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Future of Publishing

YouTube videos of 'research in action' foster diverse public interest in science

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Abstract

Globally, scientific enterprises seek to diversify interest and participation in STEM fields, to both provide equitable opportunities and to push research forward. However, diversity in STEM remains low in many institutions. Internet-based video has emerged as a dominant communication medium that scientists can use to communicate the motivations, process, and products of their work to a diverse, mass audience. Here I describe my use of internet-based video about my research and career as a marine biologist as a tool to inspire broad public interest in science. With my YouTube videos, I have reached a diverse and growing global viewership, amassing >10,000 hours of watch time at the time of this writing. Viewer surveys revealed that my videos have improved individual perceptions about science and science careers, particularly among women and minority groups. I conclude that the emergence of internet-based video as a dominant, ever-expanding communication medium provides an unprecedented but largely untapped opportunity for scientists to broadly communicate their research and to inspire diverse interest in STEM careers.

Keywords: mass science communication; STEM diversity; social media; broader impacts activities; scientific publishing.

Introduction

Science technology, engineering and mathematics (STEM) fields are highly valued by the national and international enterprises they serve, because they give rise to innovations that enhance industry and society. Because of innovative and transformative ideas and collaborations that can emerge from the participation of individuals with underrepresented backgrounds and perspectives (Page 2007, Jackson and Joshi 2011), STEM fields generally place a high premium on the diversity of their professional workforce (Ong et al. 2011, Allen-Ramdial and Campbell 2014, Asai and Bauerle 2016). Furthermore, diversifying interest in and appreciation for STEM fields is a high priority in the United States and in other countries with active research enterprises (Ong et al. 2011, Asai and Bauerle 2016). Diversifying general appreciation for STEM is likely to expand the influence of scientific research on average public opinion and behavior (Jucan and Jucan 2014). This could elicit a positive feedback loop that drives further scientific innovation and allows for new scientific insights to more rapidly and/or intensively influence individual decisions (Gauchat 2015), which, in the case of environmental sciences, can facilitate ecological and economic sustainability.

Despite near-universal expectations that diversification of STEM fields will enhance productivity and innovations, diversity in STEM fields generally remains low, with women and minority groups occupying disproportionately few top positions in active research fields (National Science Foundation 2015, Asai and Bauerle 2016). There are multiple mechanisms that likely contribute to this pattern, including: 1) historical disenfranchisement of women and minority groups (i.e., generally low precedents of involvement), and 2) socioeconomic limitations of minority groups, including poorer educational facilities and opportunities and fewer resources (Ong et al. 2011, Allen-Ramdial and Campbell 2014). Under such scenarios, a student's understanding of the inquiry-based process of science or what STEM careers offer to individuals and society can be severely hindered, and this can push individuals away from considering STEM fields early on. Thus, unconventional educational approaches may be necessary to showcase the scientific process to many otherwise disinterested individuals, particularly those from groups traditionally underrepresented in STEM fields.

Internet-based video has reached unparalleled levels of popularity among a diverse, international audience (Burgess and Green 2013, Brain 2016). Leading this charge is YouTube, which provides free, on-demand videos that are interactive and globally accessible (Burgess and Green 2013). Despite the incredible volumes of daily video uploads, estimated at 300 hours per minute on YouTube alone (Brain 2016), there remains a dearth of web-based videos that showcase the process of actual scientific research (i.e., science 'behind the scenes') or, perhaps even more poorly understood, careers in science. Freely accessible internet-based video could provide a simple, yet powerful and inclusive tool for scientists to use to communicate directly with large, diverse swaths of the public. Here, I present the results of my use of internet-based videos (hosted on YouTube) that showcase my research and career as a marine biologist.

