closely with the PES model.

Throughout the Discovery Dialogues project, Radiolab devised and implemented opportunities for members of the general public to learn about science alongside scientists. The number of professional scientists and self-proclaimed science enthusiasts who count themselves among Radiolab's core audience provide evidence of this fact, as do statements from scientists, lay-scientists and general audience members alike.

As part of the Discovery Dialogues project, Radiolab provided several opportunities for members of various "publics" (as they are referred to within the PES model), to actively participate in the process of doing science. The cicada tracking project provided opportunities for audience members to create measurement devices, to collect and share temperature readings, and to follow updates on the emergence of cicadas in various parts of the United States. The ancestor naming bracket provided a unique opportunity for lay audiences and scientists to compete and debate alongside one another in the process of proposing and selecting a name for the common ancestral mammal of which all mammalian species are descendants.

According to the CAISE Inquiry Group's Report, "Public Engagement with Science" experiences allow people with varied backgrounds and scientific expertise to articulate and contribute their perspectives, ideas, knowledge and values in response to scientific questions or science-related controversies."[56] Audience feedback suggests that Radiolab is particularly well-suited to fostering Public Engagement with Science because the most compelling stories are often those that focus on new breakthroughs and discoveries or topics that have inherent controversy or drama.

Outcomes of Public Engagement with Science

Increasing audience members' interest in science

Radiolab's skillful use of stories helps to create narrative hooks that lure audience members into articles and episodes that have scientific topics and issues at their core. In other words, Radiolab helps make science

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[56] Page 12 in McCallie, E., Bell, L., Lohwater, T., Falk, J. H., Lehr, J. L., Lewenstein, B. V., & Wiehe, B. (2009). Many Experts, Many Audiences: Public engagement with science and informal science education. A CAISE Inquiry Group Report, 1.

interesting to its audience members by tapping into our basic human interest in well-told stories. Through comments posted online and in response to open-ended survey questions, this evaluation uncovered copious amounts of praise for Radiolab's use of humor and visual elements to engage audiences and foster increased interest in science.

Increasing audience members' knowledge of science

While it is challenging to prove with certainty an increase in audience members' scientific knowledge resulting from an informal science learning program, we did find ample evidence of Radiolab audience members self-reporting gains in scientific knowledge. Additionally, Radiolab's audience seems to demonstrate an ability to think and reason in scientific ways when challenged with puzzling questions or intriguing topics on the Radiolab blog. It is unclear whether this trend is a product of Radiolab's success among people who are predisposed to think scientifically and more willing to express curiosity, or whether it is a case of audience members acquiring new skills as a result of long-term exposure to Radiolab programming and experiences. In either case, there is a great deal of evidence that Radiolab fans, audience members, and program participants are viewed—and view themselves—as being more knowledgeable about science. Radiolab fans often express a hunger for learning more, and cite Radiolab's compelling narrative style and the dynamic nature of its hosts as two reasons for what is often described as an addiction—albeit in the most positive possible sense of that term.

Exposing audience members to more science and current scientific research

Radiolab exposes its audience to science, including breaking news about science, and examples of current scientific research, through a combination of broadcasts, static and interactive online content, and live events. Comments shared by Radiolab audience members suggest that they are are becoming more aware of current scientific research and that they also find the content to be quite stimulating in a more general sense. Audiences identify the great "water cooler" value or "conversational currency" of the things they learn about through Radiolab, i.e., topics that can be used to stimulate discussions with friends or anecdotes and facts that can be brought up in conversations.

Increasing audience members' engagement with science

Ample evidence exists to suggest that Radiolab has been effective in engaging its audience with science. Through their participation in live chats and willingness to share data and personal stories, the Radiolab audience has repeatedly jumped in to participate in both online and offline activities that allow them to engage more actively with scientific concepts, interact with scientists, and even contribute to the scientific process themselves. Examples that demonstrate engagement abound in

unsolicited tweets and online comments, but we found particularly high levels of engagement and response when Radiolab gave audience members a specific call to action, e.g., sending photos, casting votes, or sharing their comments.

Level and Extent of Professional Scientists' Activity

Within the Discovery Dialogues project, scientists and STEM-experts were engaged in activities that supported Radiolab's public communication efforts. These activities included opportunities for STEM-experts to serve as special guests or contributors to broadcast or blog articles, to share specific examples from their own work, and to further develop their own communication skills.

The Radiolab Discovery Dialogues project sought to actively include scientists and other STEM professionals in the production of its programs and blog posts and as part of live events or discussions, but also succeeded in attracting STEM professionals—what the CAISE Inquiry group on PES referred to as "voluntary publics," i.e., willing participants in scientific activities that extend beyond a given professional's specific area of expertise. By developing a large and diverse audience that includes lay audiences as well as scientists and STEM professionals from a vast array of different fields, the Radiolab Discovery Dialogues project created opportunities for scientists and STEM professionals to inform and be informed by lay audiences and STEM professionals in other fields.

Outcomes of Scientists' Involvement

Evaluation findings suggest that STEM professionals exhibit a range of interests and resulting benefits from their interactions with public audiences. There is clear evidence that scientists see the potential benefits that can result from being able to present information to public (i.e., non-professional) audiences as well as being able to interact more directly with those audiences.

There is less evidence to suggest that scientists were actively seeking to incorporate or respond to public audiences' input or suggestions. However, some professional scientists expressed instances where things they had heard on Radiolab had fostered greater interest in particular scientific topics and the field of science in general.

Content Focus

The final dimension in the CAISE Inquiry Group's framework for understanding and categorizing PES and PUS in Informal Science Education programs focuses on the content at the core of all programming initiatives. Radiolab's Discovery Dialogues project

incorporated the full spectrum of possible content areas identified by the PES model, including topics related to the natural and human-made world, the scientific process, societal and environmental impacts of science and technology, cultural values related to science and technology, and public policies related to science and technology.

Conclusion

Radiolab set out to create a robust set of informal science learning resources and experiences and to therein learn more about resulting patterns of engagement and outcomes from such engagement. The Discovery Dialogues project can count among its many successes a wide range of products and events that contributed to public understanding of science, public engagement with science and professionals' ability to communicate to and interact in more meaningful ways with members of the general population. By harmoniously blending elements of both PUS and PES approaches to informal science learning, Radiolab succeeded in broadening audiences' interest in and understanding of science. The Discovery Dialogues project demonstrated audiences' ability and desire to be more actively engaged and to make meaningful contributions to science. Furthermore, the project also provides a successful example of how to engage professional audiences alongside public audiences and to foster mutual learning experiences for professional and lay audiences.

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*NOTE: All digital items listed above were retrieved between October 1st, 2013 and September 30th 2014.

Appendices

✦ **A: "Radiolab: In the Dark" Survey Questions**
This section summarizes the set of survey questions used to gather feedback from members of the "Radiolab: In the Dark" live shows in 2011.

✦ **B: Radiolab Live: Apocalyptical Survey Questions**
This appendix presents an overview of all survey questions used to gain feedback form "Radiolab Live: Apocalyptical" attendees.

✦ **C: Radiolab Live: Apocalyptical Survey Supplemental Data**
This appendix presents an overview findings and data from "Radiolab Live: Apocalyptical" attendees who responded to a post-show survey.

✦ **D: Radiolab Live: Apocalyptical Interview Questions**
This appendix presents an overview of all interview questions used to gain feedback form "Radiolab Live: Apocalyptical" attendees.

✦ **E: General Audience + Scientist Survey**
This appendix presents the survey questions used to gather feedback about Radiolab and its impacts in 2014.

✦ **F: General Audience + Scientist Survey Supplemental Data**
This appendix presents an overview findings and data from the Radiolab general audience and scientist survey conducted in 2014.

✦ **G: Formative Focus Group Findings**
This section contains a summary of Focus Groups conducted by the RMC Research and synthesized by Rockman Et Al.

Appendix A

Radiolab: "In the Dark" Survey Questions

This appendix provides a detailed overview of the questions that were asked of respondents on a survey of administered in 2012 to people who attended Radiolab "In the Dark." The survey instrument was designed and implemented by RMC Research.

1. Did you enjoy the show? ❍ Yes   ❍ No

2. Was the show better than what you expected, worse that what you expected or about what you expected?
   - ❍ Much better
   - ❍ Somewhat better
   - ❍ Slightly better
   - ❍ About what was expected
   - ❍ Slightly worse
   - ❍ Much Worse

3. Would you see another Radiolab live show? ❍ Yes   ❍ No
   Why or why not?

4. What suggestions do you have for future Radiolab live shows?

5. Did you stop by the merchandise table? ❍ Yes   ❍ No

6. Did you buy a Radiolab t-shirt? ❍ Yes   ❍ No

7. What other merchandise would you like to see?

8. How did you find out about the show?
   - ❑ Facebook
   - ❑ Twitter
   - ❑ Local Press
   - ❑ Podcast Message
   - ❑ Radiolab Website
   - ❑ Other (please specify)

9. How do you listen to Radolab?

- ❑ Local Radio Station
- ❑ Podcast
- ❑ Other (please specify)

10. Tell us about yourself, it'll help us reach sponsors who can support the production costs of the show.

Age: ◐12-15 ◐16-17 ◐25-34 ◐45-54 ◐55-64 ◐65+

Income: ◐Under $5000 ◐$5000-$9,999 ◐$10,000-$19,999
◐$20,000-$29,0000 ◐$30,000-$49,999 ◐$50,000-$59,999
◐$60,000-$74,999 ◐$75,000-$99,999 ◐$100,000-$149,999
◐$150,000-$199,999 ◐$200,000 or over

Gender: ◐ Male ◐ Female

Profession:

- ❑ Arts/Creative Design
- ❑ Business Development/Strategic Planning
- ❑ Consulting
- ❑ Customer Service
- ❑ Education/Teaching
- ❑ Engineering
- ❑ Executive
- ❑ Finance
- ❑ Healthcare Provider
- ❑ Human Resources
- ❑ IT Services
- ❑ Legal Services
- ❑ Production/Operations
- ❑ Research
- ❑ Sales/Marketing
- ❑ Software Development
- ❑ Student
- ❑ Technology Support/Help Desk
- ❑ Other:

Appendix B

Radiolab: "Apocalyptical " Survey Questions

This appendix contains a list of all survey questions that were designed by Rockman Et Al and administered to people who attended a Radiolab Live: "Apocalyptical" show in 2013. The link to the survey was sent to attendees via email.