Methods

YouTube channels

I created and launched two YouTube channels, one "Mike Gil" in May 2012, and the other "SciAll.org" in September 2015. I have used both of these channels to post videos pertaining exclusively to my career as a marine biologist, with video content centered on a 'behind-the-scenes' perspective of my field-based research on the ecology and conservation of tropical coral reefs in Mexico, French Polynesia and Southeast Asia. My first channel is comprised of minimally-curated video clips collected during field research (e.g., unique sightings, animal encounters, field deployments, etc.), combined with recorded conference talks and invited seminars. The results of this first YouTube channel motivated my creation of a second YouTube channel, with a more directed focus on 'getting the secret about science out'. With this new channel, I have created and regularly contribute new videos, mostly in a narrated 'vlog-style' ('vlog' = 'video log', akin to 'blog', short for 'weblog'), to 4 separate series: "Confessions of a Marine Biologist" (featuring field research stories), "Misconceptions" (about science), "Expeditions" (ad-hoc videos while in the field), and "From the (sea) horse's mouth" (general commentary on science and science careers). Generally, these videos are logistically simple and inexpensive to shoot and process, and much of the footage I use I gather while conducting research in the field, often with an entry-level GoPro™ video camera (<$200 USD), or I record onto an iPhone™, DSLR camera, or simple point-and-shoot camera (today, entry-level point-and-shoot cameras under $100 USD shoot high-definition video). Once the video is shot, the simple cuts and minimal effects I use in my videos are well-accommodated by entry-level video editing software, including free, downloadable programs like Lightworks™, Shotcut™ and HitFilm Express™.

Video Analytics & Viewer Surveys

YouTube provides free analytics that I used to summarize information about viewer data. In addition to these analytics, I collected my own viewer data by administering voluntary viewer surveys, which I created for free using SurveyMonkey.com, and I placed links to these surveys in the text descriptions of my videos. I did this first for the most popular video from my original channel, beginning on May 13, 2013, and I administered the same survey questions for each video (at the time of each release) for my second channel, 'SciAll.org'. These viewer surveys assess self-reported changes in perceptions about science and scientists. It is important to note that it would be ideal to directly measure perceptual changes by comparing individual responses between surveys administered before and after the individual was exposed to the content. However, such an approach is not yet practical to administer to casual viewers on YouTube.

Results

Video Analytics

I created and published 26 videos on my YouTube channel 'Mike Gil' between May 12, 2012 and March 19, 2017 and 61 videos on my second YouTube channel 'SciAll.org' between September 2, 2015 and March 19, 2017. The content of all these videos centers on my research and/or my career as a scientist. YouTube Analytics reported in this section are from the time period from May 12, 2012 to March 19, 2017, unless otherwise noted. These analytics revealed that, collectively, my YouTube videos have been watched for 641,952 minutes (equal to 10,699 hours, or 445.8 days; watch time calculated from September 1, 2012 [earliest date this feature was added by YouTube] to March 19, 2017). Of this total watch time, nearly equal percentages came from females and males (47.7% and 52.3%, respectively), and the demographics of viewers generally skewed toward college/university-aged individuals, as revealed by the total watch time broken up by the years of age of the viewer: 13 to 17, 15.8%; 18 to 24, 40.6%; 25 to 34, 26.4%; 35 to 44, 9.0%; 45 to 54, 5.0%; 55 to 64, 1.6%; and 65+, 1.5% (Figure 1). However, the ratio of watch

Table 1: Summary of watch time of all of my YouTube videos by country. The majority (85.9%) of watch time resulted from viewers in the 10 countries listed, while the remaining 14.1% of watch time was spread over viewers in an additional 201 countries/regions across all continents (except Antarctica).

Country	Subscribers	Likes	Comments	Playlists	Watch time (minutes)	% of total watch time
United States	2,842	3,241	482	1,271	364,498	56.8
United Kingdom	383	460	71	164	70,895	11.0
Canada	264	230	23	98	67,285	10.5
Australia	122	139	15	47	18,334	2.8
India	52	30	12	33	10,905	1.7
New Zealand	34	35	6	20	5,150	0.8
Mexico	59	44	4	25	4,946	0.8
Brazil	44	75	9	61	4,895	0.8
Philippines	49	54	18	8	4,616	0.7
Other	796	1,075	223	492	90,428	14.1

time between females and males changed with age, with female watch time being greater at the youngest ages but lesser at older ages, relative to male watch time.

Though viewership was dominated by Americans (accounting for 56.8% of total watch time), my videos also reached a broad international audience, including viewers from 211 different countries/geographic regions (see summary of leading countries by watch time in Table 1). Collectively, my YouTube videos received various forms of engagement from the audience. My channels received 4,645 subscriptions from viewers; these subscriptions are free and simply provide subscribers with alerts when a new video is published to the channel. In addition, my videos received 5,383 'Likes' and 863 comments (note: less than half of these comments were posted by me in response to viewer questions, which I attempt to answer as frequently as possible), and one of my videos was added by a viewer to his/her personal video playlist on 2,219 occasions.

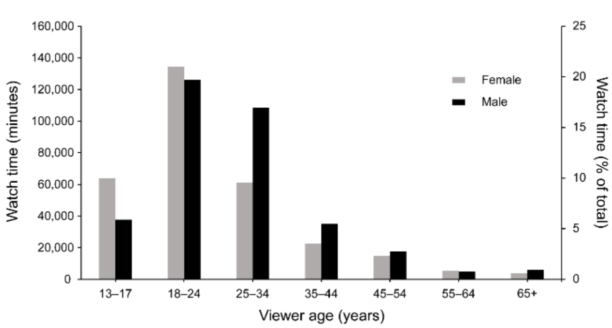

Figure 1. YouTube analytics showing the absolute and relative contribution of gender and age group to total watch time for all of my science outreach videos combined.

Viewer Surveys

Voluntary surveys were completed by a diverse public viewership: out of 530 total surveys completed by March 19, 2017, 320 (60.4%) respondents identified as female, 333 (62.8%) identified as being from the United States of America, while 190 (35.8%) identified as being from a country/region other than the USA. Of the 333 American respondents, 101 (19.1%) identified as being a member of one or more minority groups, including African Americans (28; 5.3% of total), Hispanics (68; 12.8% of total), Native Americans (12; 2.3% of total) and Pacific Islanders (8; 1.5 % of total; Figure 2 [top]). It is not possible to know how many unique individuals completed these 530 surveys, but 517 unique IP addresses were used. While multiple individuals could have used the same IP address or a single individual could have used multiple IP addresses, these outcomes are likely uncommon and these results generally suggest that for the vast majority (97.5%) of the 530 surveys a unique individual completed each survey.

Underrepresented groups in STEM, including females and minorities, responded more positively to videos; exceeding the percentage of responses by non-female, non-minority individuals in 10 out of 10 'positive' answer categories (Figure 2 [top], Table A1). A slight majority of individuals from both underrepresented and non-underrepresented groups indicated that one of the videos made them consider science as a career path more than before (non-female, non-minority: 50.8%, female: 50.9%, minority: 53.5%; Figure 2 [top], Table A2). Younger respondents and respondents that had completed less formal science education were more common (with the exception of individuals age 12 and under or individuals with no formal science education) and generally had stronger positive reactions to the