Thanks for attending Radiolab Live Apocalyptical. This survey is designed to help inform future programming decisions and help us gather data about Radiolab that can be shared with the funders who helped to make it, and other Radiolab programming, possible. We appreciate your feedback!

1.   Did you attend more than one Radiolab Live Apocalyptical program?

❍ Yes   ❍ No

2.   With whom did you attend the Radiolab Live program?

- ❍   No one, I attended by myself
- ❍   I attended with someone else
- ❍   I attended with a larger group of people

3.   Which Radiolab Live Apocalyptical program did you attend?

- September 25th, Hartford CT
- September 26th, Hartford CT
- October 3rd, Columbus OH
- October 4th, Cleveland OH
- October 5th, Toronto ON
- October 7th, Ann Arbor MI
- October 8th, Detroit MI
- October 11th, Milwaukee WI
- October 12th, Chicago IL
- October 21st, Nashville TN
- October 22nd, Atlanta GA
- October 24th, New York NY
- October 25th, New York NY
- November 1st, Denver CO
- November 2nd, Denver CO
- November 4th, Dallas TX
- November 5th, Austin TX
- November 6th, Houston TX
- November 12th, Oakland CA
- November 13th, Cupertino CA
- November 14th, Los Angeles CA
- November 15th, Los Angeles CA
- November 17th, Oakland CA
- November 19th, Portland OR
- November 20th, Portland OR
- November 21st, Seattle WA
- November 22nd, Seattle WA
- December 2nd, New York NY

4. Did you also want to share this survey with someone who went with you to see Radiolab Live Apocalyptical? ○ Yes   ○ No

5. If yes, in the spaces provided below, please enter your name, followed by five email addresses for anyone who attended the program with you. If no, simply click the button below to continue to the next page.

6. Please indicate your level of agreement with each of the following statements about Radiolab Live program.

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
a. I enjoyed this program.	○	○	○	○	○
b. The program exposed me to new scientific concepts.	○	○	○	○	○
c. The program helped me understand scientific concepts more clearly.	○	○	○	○	○
d. The program made me feel more knowledgeable about the scientific topics that were discussed.	○	○	○	○	○
e. The program made me feel more knowledgeable about science in general.	○	○	○	○	○
f. The program raised my general level of interest in science.	○	○	○	○	○
g. The program raised my level of interest in specific types of current scientific research.	○	○	○	○	○
h. The program sparked a desire to learn more about one or more of the topics.	○	○	○	○	○
i. The program sparked a desire to do something related to one or more of the topics.	○	○	○	○	○

7. To what extent did each of the following have an impact on your overall impression of the Radiolab Live program?

	Strongly Negative	Somewhat Negative	Neutral	Somewhat Positive	Strongly Positive
a. The pre-recorded content.	○	○	○	○	○
b. The live comedic performance.	○	○	○	○	○
c. The live music.	○	○	○	○	○
d. Interactive components of the program.	○	○	○	○	○

8.   List three words that describe the Radiolab Live program

9.   What did you like most about the Radiolab Live program?

10.   What did you like least about the Radiolab Live program?

11.   Which of the following best describes your level of familiarity with the broadcast or podcast version of Radiolab <u>before</u> this event:
❍ I'd never heard of Radiolab before this event
❍ I'd heard of Radiolab but had never listened to the program
❍ I listen to the program periodically
❍ I listen to the program regularly

12.   Please share more info on the other ways you may have interacted with Radiolab prior to the Radiolab Live program (check all that apply):
❑ Reading info on the Radiolab website
❑ Doing activities on the Radiolab website
❑ Following Radiolab via social media (Facebook, Twitter, etc.)
❑ Attending other Radiolab outreach events
❑ Other:

13.   Which of the following do you plan to do after today's program? (check all that apply)
❑ Listen to the Radiolab program
❑ Read info on the Radiolab website
❑ Do activities on the Radiolab website
❑ Follow Radiolab via social media (Facebook, Twitter, etc.)
❑ Attend another Radiolab Live event
❑ Look up more information on one or more of the topics discussed   today
❑ Other:

14.   Generally speaking, which of the following best describes your level of scientific <u>knowledge</u>?
❍ (LOW): I wouldn't consider myself to be particularly knowledgeable in science
❍ (BELOW AVERAGE)
❍ (AVERAGE)
❍ (ABOVE AVERAGE)
❍ (HIGH): I work/worked professionally in a scientific field

15.   Prior to this program, how would you rate your level of <u>interest </u>in science?
❍ (LOW): I'm not really interested in science at all
❍ (BELOW AVERAGE): I'm less interested in science than the average person
❍ (AVERAGE): My interest in science is average
❍ (ABOVE AVERAGE): I'm more interested in science than the average person
❍ (HIGH): I am extremely interested in science

Please tell us a little more about yourself- it helps Radiolab reach foundations and sponsors who can support the production costs of our show.

16.   What is your age?
- ❍ Under 18   ❍ 18-24   ❍ 24-34   ❍ 35-49
- ❍ 50-65   ❍ 66-74   ❍ 75 or older

17.   Do you support a public radio station? ❍ Yes   ❍ No   ❍ Not Sure

18.   Which public radio station(s) do you support?

19.   What is your gender?   ❍ Male   ❍ Female

20.   What is the highest level of education you have completed?
- ❍ Less than high school
- ❍ High school or equivalent
- ❍ Associate's certificate or degree
- ❍ Undergraduate degree
- ❍ Master's degree or equivalent
- ❍ Doctorate or equivalent

21.   What is your approximate average household income?
- ❍ $0-$24,999   ❍ $25,000-$49,999
- ❍ $75,000-$99,999   ❍ $100,000-$124,999
- ❍ $125,000-$149,999   ❍ $150,000-$174,999
- ❍ $175,000-$199,999   ❍ $200,000 and up

22.   Do you follow Radiolab on any of the following social media sources? (check all that apply)
- ❑ Facebook   ❑ Twitter
- ❑ Google Plus ❑ Pinterest
- ❑ Reddit   ❑ Instagram
- ❑ Tumblr   ❑ Other:

23.   How did you find out about the Radiolab Live Apocalyptical show? (Check all that apply)
- ❑ I heard a message in the podcast
- ❑ I heard a message in the radio broadcast
- ❑ I heard about it on my local public radio station
- ❑ I read about it in the paper
- ❑ I saw an ad about it
- ❑ A friend told me
- ❑ I heard about it on Twitter
- ❑ I heard about it on Facebook
- ❑ Other:

24.   Last question, or rather a simple request- If you'd like a chance to win a toy dinosaur signed by Jad and Robert, we just need you to list your email address below.

- ❍ No thanks—I think someone else needs that dinosaur more than I do.
- ❍ Yes—I thought you'd never ask!

Appendix C

Radiolab: "Apocalyptical" Survey Findings

This Appendix contains a comprehensive summary of survey findings from "Apocalyptical" attendees. Differences that are statistically significant are underlined.

Table 1: Number of Events Attended

Did you attend more than one event?	N	%
Yes	771	12.51%
No	5392	87.49%

Table 2: Who Respondents Attended With

With whom did you attend?	N	%
Myself	408	6.63%
Someone Else	4890	79.42%
With a Group	859	13.95%

Table 3: Respondents' Prior Familiarity with Radiolab

Which best describes your familiarity with Radiolab before this event?	N	%
Never heard of Radiolab before this event	40	0.77%
Heard of it, but never listened to the program	81	1.57%
I listen to the program periodically	1042	20.16%
I listen to the program regularly	4005	77.50%

Table 4: Respondents' Prior Engagement with Radiolab*

In what ways have in you interacted with Radiolab before this event?	N	%
Reading info on the Radiolab website	2926	47.45%
Doing activities on the Radiolab website	514	8.34%
Following Radiolab via Social Media	1765	28.62%
Attending other Radiolab outreach events	441	7.15%

*Percentages based on total number of respondents (N=6166)

Table 5: Distribution of Respondents By Site

Which show did you attend?	N	%
September 25th, Hartford CT	41	0.83%
September 26th, Hartford CT	60	1.21%
October 3rd, Columbus OH	100	2.02%
October 4th, Cleveland OH	156	3.15%
October 5th, Toronto ON	244	4.93%
October 7th, Ann Arbor MI	134	2.71%
October 8th, Detroit MI	109	2.20%
October 11th, Milwaukee WI	123	2.48%
October 12th, Chicago IL	116	2.34%
October 21st, Nashville TN	134	2.71%
October 22nd, Atlanta GA	152	3.07%
October 24th, New York NY	169	3.41%
October 25th, New York NY	141	2.85%
October 26th, Boston MA	1	0.02%
November 1st, Denver CO	222	4.48%
November 2nd, Denver CO	239	4.83%
November 4th, Dallas TX	242	4.89%
November 5th, Austin TX	169	3.41%
November 6th, Houston TX	177	3.58%
November 12th, Oakland CA	318	6.42%
November 13th, Cupertino, CA	253	5.11%
November 14th, Los Angeles CA	165	3.33%
November 15th, Los Angeles CA	168	3.39%
November 17th, Oakland CA	258	5.21%
November 19th, Portland OR	318	6.42%
November 20th, Portland OR	192	3.88%
November 21st, Seattle WA	254	5.13%
November 22nd, Seattle WA	295	5.96%
December 2nd, New York, NY	0	0.00%

Table 6: Levels of Agreement with Statements about "Apocalyptical"