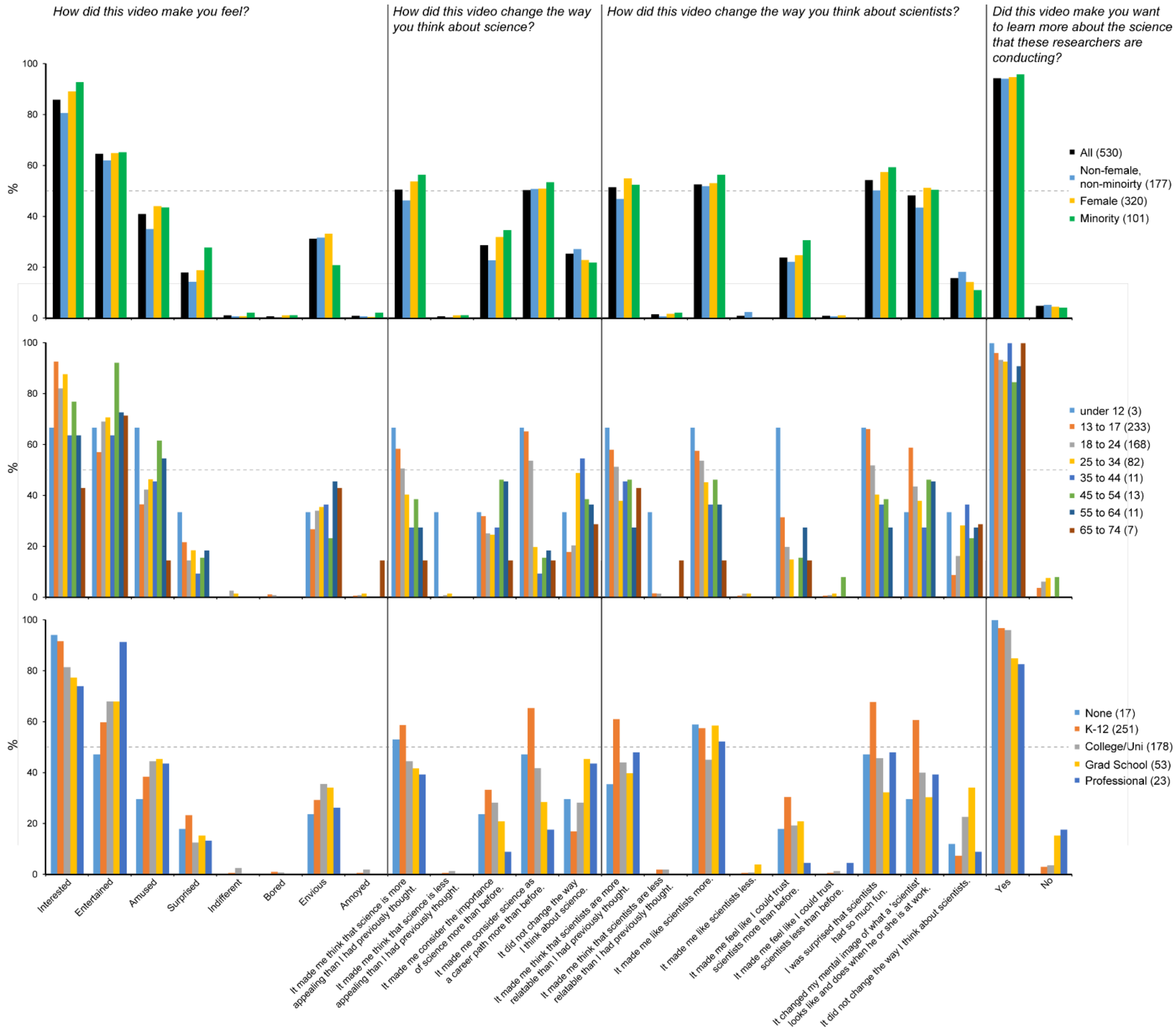

Figure 2. Results from voluntary viewer surveys on the impact of web-based (YouTube) videos about my research and career in science on public perception of science and scientists, broken up by racial, ethnic, and gender identity (top), age (middle), and level of science education (bottom). Numbers in parentheses in the legends denote the number of respondents in each category. These results, including raw counts and percentages, are also presented in Tables A1-A4.

videos (Figure 2 [middle, top], Table A1–A4). There were zero respondents in the ’75 years of age and older’ category. The vast majority of respondents, regardless of racial/ethnic background, age, or level of science education, indicated that one of the videos made them want to learn more about the research that the featured scientists are conducting (Figure 2 [right], Table A4).

Discussion

By creating YouTube videos that showcase my field-based scientific research and, more generally, my career as a professional scientist studying marine ecology and conservation, I have been able to communicate the process and purpose of science to large, diverse public audiences around the world. In addition, voluntary surveys associated with my videos indicated that across racial, ethnic, and gender identities, as well as across ages and educational backgrounds, my videos elicited positive feelings from viewers that—as a result of watching—became more interested in, and appreciative of science and scientists. Many viewers who completed surveys, particularly minorities, also became more interested in science careers after watching my videos (Figure 2, Table A2). It is also important to note that the percentages of minority participation in my voluntary viewer surveys exceeded percentages of minority groups in the United States’ science and engineering workforce, which, in 2013, was composed of <5% African Americans, 6% Hispanics and 2% Native Americans or Pacific Islanders (as a reference, these groups accounted for 12.6 %, 16.4%, and 2.4%, respectively, of the non-institutionalized resident population of the United States, ages 18–64, in 2012; National Science Foundation 2015).