	SD	D	NA/D	A	SA	N	Mean
a. I enjoyed this program.	57	50	117	1755	3633	5612	4.58
b. The program exposed me to new scientific concepts.	55	51	182	2157	3163	5608	4.48
c. The program helped me understand scientific concepts more clearly.	57	66	399	2277	2802	5601	4.37
d. The program made me feel more knowledgeable about the scientific topics that were discussed.	56	54	267	2260	2970	5607	4.43
e. The program made me feel more knowledgeable about science in general.	66	232	1180	2273	1846	5597	4.00
f. The program raised my general level of interest in science.	76	301	1657	1934	1630	5598	3.85
g. The program raised my level of interest in specific types of current scientific research.	68	312	1438	2123	1649	5590	3.89
h. The program sparked a desire to learn more about one or more of the topics.	58	440	1329	2123	1646	5596	3.87
i. The program sparked a desire to do something related to one or more of the	150	1065	2363	1153	866	5597	3.27

Table 7: Impact of Various Components of the "Apocalyptical" Program

	Strongly Negative	Somewhat Negative	Neutral	Somewhat Positive	Strongly Positive	N	Mean
a. The pre-recorded content	57	50	117	1755	3633	5612	4.58
b. The live comedic performance	55	51	182	2157	3163	5608	4.48
c. The live music	57	66	399	2277	2802	5601	4.37
d. Interactive components of the program	56	54	267	2260	2970	5607	4.43

Table 8: Respondents Post-Attendance Plans*

Which of the following do you plan to do after seeing Apocalyptical?	N	%
Listen to the Radiolab Program	4516	73.24%
Read info on the Radiolab website	2434	39.47%
Do activities on the Radiolab website	1120	18.16%
Follow Radiolab via Social Media	1674	27.15%
Attending another Radiolab Live events	3596	58.32%
Look up more info on one or more of the topics discussed today	1862	30.20%

*Percentages based on total number of respondents (N=6166)

Table 9: Science Knowledge (N=5118)

Which of the following best describes your level of scientific knowledge?	N	%
1 (LOW): I wouldn't consider myself to be particularly knowledgeable in science	92	1.80%
2 (BELOW AVERAGE)	244	4.77%
3 (AVERAGE)	1741	34.02%
4 (ABOVE AVERAGE)	2051	40.07%
5 (HIGH): I work/worked professionally in a scientific field	990	19.34%

Table 10: Science Interest (N=5116)

Which of the following best describes your level of scientific knowledge?	N	%
1 (LOW): I am not really interested in science at all	16	0.31%
2 (BELOW AVERAGE): I am less interested in science than the average person	84	1.64%
3 (AVERAGE): My interest in science is average	965	18.86%
4 (ABOVE AVERAGE): I am more interested in science than the average person	2365	46.23%
5 (HIGH): I am extremely interested in science	1686	32.96%

Table 11: Respondents' Ages (N=5114)

What is your age?	N	%
Under 18	44	0.86%
18-24	315	6.16%
24-34	2473	48.36%
35-49	1519	29.70%
50-65	680	13.30%
66 to 74	78	1.53%
75 or older	5	0.10%

Table 12: Respondents' Support for Public Radio (N=5103)

Do you support a public radio station?	N	%
Yes	3748	73.45%
No	1156	22.65%
Not Sure	199	3.90%

Table 13: Respondents' Gender (N=5084)

What is your gender?	N	%
Male	2298	45.20%
Female	2786	54.80%

Table 14: Respondents' Education Level (N=5092)

What is the highest level of education you have completed?	N	%
Less than high school	38	0.75%
High school or equivalent	270	5.30%
Associate's certificate or degree	305	5.99%
Undergraduate degree	2410	47.33%
Master's degree or equivalent	1513	29.71%
Doctorate or equivalent	556	10.92%

Table 15: Respondents' Income Level (N=4843)

What is your approximate income level?	N	%
$0-24,999	372	7.68%
$25,000-$49,999	789	16.29%
$50,000-$74,999	922	19.04%
$75,000-$99,999	701	14.47%
$100,000-$124,999	632	13.05%
$125,000-$149,999	428	8.84%
$150,000-$174,999	325	6.71%
$175,000-$199,999	174	3.59%
$200,000 and up	500	10.32%

Table 16: Respondents' Engagement with Radiolab Social Media*

Do you follow Radiolab on any of the following social media sources? (Check all that apply)	N	%
Facebook	1664	26.99%
Twitter	928	15.05%
Google Plus	84	1.36%
Pinterest	38	0.62%
Reddit	156	2.53%
Instagram	209	3.39%
Tumblr	175	2.84%

*Percentages based on total number of respondents (N=6166)

Table 17: Respondents' Means of Learning About Apocalyptical*

Do you follow Radiolab on any of the following social media sources? (Check all that apply)	N	%
I heard a message in the podcast	2569	41.66%
I heard a message in the radio broadcast	778	12.62%
I heard about it on my local public radio station	1123	18.21%
I read about it in the paper	131	2.12%
I saw an ad about it	323	5.24%
A friend told me	1072	17.39%
I heard about it on Twitter	233	3.78%
I heard about it on Facebook	619	10.04%
Other	719	11.66%

*Percentages based on total number of respondents (N=6166)

Analyses by Science Knowledge and Interest Levels

Table 18: Numbers and Percentages of Respondents in Each Knowledge and Interest Category

Category	Level	N	Valid Percent
Science Knowledge	Low	2077	40.6
	High	3041	59.4
	Total	5118	100.0
Science Interest	Low	1065	20.8
	High	4051	79.2
	Total	5116	100.0

Table 19: Program Ratings by Science Knowledge Levels

	Level	N	Mean	SD
a. I enjoyed this program.	Low	2074	4.58	0.684
	High	3030	4.60	0.652
b. The program exposed me to new scientific concepts.	Low	2072	4.55	0.654
	High	3029	4.47	0.695
c. The program helped me understand scientific concepts more clearly.	Low	2066	4.46	0.704
	High	3028	4.34	0.758
d. The program made me feel more knowledgeable about the scientific topics that were discussed.	Low	2073	4.47	0.701
	High	3029	4.43	0.704
e. The program made me feel more knowledgeable about science in general.	Low	2070	4.10	0.855
	High	3023	3.94	0.913
f. The program raised my general level of interest in science.	Low	2069	4.00	0.906
	High	3027	3.75	0.953
g. The program raised my level of interest in specific types of current scientific research.	Low	2062	3.90	0.939
	High	3026	3.89	0.918
h. The program sparked a desire to learn more about one or more of the topics.	Low	2070	3.81	0.969
	High	3023	3.91	0.942
i. The program sparked a desire to do something related to one or more of the topics.	Low	2068	3.26	1.035
	High	3026	3.27	1.012

Table 20: Program Ratings by Science Interest Levels

	Level	N	Mean	SD
a. I enjoyed this program.	Low	1065	4.54	0.686
	High	4037	4.60	0.659
b. The program exposed me to new scientific concepts.	Low	1063	4.52	0.660
	High	4036	4.49	0.685
c. The program helped me understand scientific concepts more clearly.	Low	1064	4.43	0.697
	High	4028	4.38	0.749
d. The program made me feel more knowledgeable about the scientific topics that were discussed.	Low	1064	4.42	0.703
	High	4036	4.45	0.703
e. The program made me feel more knowledgeable about science in general.	Low	1063	4.05	0.868
	High	4028	4.00	0.899
f. The program raised my general level of interest in science.	Low	1062	3.92	0.894
	High	4032	3.83	0.953
g. The program raised my level of interest in specific types of current scientific research.	Low	1060	3.79	0.936
	High	4026	3.92	0.922
h. The program sparked a desire to learn more about one or more of the topics.	Low	1064	3.65	0.965
	High	4027	3.93	0.943
i. The program sparked a desire to do something related to one or more of the topics.	Low	1062	3.11	1.000
	High	4030	3.31	1.023

Table 21: Program Ratings by Gender

	Level	N	Mean	SD
a. I enjoyed this program.	Male	2292	4.56	0.679
	Female	2778	4.61	0.650
b. The program exposed me to new scientific concepts.	Male	2289	4.46	0.701
	Female	2777	4.53	0.657
c. The program helped me understand scientific concepts more clearly.	Male	2287	4.34	0.752
	Female	2773	4.43	0.725
d. The program made me feel more knowledgeable about the scientific topics that were discussed.	Male	2290	4.42	0.709
	Female	2777	4.47	0.694
e. The program made me feel more knowledgeable about science in general.	Male	2283	3.97	0.886
	Female	2775	4.04	0.898
f. The program raised my general level of interest in science.	Male	2289	3.78	0.938
	Female	2772	3.91	0.942
g. The program raised my level of interest in specific types of current scientific research.	Male	2283	3.84	0.920
	Female	2770	3.94	0.930
h. The program sparked a desire to learn more about one or more of the topics.	Male	2286	3.85	0.951
	Female	2772	3.89	0.956
i. The program sparked a desire to do something related to one or more of the topics.	Male	2287	3.26	1.010
	Female	2773	3.27	1.030

Notes about findings related to respondents' ages (i.e. those found in Table 22): ANOVAs revealed that there were differences in program ratings by gender for ALL ratings. Post hoc tests revealed that the 18-24 year old group gave higher ratings for all program aspects, Additionally 1) 18-24 gave higher ratings than 35-49 and 50-65 year olds. 2) B, F, G, H, I: 18-24 year old gave higher ratings than 24-34, 35-49, 50-65, and 66-74 years old. 3) C and E: 18-24 year olds gave higher ratings than 24-34, 35-49, and 50-65 year olds and 4) D: 18-24 year olds gave higher ratings than 50-65 year olds.

Table 22: Agreement with Statements about Apocalyptical by Age

a. I enjoyed this program.			
Age	N	Mean	SD
Under 18	44	4.80	0.408
18-24	315	4.70	0.540
25-34	2470	4.61	0.645
35-49	1514	4.56	0.675
50-65	674	4.53	0.719
66-74	78	4.45	0.921
75 or older	5	4.60	0.548
TOTAL	5100	4.59	0.663

b. The program exposed me to new scientific concepts.