With the assistance of the unprecedented power of social media to disseminate content, including new scientific findings (Darling et al. 2013), web-based video has the potential to rapidly influence an extensive culturally and geographically diverse viewership. Here, I show that simple, ‘low-tech’ videos can result in self-reported changes in perceptions about science and scientists, particularly among groups underrepresented in STEM fields. This medium can not only connect scientists and their specific work to broad audiences that range from non-scientists to colleagues (e.g., Figure 2 [bottom], Table A1-A4), but it can be a more efficient, complementary communication tool, relative to traditional approaches in science. To illustrate this point, let us consider a hypothetical professional scientist that diligently delivers an average of two professional conference talks per year (e.g., a standard conference oral presentation of 12 minutes, followed by a 3-minute Q&A period) or an average of one seminar (50-minute oral presentation, followed by a 10-minute Q&A period) every two years. Over a 50-year career (e.g., from the age of 25 to 75), if this scientist achieves an average audience of 100 attendees per talk (a high average for many scientists) at 100 conference talks or 25 seminars (or a combination of these two types), this would result in a total watch time of 150,000 minutes. Not including the watch time that arises from frequent online Q&A exchanges elicited by viewers, over less than 5 years, my 87 YouTube videos have achieved a combined total watch time that is equivalent to 4.3 lifetimes of the diligent scientist using standard talks as his or her sole medium for science communication, beyond the compulsory publication of peer-reviewed scientific articles. Of course, the audiences at scientific conferences and seminars could be quite different than audiences for online videos, depending on the audience the videos are intended to target. Nonetheless, freely-accessible online video showcasing science at various levels (e.g., to communicate to the public or to professionals) has the potential to reach large, diverse audiences much more efficiently than traditional science-communication approaches, such as talks at conferences or in K-12 classrooms.

With >1.3 billion users of YouTube alone (Brain 2016), the popularity of web-based video is forecasted to continue to grow rapidly (Burgess and Green 2013). This exciting global medium provides an unprecedented opportunity for communicators of all types to reach previously unreachable numbers and demographics of viewers. Moreover, a recent content analysis of 390 YouTube videos from 39 separate science communication channels revealed that user-generated content was significantly more popular than professionally generated content, and videos featuring consistent science communicators were more popular than videos without a regular communicator (Welbourne and Grant 2016). Therefore, individual scientists should give strong consideration to web-based video as a means to not only broaden interest in and exposure of their own research, but to foster diverse public interest in science in general, potentially increasing the diversity in future cohorts of STEM professionals.

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Appendix

Table A1. Results from voluntary viewer surveys on the impact of web-based (YouTube) videos about my research and career in science on public perception of science and scientists. Reported below are responses to the question "How did this video make you feel?", with raw numbers of respondents reported and percentages of totals for each group reported in parentheses.