Age	N	Mean	SD
Under 18	44	4.48	0.549
18-24	315	4.63	0.596
25-34	2466	4.50	0.668
35-49	1514	4.49	0.686
50-65	674	4.45	0.716
66-74	78	4.36	0.837
75 or older	5	4.40	0.548
TOTAL	5096	4.50	0.678

c. The program helped me understand scientific concepts more clearly.

Age	N	Mean	SD
Under 18	44	4.45	0.627
18-24	314	4.53	0.665
25-34	2463	4.39	0.738
35-49	1512	4.39	0.747
50-65	674	4.33	0.735
66-74	78	4.29	0.854
75 or older	5	4.60	0.548
TOTAL	5090	4.39	0.738

d. The program made me feel more knowledgeable about the scientific topics that were discussed.

Age	N	Mean	SD
Under 18	44	4.55	0.627
18-24	315	4.55	0.672
25-34	2465	4.46	0.701
35-49	1516	4.44	0.693
50-65	674	4.36	0.712
66-74	78	4.31	0.887
75 or older	5	4.40	0.548
TOTAL	5097	4.45	0.702

e. The program made me feel more knowledgeable about science in general.

Age	N	Mean	SD
Under 18	44	4.02	0.927
18-24	311	4.23	0.836
25-34	2464	4.05	0.892
35-49	1512	3.97	0.878
50-65	674	3.82	0.901
66-74	78	3.92	0.990
75 or older	5	3.60	0.894
TOTAL	5088	4.01	0.893

f. The program raised my general level of interest in science.

Age	N	Mean	SD
Under 18	44	4.07	0.974
18-24	314	4.20	0.870
25-34	2465	3.92	0.935
35-49	1513	3.78	0.927
50-65	673	3.57	0.925
66-74	77	3.69	1.067
75 or older	5	3.40	0.894
TOTAL	5091	3.85	0.941

g. The program raised my level of interest in specific types of current scientific research

Age	N	Mean	SD
Under 18	44	4.25	0.751
18-24	315	4.14	0.917
25-34	2462	3.95	0.930
35-49	1511	3.86	0.907
50-65	669	3.68	0.912
66-74	77	3.66	0.968
75 or older	5	4.00	0.707
TOTAL	5083	3.90	0.926

h. The program sparked a desire to learn more about one or more of the topics.

Age	N	Mean	SD
Under 18	43	4.05	0.999
18-24	314	4.18	0.904
25-34	2464	3.92	0.962
35-49	1512	3.82	0.934
50-65	672	3.71	0.935
66-74	78	3.68	1.013
75 or older	5	3.40	1.140
TOTAL	5088	3.87	0.954

i. The program sparked a desire to do something related to one or more of the topics

Age	N	Mean	SD
Under 18	43	3.88	0.981
18-24	314	3.59	1.087
25-34	2465	3.29	1.046
35-49	1511	3.20	0.980
50-65	674	3.13	0.943
66-74	77	3.13	0.991
75 or older	5	2.80	1.483
TOTAL	5089	3.27	1.022

Table 23: Level of Familiarity with Radiolab by Science Knowledge

		Never heard of RL	Heard of RL but hadn't listened	Listen Periodically	Listen Regularly	Total
Low	Frequency	18	41	466	1551	2076
	% in Low	0.9%	2.0%	22.4%	74.7%	100.0%
	% withing rating	45.0%	50.6%	45.2%	39.1%	40.6%
High	Frequency	22	40	565	2411	3038
	% within high	0.7%	1.3%	18.6%	79.4%	100.0%
	% within rating	55.0%	49.4%	54.8%	60.9%	59.4%

Table 24: Level of Familiarity with Radiolab by Science Interest

		Never heard of RL	Heard of RL but hadn't listened	Listen Periodically	Listen Regularly	Total
Low	Frequency	14	32	288	730	1064
	% in Low	1.3%	3.0%	27.1%	68.6%	100.0%
	% withing rating	35.0%	39.5%	27.9%	18.4%	20.8%
High	Frequency	26	49	743	3230	4048
	% within high	0.6%	1.2%	18.4%	79.8%	100.0%
	% within rating	65.0%	60.5%	72.1%	81.6%	79.2%

Notes about analysis based on level of familiarity with Radiolab as reported in Table 25: Level of familiarity was either coded as a) None = Never Heard of it, b) Some = Heard of/Listen Periodically or c) High = Listen Regularly. Differences between Familiarity groups were found on Program Ratings, items e, f, g, h, and i. When there were differences, the "High" group (those who listened regularly to the Broadcast or Podcast) gave higher ratings to the Live Program. E and H: High gave higher ratings than both the None and Some groups and F, G and I: High gave higher ratings than the Some group.

Table 25: Program Ratings by Level or Familiarity* with Radiolab

	Familiarity	N	Mean	SD
a. I enjoyed this program	None	121	4.59	0.558
	Some	1042	4.57	0.665
	High	3992	4.59	0.676
b. The program exposed me to new scientific concepts	None	120	4.43	0.775
	Some	1040	4.48	0.678
	High	3991	4.50	0.685
c. The program helped me understand scientific concepts more clearly.	None	121	4.32	0.788
	Some	1041	4.35	0.730
	High	3983	4.40	0.745
d. The program made me feel more knowledgeable about the scientific topics that were discussed.	None	121	4.44	0.694
	Some	1040	4.40	0.709
	High	3992	4.45	0.709
e. The program made me feel more knowledgeable about science in general.	None	121	3.83	0.910
	Some	1041	3.92	0.891
	High	3982	4.04	0.895
f. The program raised my general level of interest in science.	None	121	3.83	0.879
	Some	1039	3.75	0.912
	High	3987	3.88	0.954
g. The program raised my interest in specific types of current research.	None	120	3.79	0.952
	Some	1035	3.81	0.922
	High	3984	3.92	0.930
h. The program sparked a desire to learn more about one or more of the topics.	None	120	3.68	0.970
	Some	1039	3.76	0.963
	High	3985	3.91	0.952
i. The program sparked a desire to do something related to one or more of the topics.	None	121	3.12	0.962
	Some	1038	3.18	1.005
	High	3987	3.29	1.029

* None=Never heard of, Some=Heard of/Listen Periodically, High=Listen Regularly

Table 26: Impression of the Program by Gender

Program Component	Rating Level	Males		Females	
		N	% within Gender	N	% within Gender
Pre-Recorded Content	Negative	263	11.5%	370	13.3%
	Positive	883	38.6%	855	30.8%
	Very Positive	1142	49.9%	1552	55.9%
Live Comedic Performance	Frequency	568	24.8%	622	22.4%
	% within high	724	31.6%	732	26.4%
	% within rating	997	43.6%	1422	51.2%
Live Music	Negative	213	9.3%	309	11.1%
	Positive	614	26.8%	636	22.9%
	Very Positive	1462	63.9%	1829	65.9%
Interactive Components	Negative	496	21.8%	459	16.6%
	Positive	633	27.8%	623	22.5%
	Very Positive	1150	50.5%	1683	60.9%

Table 27: Impact of Science <u>Knowledge</u> Level on Plans for Post Show Attendance on Behaviors

		Low			High		
		N	% Within Low	% Within statement	N	% Within High	% Within statement
a. Listen to the Radiolab program	No	281	13.5%	45.3%	339	11.1%	54.7%
	Yes	1796	<u>86.5%</u>	39.9%	2702	<u>88.9%</u>	60.1%
	Total	2077	100.0%	40.6%	3041	100.0%	59.4%
b. Read info on the Radiolab website	No	1152	55.5%	42.8%	1539	50.6%	57.2%
	Yes	925	<u>44.5%</u>	38.1%	1502	<u>49.4%</u>	61.9%
	Total	2077	100.0%	40.6%	3041	100.0%	59.4%
c. Do activities on the Radiolab website	No	1623	78.1%	40.6%	2377	78.2%	59.4%
	Yes	454	21.9%	40.6%	664	21.8%	59.4%
	Total	2077	100.0%	40.6%	3041	100.0%	59.4%
d. Follow Radiolab via social media	No	1410	67.9%	40.9%	2039	67.1%	59.1%
	Yes	667	32.1%	40.0%	1002	32.9%	60.0%
	Total	2077	100.0%	40.6%	3041	100.0%	59.4%
e. Attend other Radiolab outreach activities.	No	615	29.6%	40.1%	917	30.2%	59.9%
	Yes	1462	70.4%	40.8%	2124	69.8%	59.2%
	Total	2077	100.0%	40.6%	3041	100.0%	59.4%
f. Lookup more info on topics discussed today.	No	1395	67.2%	42.8%	1865	61.3%	57.2%
	Yes	682	<u>32.8%</u>	36.7%	1176	<u>38.7%</u>	63.3%
	Total	2077	100.0%	40.6%	3041	100.0%	59.4%
g. Other.	No	2001	96.3%	40.8%	2898	95.3%	59.2%
	Yes	76	3.7%	34.7%	143	4.7%	65.3%
	Total	2077	100.0%	40.6%	3041	100.0%	59.4%

Table 28: Impact of Science <u>Interest</u> Level on Plans for Post Show Attendance on Behaviors

		Low			High		
		N	% Within Low	% Within statement	N	% Within High	% Within statement
a. Listen to the Radiolab program	No	155	15.5%	26.7%	454	11.2%	73.3%
	Yes	900	<u>84.5%</u>	20.0%	3597	<u>88.8%</u>	80.0%
	Total	1065	100.0%	20.8%	4051	100.0%	79.2%
b. Read info on the Radiolab website	No	648	60.8%	24.1%	2041	50.4%	75.9%
	Yes	417	<u>39.2%</u>	17.2%	2010	<u>49.6%</u>	82.8%
	Total	1065	100.0%	20.8%	4051	100.0%	79.2%
c. Do activities on the Radiolab website	No	867	81.4%	21.7%	3132	77.3%	78.3%
	Yes	198	<u>18.6%</u>	17.7%	919	<u>22.7%</u>	82.3%
	Total	1065	100.0%	20.8%	4051	100.0%	79.2%
d. Follow Radiolab via social media	No	754	70.8%	21.9%	2694	66.5%	78.1%
	Yes	311	29.2%	18.6%	1357	33.5%	81.4%
	Total	1065	100.0%	20.8%	4051	100.0%	79.2%
e. Attend other Radiolab outreach activities.	No	353	33.1%	23.0%	1179	29.1%	77.0%
	Yes	712	66.9%	19.9%	2872	70.9%	80.1%
	Total	1065	100.0%	20.8%	4051	100.0%	79.2%
f. Lookup more info on topics discussed today.	No	800	75.1%	24.6%	2458	60.7%	75.4%
	Yes	265	24.9%	14.3%	1593	39.3%	85.7%
	Total	1065	100.0%	20.8%	4051	100.0%	79.2%
g. Other.	No	1034	97.1%	21.1%	3863	95.4%	78.9%
	Yes	31	2.9%	14.2%	188	4.6%	85.8%
	Total	1065	100.0%	20.8%	4051	100.0%	79.2%

Appendix D

Radiolab Live: "Apocalyptical" Interview Questions

The following questions were asked of "Apocalyptical" Attendees following the show in Los Angeles, California. Interviews were conducted with individuals or small groups of attendees.

1. Where are you from?

2. Were you a Radiolab listener or fan before tonight's show?

3. What did you think of the Apocalyptical show?

4. Did you learn anything new?

5. How did the show expand your knowledge or understanding of science?

6. What, if anything, could be done to improve upon this program or similar programs in the future?

7. Do you have other comments to share about your experience tonight or with Radiolab in general?

Appendix E

General Audience +Scientist Survey

This appendix contains a list of all survey questions that were designed by Rockman Et Al and disseminated in the Fall of 2014 to Radiolab listeners, event participants, and a select group of scientists who had contributed to the show (as well as scientists who were part of the general listening audience). The link to the survey was administered online and an invitation link was sent to attendees via email.

1. Please check any of the following ways that you have engaged with Radiolab. (check all that apply)
   - ❑ Listening to the radio show
   - ❑ Listening to the podcast
   - ❑ Using the Radiolab app to access content
   - ❑ Using the Radiolab app to submit content
   - ❑ Reading/Looking at content on the Radiolab website
   - ❑ Doing activities on the Radiolab website
   - ❑ Taking polls or quizzes posted on the Radiolab website
   - ❑ Following Radiolab via social media (e.g. Facebook, Twitter, etc.)

2. How often do you listen to Radiolab?
   - ❍ I listen regularly (e.g., every episode or just about every episode)
   - ❍ I listen occasionally
   - ❍ I listen rarely

3. How often do you read or watch Radiolab content online (e.g., read blog posts, watch videos, etc.)?
   - ❍ Regularly (e.g., daily or a few times a week)
   - ❍ Occasionally (e.g., once a month or only a few times a month)
   - ❍ Rarely (e.g., only once or twice ever)

4. How often do you interact with Radiolab content online (e.g., participate in online discussions or polls)?
   - ❍ Regularly (e.g., daily or a few times a week)
   - ❍ Occasionally (e.g., once a month or only a few times a month)
   - ❍ Rarely (e.g., only once or twice ever)

5. How has your level of engagement with Radiolab changed over the past three years?
   - ❍ My level of engagement has decreased
   - ❍ My level of engagement has stayed the same
   - ❍ My level of engagement has increased

6.   Which of the following Radiolab special events have you attend? (check all that apply)
❑   Life public outreach events hosted by Radiolab
❑   Radiolab "In the Dark" live show (2011-2012)
❑   Radiolab "Apocalyptical" live show (2013)
❑   "Radiolab Trusts No One" Brooklyn Academy of Music (6/4/14)
❑   Online discussions hosted by Radiolab (e.g., Google Hangouts, Skype conversations, CoverlitLive, Twitter chat, etc.)
❑   Cicada Tracking project in 2013
❑   Ancestor-naming bracket in 2013
❑   Mars Rover Watching Party in 2013
❑   "Cellular Surgeons" Live Chat in 2013
❑   "Diagnosis" Google Hangout in 2012
❑   Other:
❑   None of the above

If applicable, please describe any other events or activities that you participated in that were hosted by Radiolab or Radiolab staff.

ABOUT YOU

7.   Which of the following statements describe you. (check all that apply)
❑   I am a scientist.
❑   I am a lay-scientists or citizen scientist (i.e., I do science, but not in a professional capacity).
❑   I am, or have been, employed in a technology-related field.
❑   I am an engineer.
❑   I am, or have been, employed in a field related to mathematics.
❑   I am currently a student.
❑   I am currently retired.
❑   None of the above.

8.   Which of the following best describes your current employer: (check all that apply)
❑   University/Higher Education Institution
❑   Elementary or Secondary Education Institution
❑   For Profit Business
❑   Not-for-Profit Business
❑   Other:

9.   Which of the following statements describe your current role in science? (check all that apply)
❑   I am actively researching in one or more scientific fields.
❑   I am actively teaching one or more scientific disciplines.
❑   I am employed full-time in a scientific field.
❑   I am employed part-time in a scientific field.
❑   I am retired, but was formerly employed in a scientific field.

10. Please rate your level of personal or professional engagement with each of the following:

	Not engaged at all	Low to Moderate Interest in this field as a lay person	High Interest as a lay person	I am employed/ do work in this field
a. Astronomy	❍	❍	❍	❍
b. Biology/Life Sciences	❍	❍	❍	❍
c. Biotechnology	❍	❍	❍	❍
d. Chemistry	❍	❍	❍	❍
e. Computing	❍	❍	❍	❍
f. Earth & Environmental Science	❍	❍	❍	❍
g. Engineering	❍	❍	❍	❍
h. Physics	❍	❍	❍	❍
i. Nanoscience	❍	❍	❍	❍

THOUGHTS ABOUT RADIOLAB AND SCIENCE

11. Please indicate how much your agree with each of the following statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. Radiolab programming and content appeals to people with a scientific background.	❍	❍	❍	❍	❍
b. Radiolab programming and content helps to expand the public's interest in science.	❍	❍	❍	❍	❍
c. Radiolab programming and content helps to expand the public's understanding of science.	❍	❍	❍	❍	❍
d. Radiolab communicates information in ways that are engaging for scientists.	❍	❍	❍	❍	❍
e. Radiolab values the input of members of the scientific community.	❍	❍	❍	❍	❍
f. Radiolab provides engaging ways for scientists to interact with the general public.	❍	❍	❍	❍	❍

12. How knowledgeable, on average, do you feel members of the Radiolab audience are about science?
    - ❍ Not knowledgeable at all
    - ❍ Less knowledgeable than the population in general
    - ❍ About as knowledgeable as the population in general
    - ❍ Somewhat more knowledgeable than the population in general
    - ❍ Extremely more knowledgeable than the population in general

SCIENTIST QUESTIONS (SCIENTISTS ONLY)

13. What does Radiolab currently do well when it comes to engaging you as a scientist and your scientific field?

14. What could Radiolab do to more effectively involve and/or collaborate with scientists? Please feel free to include examples from other projects you may have worked on or heard about, as well as your own ideas.

15. What does Radiolab currently do well in terms of engaging the general public in science?

16. What could Radiolab do to more effectively engage public audiences in science? Please feel free to include examples from other projects you may have worked on or heard about, as well as your own ideas.

17. Did Radiolab have an impact on your decision to become a scientist?
    - ❍ No, I made the decision to become a scientist before I learned about Radiolab.
    - ❍ No, it did not have an impact.
    - ❍ Yes, it had some impact.
    - ❍ Yes, it had a significant impact.

18. What was it about Radiolab specifically that had an impact on your interest in science?

19. Did any other media program have an impact on your decision to become a scientist or pursue an interest in science?
    - ❍ Definitely not
    - ❍ Probably not
    - ❍ Maybe
    - ❍ Probably yes
    - ❍ Definitely yes

20. Which programs had an impact on your interest in science? Why?

21. In which of the following ways, if any, have you worked with Radiolab in your capacity as a scientist?
    - ❍ I have been interviewed for an online article that Radiolab posted online.
    - ❍ I have been interviewed for a broadcast/podcast episode of Radiolab.
    - ❍ Neither of the above

22. Please check any of the following that you have been invited to participate in as a scientist by Radiolab: (check all that apply)
    ❑ Live public outreach events hosted by Radiolab
    ❑ Radiolab "In the Dark" Live show (2011-2012)
    ❑ Radiolab "Apocalyptical" (2013)
    ❑ Online discussions hosted by Radiolab (e.g., Google Hangouts, Skype conversations, CoverItLive, Twitter chat, etc.)
    ❑ Cicada Tracking project in 2013
    ❑ Ancestor-naming bracket in 2013
    ❑ Mars Rover Watching Party in 2013
    ❑ "Cellular Surgeons" Live Chat in 2013
    ❑ "Diagnosis" Google Hangout in 2012
    ❑ Other:
    ❑ None of the above

FOLLOW-UP QUESTIONS (All Respondents)

23. Please indicate how much you agree with each of the following statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. Radiolab has increased my awareness of current scientific research.	○	○	○	○	○
b. Radiolab has increased my knowledge of current scientific research.	○	○	○	○	○
c. Radiolab has increased my long-term interest in science.	○	○	○	○	○
d. Radiolab has increased my long-term interest in technology.	○	○	○	○	○
e. Radiolab has increased my long-term interest in engineering.	○	○	○	○	○
f. Radiolab has increased my long-term interest in mathematics.	○	○	○	○	○

24. Would you be willing to participate in a follow-up interview?
    ○ Yes ○ No

25. Would you like to be entered into a drawing for a 3-D printed skull signed by Jad and Robert? ○ Yes ○ No

    Please enter the information below only if you would like to be entered in our drawing or would be willing to participate in a follow-up interview.
    Email:
    First Name:
    Last Name:

Appendix F

**General Audience +Scientist Survey
Supplemental Data**

This section contains supplemental details about the analyses run on data form the General Audience and Scientist Survey. Significant differences are underlined.