			How did this video make you feel?								
Category	**Group**	**Total**	**Interested**	**Entertained**	**Amused**	**Surprised**	**Indifferent**	**Bored**	**Envious**	**Annoyed**
None	*All*	530 (100.00)	456 (86.04)	343 (64.72)	217 (40.94)	95 (17.92)	5 (0.94)	3 (0.57)	165 (31.13)	4 (0.75)
Gender, race, ethnicity	*Non-female, non-minority*	177 (33.40)	143 (80.79)	110 (62.15)	62 (35.03)	25 (14.12)	1 (0.56)	0 (0.00)	56 (31.64)	1 (0.56)
	Female	320 (60.38)	286 (89.38)	208 (65.00)	141 (44.06)	60 (18.75)	2 (0.63)	3 (0.94)	106 (33.13)	1 (0.31)
	Minority	101 (19.06)	94 (93.07)	66 (65.35)	44 (43.56)	28 (27.72)	2 (1.98)	1 (0.99)	21 (20.79)	2 (1.98)
	African American	28 (5.28)	26 (92.86)	15 (53.57)	10 (35.71)	5 (17.86)	0 (0.00)	1 (3.57)	4 (14.29)	0 (0.00)
	Hispanic	68 (12.83)	64 (94.12)	44 (64.71)	29 (42.65)	20 (29.41)	2 (2.94)	0 (0.00)	14 (20.59)	2 (2.94)
	Native American	12 (2.26)	12 (100.00)	11 (91.67)	7 (58.33)	4 (33.33)	0 (0.00)	0 (0.00)	2 (16.67)	0 (0.00)
	Pacific Islander	8 (1.51)	7 (87.50)	5 (62.50)	4 (50.00)	2 (25.00)	0 (0.00)	0 (0.00)	2 (25.00)	0 (0.00)
Highest level of education in science (so far)	*None at all*	17 (3.21)	16 (94.12)	8 (47.06)	5 (29.41)	3 (17.65)	0 (0.00)	0 (0.00)	4 (23.53)	0 (0.00)
	I took/am taking science classes in school (e.g., K-12)	251 (47.36)	230 (91.63)	150 (59.76)	96 (38.25)	58 (23.11)	1 (0.40)	2 (0.80)	73 (29.08)	1 (0.40)
	I took/am taking science classes in college/university	178 (33.58)	145 (81.46)	121 (67.98)	79 (44.38)	22 (12.36)	4 (2.25)	1 (0.56)	63 (35.39)	3 (1.69)
	I studied/am studying science in graduate school	53 (10.00)	41 (77.36)	36 (67.92)	24 (45.28)	8 (15.09)	0 (0.00)	0 (0.00)	18 (33.96)	0 (0.00)
	I am a scientific researcher	23 (4.34)	17 (73.91)	21 (91.30)	10 (43.48)	3 (13.04)	0 (0.00)	0 (0.00)	6 (26.09)	0 (0.00)
Years of age	*under 12*	3 (0.57)	2 (66.67)	2 (66.67)	2 (66.67)	1 (33.33)	0 (0.00)	0 (0.00)	1 (33.33)	0 (0.00)
	12 to 17	233 (43.96)	216 (92.70)	133 (57.08)	85 (36.48)	50 (21.46)	0 (0.00)	2 (0.86)	62 (26.61)	1 (0.43)
	18 to 24	168 (31.70)	138 (82.14)	116 (69.05)	71 (42.26)	24 (14.29)	4 (2.38)	1 (0.60)	57 (33.93)	1 (0.60)
	25 to 34	82 (15.47)	72 (87.8)	58 (70.73)	38 (46.34)	15 (18.29)	1 (1.22)	0 (0.00)	29 (35.37)	1 (1.22)
	35 to 44	11 (2.08)	7 (63.64)	7 (63.64)	5 (45.45)	1 (9.09)	0 (0.00)	0 (0.00)	4 (36.36)	0 (0.00)
	45 to 54	13 (2.45)	10 (76.92)	12 (92.31)	8 (61.54)	2 (15.38)	0 (0.00)	0 (0.00)	3 (23.08)	0 (0.00)
	55 to 64	11 (2.08)	7 (63.64)	8 (72.73)	6 (54.55)	2 (18.18)	0 (0.00)	0 (0.00)	5 (45.45)	0 (0.00)
	65 to 74	7 (1.32)	3 (42.86)	5 (71.43)	1 (14.29)	0 (0.00)	0 (0.00)	0 (0.00)	3 (42.86)	1 (14.29)

Table A2. Results from voluntary viewer surveys on the impact of web-based (YouTube) videos about my research and career in science on public perception of science and scientists. Reported below are responses to the question "How did this video change the way you think about science?", with raw numbers of respondents reported and percentages of totals for each group reported in parentheses.