Demographics

Table 1. Frequencies of Respondents by Engagement Type and Levels

	LISTEN		READ		INTERACT	
	N	%	N	%	N	%
Rarely	58	0.6	2301	28.1	5450	73.4
Occasionally	1557	16.8	4574	55.9	1715	23.1
Regularly	7672	82.6	1303	15.9	262	3.5

Note: For the "Listening" Type of participation, respondents in the "Rarely" and Occasionally" group were subsequently combined due to small numbers in the "Rarely" group. Below: Anyone who indicated that they were a professional in scientific field were not included in the analysis.

Table 2a. Personal or Professional Engagement by Radiolab Listening Frequency

	Rarely/Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD
Astronomy and Space	1422	2.30	0.704	7093	2.40	0.706
Biology/Life Sciences	1252	2.39	0.679	6268	2.49	0.668
Biotechnology	1382	2.11	0.718	6884	2.25	0.726
Chemistry	1384	1.90	0.698	6902	2.03	0.717
Computing	1269	2.05	0.718	6297	2.13	0.716
Earth/Environmental Science	1357	2.41	0.687	6763	2.48	0.667
Engineering	1367	1.89	0.718	6704	2.03	0.737
Physics	1400	2.05	0.746	7004	2.23	0.747
Nanoscience	1413	1.94	0.745	7057	2.09	0.760

Table 2b. Personal or Professional Engagement by <u>Frequency of Reading</u> Radiolab Content

	Rarely			Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Astronomy and Space	2106	2.27	0.733	4208	2.43	0.676	1197	2.50	0.687
Biology/Life Sciences	1895	2.38	0.698	3692	2.52	0.644	1044	2.58	0.643
Biotechnology	2075	2.11	0.729	4073	2.24	0.722	1148	2.38	0.703
Chemistry	2064	1.87	0.697	4096	2.03	0.708	1152	2.16	0.723
Computing	1890	2.03	0.729	3737	2.13	0.708	1063	2.22	0.714
Earth/ Environmental Science	2021	2.37	0.697	4010	2.51	0.645	1138	2.59	0.635
Engineering	2000	1.91	0.734	4007	2.02	0.729	1125	2.14	0.734
Physics	2078	2.08	0.751	4168	2.23	0.740	1173	2.36	0.739
Nanoscience	2098	1.96	0.760	4190	2.08	0.751	1187	2.21	0.766

Table 2c. Personal or Professional Engagement by <u>Frequency of Interacting</u> with Radiolab Content

	Rarely			Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Astronomy and Space	5036	2.36	0.708	1552	2.50	0.670	245	2.46	0.727
Biology/Life Sciences	4440	2.45	0.675	1387	2.57	0.629	209	2.49	0.694
Biotechnology	4902	2.19	0.730	1504	2.31	0.714	235	2.40	0.736
Chemistry	4910	1.97	0.714	1510	2.11	0.714	235	2.16	0.739
Computing	4524	2.09	0.718	1366	2.20	0.709	209	2.21	0.756
Earth/ Environmental Science	4799	2.45	0.676	1481	2.55	0.630	234	2.59	0.682
Engineering	4773	1.98	0.736	1486	2.09	0.728	233	2.14	0.772
Physics	4988	2.17	0.751	1532	2.30	0.736	237	2.32	0.786
Nanoscience	5024	2.03	0.760	1542	2.15	0.750	241	2.24	0.784

Engagement over Time

Table 3. Engagement over Time by Participation Type and Level

		Decreased		Stayed Same		Increased	
		N	%	N	%	N	%
LISTEN	Rarely/Ocassionally	294	18.6	571	36.1	718	45.4
	Regularly	395	5.2	2847	37.5	4358	57.3
READ	Rarely	211	9.3	936	41.2	1124	49.5
	Occasionally	329	7.3	1629	36.0	2566	56.7
	Regularly	38	3.0	390	30.3	859	66.7
INTERACT	Rarely	407	7.6	2040	37.9	2939	54.6
	Occasionally	102	6.0	561	33.1	1031	60.9
	Regularly	11	4.2	60	23.1	189	72.7

Science Attitudes

Table 4a. Descriptive Statistics for Radiolab and Science Attitudes by Listening Frequency Level

	Rarely/ Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD
a. RL programming and content appeals to people with a scientific background.	1349	4.02	0.865	6844	4.08	0.912
b. RL programming and content helps to expand the public's interest in science.	1350	4.59	0.617	6844	4.71	0.599
c. RL programming and content helps to expand the public's understanding of science.	1351	4.50	0.672	6840	4.61	0.649
d. RL communicates information in ways that are engaging for scientists.	1349	3.93	0.880	6838	4.02	0.880
e. RL values the input of members for the scientific community.	1350	4.23	0.818	6835	4.42	0.777
f. RL provides engaging ways for scientists to interact with the general public.	1349	4.24	0.809	6841	4.39	0.804

Table 4b. Descriptive Statistics for Radiolab and Science Attitudes by Reading Frequency Level

	Rarely			Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Appeal	2009	4.04	0.874	4059	4.09	0.897	1161	4.15	0.952
b. Interest	2011	4.66	0.608	4060	4.72	0.577	1160	4.76	0.626
c. Understanding	2009	4.57	0.646	4061	4.61	0.642	1161	4.68	0.662
d. Communicate	2009	3.89	0.869	4055	4.03	0.872	1160	4.16	0.880
e. Value Input	2010	4.31	0.800	4055	4.43	0.763	1159	4.51	0.784
f. Interact	2009	4.29	0.818	4059	4.40	0.783	1161	4.45	0.822

Table 4c. Descriptive Statistics for Radiolab and Science Attitudes by Interacting Frequency Level

	Rarely			Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Appeal	4843	4.08	0.891	1505	4.11	0.913	234	4.24	0.945
b. Interest	4845	4.70	0.589	1506	4.73	0.595	234	4.77	0.562
c. Understanding	4842	4.60	0.646	1506	4.65	0.633	234	4.70	0.597
d. Communicate	4840	3.98	0.880	1504	4.12	0.858	234	4.25	0.883
e. Value Input	4839	4.39	0.787	1505	4.50	0.733	234	4.57	0.745
f. Interact	4844	4.35	0.810	1504	4.47	0.764	234	4.51	0.787

Ratings of Audiences' Knowledge About Science

Table 5. Mean Rating of Audience-Knowledge of Science by Engagement Type and Levels

		N	Mean	SD
LISTEN	Rarely/Ocassionally	1340	3.97	0.512
	Regularly	6806	4.03	0.497
READ	Rarely	1988	3.98	0.478
	Occasionally	4044	4.03	0.493
	Regularly	1155	4.07	0.515
INTERACT	Rarely	4805	4.02	0.491
	Occasionally	1506	4.03	0.494
	Regularly	233	4.10	0.604

Table 6a. Mean Ratings for Science and STEM Outcomes by <u>Listening Frequency</u> Level

	Rarely/			Regularly		
	N	Mean	SD	N	Mean	SD
a. RL has increased my **awareness** of current scientific research.	1283	<u>4.18</u>	0.67	6568	<u>4.39</u>	0.68
b. RL has increased my **knowledge** of current scientific research.	1283	<u>4.24</u>	0.67	6574	<u>4.43</u>	0.68
c. RL has increased my **long-term interest** in <u>science</u>.	1281	<u>4.10</u>	0.84	6566	<u>4.35</u>	0.78
d. RL has increased my **long-term interest** in <u>technology</u>.	1279	<u>3.85</u>	0.88	6557	<u>4.09</u>	0.86
e. RL has increased my **long-term interest** in <u>engineering</u>.	1282	<u>3.53</u>	0.94	6571	<u>3.77</u>	0.94
f. RL has increased my **long-term interest** in <u>mathematics</u>.	1279	<u>3.48</u>	0.94	6568	<u>3.72</u>	0.97

Table 6b. Mean Ratings for Science and STEM Outcomes by <u>Reading Frequency</u> Level

	Rarely			Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Awareness	1915	<u>4.27</u>	0.70	3906	<u>4.38</u>	0.66	1112	<u>4.50</u>	0.66
b. Knowledge	1917	<u>4.33</u>	0.73	3908	<u>4.43</u>	0.66	1114	<u>4.54</u>	0.65
c. Interest Science	1915	<u>4.21</u>	0.83	3904	<u>4.34</u>	0.77	1113	<u>4.51</u>	0.73
d. Interest Tech.	1910	<u>3.91</u>	0.89	3900	<u>4.08</u>	0.85	1111	<u>4.28</u>	0.81
e. Interest Engineer	1917	<u>3.59</u>	0.96	3907	<u>3.76</u>	0.92	1112	<u>3.97</u>	0.94
f. Interest Math	1917	<u>3.54</u>	0.99	3904	<u>3.72</u>	0.95	1112	<u>3.90</u>	0.97

Table 6c. Mean Ratings for Science and STEM Outcomes by <u>Interacting Frequency</u> Level

	Rarely			Occasionally			Regularly		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Awareness	4643	<u>4.34</u>	0.69	1457	<u>4.46</u>	0.62	220	<u>4.56</u>	0.68
b. Knowledge	4647	<u>4.40</u>	0.69	1457	<u>4.49</u>	0.62	220	<u>4.57</u>	0.68
c. Interest Science	4642	<u>4.31</u>	0.80	1456	<u>4.43</u>	0.73	220	<u>4.54</u>	0.72
d. Interest Tech.	4634	<u>4.01</u>	0.87	1455	<u>4.21</u>	0.81	220	<u>4.43</u>	0.79
e. Interest Engineer	4648	<u>3.69</u>	0.94	1453	<u>3.89</u>	0.92	220	<u>4.12</u>	0.94
f. Interest Math	4645	<u>3.64</u>	0.97	1456	<u>3.87</u>	0.93	218	<u>4.06</u>	1.03

Scientists vs. Other Respondents

Categories:

✦ Scientists (including scientists and lay-scientists

    • Professionals

    • Non-Professionals/Lay-scientists

✦ TEM-Professionals (including those employed in careers related to Technology, Engineering or Math)

✦ Non-STEM (all other respondents, including students, retirees and "none of the above" responses)

Table 7: Numbers of Scientists vs. Other Respondents

		N	%
Scientists	Professional	1111	12.3
	Lay-scientists	1227	13.6
TEM-Professionals		1671	18.5
Non-STEM		5042	55.7

Table 8a: Listen, Read, Interact Engagement Levels (S vs. TEM vs. Non-STEM)

		Scientist		TEM		Non-STEM	
		N	%	N	%	N	%
LISTEN	Rarely/Ocassionally	384	16.5	289	17.4	853	17.0
	Regularly	1948	83.5	1375	82.6	4161	83.0
READ	Rarely	492	23.6	433	30.3	1308	29.6
	Occasionally	1202	57.7	788	55.1	2445	55.3
	Regularly	390	18.7	208	14.6	667	15.1
INTERACT	Rarely	1369	71.7	953	73.7	2975	74.2
	Occasionally	462	24.2	299	23.1	893	22.3
	Regularly	78	4.1	41	3.2	139	3.5

**Table 8b: Listen, Read, Interact Engagement Levels
(Professional vs. Lay-Scientist)**

		Professionals		Lay-Scientists	
		N	%	N	%
LISTEN	Rarely/Ocassionally	201	18.1	183	15.0
	Regularly	908	81.9	1040	85.0
READ	Rarely	267	27.5	225	20.2
	Occasionally	556	57.3	646	58.0
	Regularly	148	15.2	242	21.7
INTERACT	Rarely	661	75.4	708	68.6
	Occasionally	182	20.8	280	27.1
	Regularly	34	3.9	44	4.3

Table 9a. Engagement Over Time (S vs. TEM vs. Non-STEM)

	Decreased		Stayed Same		Increased	
	N	%	N	%	N	%
Scientists	181	7.7	825	35.3	1330	56.9
TEM-Professionals	113	6.8	676	40.5	882	52.8
Non-STEM	385	7.6	1855	36.8	2800	55.6

Table 9b. Engagement Over Time (Professional vs. Lay-Scientist)

	Decreased		Stayed Same		Increased	
	N	%	N	%	N	%
Professional Scientists	84	7.6	417	37.6	609	54.9
Lay-Scientists	97	7.9	408	33.3	721	58.8

Table 10a: Attitudes about Radiolab (S vs. TEM vs. Non-STEM)

	Scientists			TEM			Non-STEM		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Appeal	2152	4.41	0.780	1519	4.13	0.882	4544	3.89	0.920
b. Interest	2153	4.72	0.585	1519	4.65	0.616	4544	4.68	0.612
c. Understanding	2153	4.60	0.660	1518	4.54	0.665	4542	4.61	0.652
d. Communicate	2153	4.42	0.768	1516	4.04	0.847	4540	3.79	0.869
e. Value Input	2150	4.50	0.736	1518	4.38	0.772	4539	4.34	0.811
f. Interact	2151	4.42	0.806	1518	4.32	0.817	4543	4.35	0.804

Table 10b: Attitudes about Radiolab (Professional vs. Lay-Scientist)

	Professional Scientists			Lay-Scientists		
	N	Mean	SD	N	Mean	SD
a. Appeal	1030	4.60	0.653	1122	4.23	0.843
b. Interest	1029	4.74	0.518	1124	4.69	0.639
c. Understanding	1029	4.62	0.620	1124	4.58	0.695
d. Communicate	1030	4.63	0.631	1123	4.23	0.832
e. Value Input	1027	4.53	0.709	1123	4.48	0.760
f. Interact	1029	4.42	0.806	1122	4.41	0.807

Table 11a: Mean Ratings for Audience's-Knowledge of Science (S vs. TEM vs. Non-STEM)

	N	Mean	SD
Scientists	2144	4.09	0.474
TEM-Professionals	1504	4.07	0.489
Non-STEM	4520	3.97	0.511

Table 11b: Mean Ratings for Audience's-Knowledge of Science (Professional vs. Lay-Scientist)

	N	Mean	SD
Scientists	1027	4.07	0.468
TEM-Professionals	1117	4.11	0.479

Table 12a: Science Engagement Levels (S vs. TEM vs. Non-STEM)

	Scientists			TEM			Non-STEM		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Astronomy and Space	2177	2.43	0.696	1577	2.48	0.670	4782	2.32	0.718
Biology/Life Sciences	1406	2.70	0.525	1526	2.44	0.664	4605	2.42	0.697
Biotechnology	1991	2.43	0.654	1557	2.31	0.703	4736	2.11	0.739
Chemistry	2019	2.25	0.664	1549	2.00	0.717	4737	1.90	0.712
Computing	1921	2.16	0.704	997	2.43	0.664	4662	2.04	0.714
Earth/ Environmental Science	1922	2.59	0.596	1525	2.48	0.666	4694	2.42	0.695
Engineering	2050	2.14	0.723	1299	2.24	0.725	4742	1.88	0.719
Physics	2121	2.33	0.703	1551	2.38	0.721	4751	2.09	0.760
Nanoscience	2173	2.18	0.725	1567	2.21	0.751	4750	1.96	0.763

Key for statistically significant differences in table above:
- Gray Shading: TEM > Scientists > Non-STEM
- Light Orange: Scientists > TEM > Non-STEM
- Dark Orange: Scientist > both TEM and Non-STEM
- No Shading: Scientists and TEM > Non-STEM

Table 12b: Science Engagement Levels (Professional vs. Lay-Scientist)

	Professional Scientists			Lay-Scientists		
	N	Mean	SD	N	Mean	SD
Astronomy and Space	1013	2.24	0.747	1164	2.59	0.605
Biology/Life Sciences	386	2.56	0.627	1020	2.76	0.470
Biotechnology	854	2.40	0.694	1137	2.46	0.621
Chemistry	891	2.17	0.698	1128	2.31	0.629
Computing	929	2.05	0.712	992	2.26	0.680
Earth/Environmental Science	838	2.48	0.659	1084	2.68	0.527
Engineering	959	2.02	0.737	1091	2.25	0.692
Physics	968	2.17	0.740	1153	2.46	0.640
Nanoscience	1007	2.07	0.739	1166	2.28	0.700

Table 13a. Mean Ratings for Science and STEM Outcomes (S vs. TEM vs. Non-STEM)

	Scientists			TEM			Non-STEM		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. RL has increased my **awareness** of current scientific research.	1959	4.31	0.696	1482	4.32	0.688	4433	4.38	0.671
b. RL has increased my **knowledge** of current scientific research.	1962	4.34	0.709	1483	4.37	0.698	4435	4.44	0.659
c. RL has increased my **long-term interest** in science.	1958	4.23	0.854	1480	4.29	0.788	4432	4.34	0.774
d. RL has increased my **long-term interest** in technology.	1957	3.99	0.893	1481	4.09	0.858	4421	4.06	0.853
e. RL has increased my **long-term interest** in engineering.	1961	3.71	0.950	1482	3.83	0.920	4433	3.71	0.945
f. RL has increased my **long-term interest** in mathematics.	1961	3.72	0.967	1479	3.75	0.941	4430	3.64	0.983

Table 13b. Mean Ratings for Science and STEM Outcomes (Professional vs. Lay-Scientist)

	Professional Scientist			Lay-Scientist		
	N	Mean	SD	N	Mean	SD
a. Awareness	864	4.23	0.700	1095	4.38	0.684
b. Knowledge	866	4.25	0.722	1096	4.42	0.691
c. Interest Science	862	4.11	0.889	1096	4.32	0.813
d. Interest Tech.	863	3.87	0.898	1094	4.08	0.878
e. Interest Engineer	865	3.62	0.945	1096	3.78	0.949
f. Interest Math	865	3.64	0.958	1096	3.79	0.970

Impact and Frequency of Special Event Attendance

Table 14. Participation in Special Events

		N	%
Participated in a Special Event (N=1649, 18.4%)	Paid	1315	14.7
	Free	334	3.7
Did Not Participate in a Special Event		7311	81.6

Table 15. Participation in Special Events (S vs. TEM vs. Non-STEM)

	No Special Event		Special Event	
	N	%	N	%
Scientists/Lay-Scientists	1807	78.9	484	21.1
TEM-Professionals	1334	81.3	307	18.7
Non-STEM	4123	83.0	847	17.0

Table 16. Participation in Special Events by Engagement Type and Frequency

		No Special Event		Special Event	
		N	%	N	%
LISTEN	Rarely/Ocassionally	1310	86.7	201	13.3
	Regularly	5964	80.5	1444	19.5
READ	Rarely	1844	83.5	365	16.5
	Occasionally	3508	79.9	883	20.1
	Regularly	952	75.8	304	24.2
INTERACT	Rarely	4302	81.8	960	18.2
	Occasionally	1216	74.3	420	25.7
	Regularly	175	69.4	77	30.6

Table 17. Participation in Paid vs. Free Special Events (S vs. TEM vs. Non-STEM)

	Free		Paid	
	N	%	N	%
Scientists/Lay-Scientists	128	26.4	356	73.6
TEM-Professionals	45	14.7	262	85.3
Non-STEM	158	18.7	689	81.3

Table 18. Participation in Paid vs. Free Special Events by Engagement Type and Frequency

		Free		Paid	
		N	%	N	%
LISTEN	Rarely/Ocassionally	58	28.9	143	71.1
	Regularly	273	18.9	1171	81.1
READ	Rarely	53	14.5	312	85.5
	Occasionally	174	19.7	709	80.3
	Regularly	85	28.0	219	72.0
INTERACT	Rarely	163	17.0	797	83.0
	Occasionally	98	23.3	322	76.7
	Regularly	28	36.4	49	63.6

Open Ended Responses From Scientists About How Radiolab Influenced Their Decision to Become Scientists

The following are select number of the more descriptive and exemplary comments shared by scientists who indicated that Radiolab had had an impact on their decision to pursue a career in science:

✦ I once told a friend that "This American Life" was the best radio show in the history of all radio shows. She simply replied, "You haven't heard Radiolab". That was 2011, and I was a technology consultant, struggling to piece together my path toward higher education in science and engineering. After one episode (Words) I was hooked. After two episodes (Numbers) I was a fanatic. I told all my friends, "You have to hear this amazing podcast I found! It's all about psychology and cognitive science and it's so creative and engaging! It's called Radiolab..." I recall a friend responding, "Hmm... radiolab, yeah, I think I've heard that. But it's not really about psychology. It covers a range of topics of general scientific interest." But to me, every episode of Radiolab is an exploration of the human mind. And THAT is how Radiolab helped me realize, that I see the world through the eyes of a psychologist. I am now happy to say that I am a graduate student in psychology, and wish to thank Jad, Robert, and the producers of Radiolab for helping me see my true calling.

✦ I knew I wanted to become a research scientist, but radiolab reminded me that research is only as good as it is able to reach the people (policy-makers, public forum, etc) who need to hear it. In other words, great discoveries need to be shared in a way that makes people care and want to continue funding research of that kind. I think not enough scientists are involved in community outreach like that. Radiolab has made a significant impact in helping me realize that.

✦ I was a graduate student in the social sciences at The University of Chicago when I decided to become a doctor. It had always been a latent dream, and my mom had recently fallen extremely and mysteriously ill. I was increasingly stressed about changing my career after already being so far underway in another when I had come across an advertisement for a show called Radiolab on a winter afternoon after just coming home from my classes from a long and frustrating day (I'd decided to finish my MA that year before going back to complete pre-med requirements and was having doubts since it was all going at the slowest pace imaginable). I changed into my sweats, turned down the lights, and randomly picked "Rodney Versus Death" on my iPhone, and it must have been fate. I now pinpoint that afternoon as a moment that solidified my decision to become a doctor, despite the obstacles. My heart leapt at the conclusion of the story and pounded every second until. The turmoil in between very much resonated with the reasons I wanted to go into medicine. On

the harder days, I still tune into Radiolab as a wind-down and inspiration refresher. I owe you guys big time.

✦ I was working as a field tech, with a history degree, in the bush of the Yukon. I was spending all of my free time reading popular science books from the library, and wished I had gotten a science degree rather than an arts. I wanted to be a scientist, but it seemed pretty far from what I was doing, something distant and unreachable. One of my co-workers introduced me to Radiolab when I was in the field, so I downloaded the podcast, and brought them into the bush with me for a long job. From the first one (I think it was Emergence?), I was hooked. But more importantly, I was hearing scientists chatting about their work, and it became easier and easier for me to imagine myself as a scientist. Long story short, after paying off my student debt, I re-enrolled in undergraduate math and science courses to qualify for an MSc program, and the next year I was accepted. I am an epidemiologist, doing research full-time. And it was Radiolab that helped me take the plunge.

✦ You offer a unique perspective to science. Sometimes when you study a specific topic, you get carried away in the science but Radiolab always offers a very intriguing perspective that helps you realize why you loved science in the first place!

✦ It helped me see beyond the mundane daily work of much of science and see the beautiful bigger picture.

✦ Radiolab does a good job of opening up the possibilities that scientists can do. Interviews with active scientists act as inspiration too.

✦ As a college student, Radiolab showed me how diverse and interdisciplinary professional engagement in science can be.

✦ I was going through a time when I wasn't sure if science was the right decision but there was just so many interesting things being talked about. Radiolab definitely helped broaden the spectrum of very interesting things!

✦ I want to be interviewed someday by Radiolab. This was my motivation for coming up with an interesting dissertation project. I'm being only a little bit facetious right now.

✦ I was a music performance major in undergrad and started listening to Radiolab my sophomore year and it made me realize how much I missed science. The more I listened to episodes, the more I realized that I could still be an artist but integrate science into that. It also helped me when I wrote my undergraduate thesis because I took the approach that Radiolab does in looking at all the different factors involved in the topic I was researching.

Appendix G

Formative Focus Group Findings

Rockman Et Al summarized findings from a variety of formative data sets including listener focus groups, online posting and participation data. This section of the report summarizes a select set of findings from the formative evaluation effort.

Three rounds of focus groups were conducted by RMC Research in the spring of 2013—including two sessions in New York, two sessions in Portland and two sessions in Boston. These focus groups sought to learn more about the types of content and features that attract listeners to Radiolab, ways in which Radiolab increases listeners' knowledge and understanding of science, and suggestions listeners have for improving Radiolab programming.

Formative focus groups found Radiolab to be highly appealing to people ages 18-34.

A common thread across all six focus groups was the common belief that Radiolab is highly appealing to people in the 18-34 year-old demographic. Even though participants voiced new ideas and suggestions for improvements, they consistently stressed the importance of not changing things too drastically and taking care not to change the things people currently love about the show and other related content. The evaluation team at REA synthesized focus group notes and preliminary summaries to establish the following list of findings.

✦ **The way in which a story is told matters to listeners.**
Radiolab listeners appreciate the way that stories unfold over time and incorporate elements of suspense. They find that they are able to make emotional connections with the characters or content of the stories and that helps to draw them in. The focus group participants also felt that the audio nature of Radiolab programming lends itself to an ability to focus deeply on the content and engage in thoughtful reflection.

Focus group participants asserted that Radiolab helps to foster greater interest in science.

✦ **Radiolab stimulates greater interest and awareness of science.**
Focus group participants suggested that they didn't necessarily listen to Radiolab because they are highly interested in science; instead, Radiolab helps to foster greater interest in science. Listeners are also

Focus group participants found science content within Radiolab to be accessible and engaging to lay audience.

Listeners don't learn because Radiolab sets out to teach them something; listeners learn because the program makes them want to learn.

gaining exposure to a wide variety of different scientific pursuits and discoveries.

✦ **Radiolab listeners are appreciative that the scientific content is highly accessible to, and engaging for, lay audiences.**
Focus group participants praised Radiolab for the extent to which it is fully accessible and engaging to people who have not studied science extensively or trained to be scientists. Concepts and terms are explained in ways that help listeners to understand the gist of things without getting bogged down in details that are too technical.

✦ **Radiolab hosts and guests help to make the science content interesting and understandable.**
Radiolab hosts and guests help to make the science content interesting and understandable. Jad Abumrad and Robert Krulwich, hosts of the Radiolab radio and podcast program, model a process of science discovery that includes presenting an interesting question, proposing hypotheses and/or theories, then having to reform or retool these hypotheses based on what they discover. They seem genuinely curious—and that, in turn, helps to foster a sense of curiosity within listeners.

✦ **Listeners feel that the Radiolab format helps to foster independent thought.**
Focus group participants like the fact that the program presents information and allows listeners to draw conclusions for themselves. In this way, the program is well-suited to fostering interest in topics in ways that more expository programs cannot. Rather than seeming to have an overt educational mission or objective, Radiolab is perceived to be more generally about interesting stories that stimulate curiosity. Listeners don't learn because Radiolab sets out to teach them something; listeners learn because the program makes them want to learn.

✦ **Radiolab programming inspires action.**
Participants were eager to share things they heard and read about on Radiolab programs, podcasts or the Radiolab website. They also indicate that they are reading books or articles that have been recommended by Radiolab—admittedly, reading material that they would not have read were it not for the recommendation. A few examples were also cited by focus group participants of ways that Radiolab programming inspired listeners to consider new careers or academic pursuits.

✦ **Radiolab provides listeners with social capital.**
Focus group participants felt that Radiolab provides questions and interesting topics that help listeners spark conversations. They also felt that the program gave deeper understanding and specific examples of real-world phenomena or events that they could call upon as examples in conversations with others. In other words, focus

group participants felt that Radiolab gives listeners something to talk about, and the skills and knowledge to do so intelligently and in an equally engaging fashion.

✦ **Levels of actual and desired engagement vary from listener to listener.**
Along a continuum of potential levels of engagement, some listeners are content to be more passive, where others are inspired to be more deeply engaged. The audio nature of Radiolab's primary content lends itself to listening in situations where audience members may be multi-tasking (e.g., driving, walking/running, cleaning, etc.). To become more active or engaged with other sources of Radiolab content, focus group participants suggested reminders that could help to push listeners to the website - i.e., a specific invitation or call to action that drives them to visit the website or do some other activity online or in the real world. Focus group participants also suggested specific reminders to check out new content. The participants don't seem to mind it when Radiolab posts content to multiple digital venues (on the website, on Facebook, on Twitter, YouTube etc.). Shorter/smaller chunks of content are seen as being more shareable.

✦ **Radiolab fans suggest more interactive opportunities that invite creativity.**
Focus group participants suggested that specific appeals for feedback or input may help to foster greater engagement. Furthermore, Radiolab seems to attract listeners with innate curiosity and creativity, and as such, the focus group participants felt that future calls-to-action (or interaction) that feature opportunities to be creative would be particularly appealing.

✦ **Focus Group participants welcome opportunities to interact, especially within the context of specific content.**
The Radiolab listeners in the focus groups generally liked the idea of Question and Answer sessions with the program's hosts and featured experts (both synchronously and asynchronously). Furthermore, there seemed to be common interest in enabling listeners to annotate and comment directly on or within episodes (e.g., as users can do with Soundcloud). Lastly, focus group participants expressed appreciation for links to books and other resources related to content featured in a program.

In sum, focus group participants were positive about Radiolab, and felt that the program, along with its many digital offerings, is getting many things right in terms of providing engaging content that fosters greater interest in, and awareness of STEM concepts. While they note that some Radiolab audience members are content to listen passively, they also value and welcome new opportunities to interact, especially in creative ways and within the context of specific content.