Category	Group	Total	***How did this video change the way you think about science?***				
			It made me think that science is more appealing than I had previously thought.	**It made me think that science is less appealing than I had previously thought.**	**It made me consider the importance of science more than before.**	**It made me consider science as a career path more than before.**	**It did not change the way I think about science.**
None	All	530 (100.00)	268 (50.57)	3 (0.57)	152 (28.68)	267 (50.38)	134 (25.28)
Gender, race, ethnicity	*Non-female, non-minority*	177 (33.4)	82 (46.33)	0 (0.00)	40 (22.60)	90 (50.85)	48 (27.12)
	Female	320 (60.38)	172 (53.75)	3 (0.94)	102 (31.88)	163 (50.94)	73 (22.81)
	Minority	101 (19.06)	57 (56.44)	1 (0.99)	35 (34.65)	54 (53.47)	22 (21.78)
	African American	28 (5.28)	15 (53.57)	0 (0.00)	6 (21.43)	14 (50.00)	5 (17.86)
	Hispanic	68 (12.83)	35 (51.47)	1 (1.47)	26 (38.24)	38 (55.88)	17 (25.00)
	Native American	12 (2.26)	6 (50.00)	0 (0.00)	4 (33.33)	8 (66.67)	3 (25.00)
	Pacific Islander	8 (1.51)	4 (50.00)	0 (0.00)	1 (12.50)	5 (62.50)	1 (12.50)
Highest level of education in science (so far)	None at all	17 (3.21)	9 (52.94)	0 (0.00)	4 (23.53)	8 (47.06)	5 (29.41)
	I took/am taking science classes in school (e.g., K-12)	251 (47.36)	147 (58.57)	1 (0.40)	83 (33.07)	164 (65.34)	42 (16.73)
	I took/am taking science classes in college/university	178 (33.58)	79 (44.38)	2 (1.12)	50 (28.09)	74 (41.57)	50 (28.09)
	I studied/am studying science in graduate school	53 (10.00)	22 (41.51)	0 (0.00)	11 (20.75)	15 (28.30)	24 (45.28)
	I am a scientific researcher	23 (4.34)	9 (39.13)	0 (0.00)	2 (8.70)	4 (17.39)	10 (43.48)
Years of age	under 12	3 (0.57)	2 (66.67)	1 (33.33)	1 (33.33)	2 (66.67)	1 (33.33)
	12 to 17	233 (43.96)	136 (58.37)	0 (0.00)	74 (31.76)	152 (65.24)	41 (17.60)
	18 to 24	168 (31.70)	85 (50.60)	1 (0.60)	42 (25.00)	90 (53.57)	34 (20.24)
	25 to 34	82 (15.47)	33 (40.24)	1 (1.22)	20 (24.39)	16 (19.51)	40 (48.78)
	35 to 44	11 (2.08)	3 (27.27)	0 (0.00)	3 (27.27)	1 (9.09)	6 (54.55)
	45 to 54	13 (2.45)	5 (38.46)	0 (0.00)	6 (46.15)	2 (15.38)	5 (38.46)
	55 to 64	11 (2.08)	3 (27.27)	0 (0.00)	5 (45.45)	2 (18.18)	4 (36.36)
	65 to 74	7 (1.32)	1 (14.29)	0 (0.00)	1 (14.29)	1 (14.29)	2 (28.57)

Table A3. Results from voluntary viewer surveys on the impact of web-based (YouTube) videos about my research and career in science on public perception of science and scientists. Reported below are responses to the question "How did this video change the way you think about scientists?", with raw numbers of respondents reported and percentages of totals for each group reported in parentheses.

			How did this video change the way you think about scientists?							
Category	**Group**	**Total**	**It made me think that scientists are more relatable than I had previously thought.**	**It made me think that scientists are less relatable than I had previously thought.**	**It made me like scientists more.**	**It made me like scientists less.**	**It made me feel like I could trust scientists more than before.**	**It made me feel like I could trust scientists less than before.**	**I was surprised that scientists had so much fun.**	**It changed my mental image of what a 'scientist' looks like and does when he or she is at work.**
None	*All*	530 (100.00)	273 (51.51)	7 (1.32)	279 (52.64)	4 (0.75)	126 (23.77)	4 (0.75)	288 (54.34)	256 (48.30)
Gender, race, ethnicity	*Non-female, non-minority*	177 (33.40)	83 (46.89)	1 (0.56)	92 (51.98)	4 (2.26)	39 (22.03)	1 (0.56)	89 (50.28)	77 (43.50)
	Female	320 (60.38)	176 (55.00)	5 (1.56)	170 (53.13)	0 (0.00)	79 (24.69)	3 (0.94)	184 (57.50)	164 (51.25)
	Minority	101 (19.06)	53 (52.48)	2 (1.98)	57 (56.44)	0 (0.00)	31 (30.69)	0 (0.00)	60 (59.41)	51 (50.50)
	African American	28 (5.28)	12 (42.86)	0 (0.00)	13 (46.43)	0 (0.00)	6 (21.43)	0 (0.00)	18 (64.29)	11 (39.29)
	Hispanic	68 (12.83)	35 (51.47)	2 (2.94)	38 (55.88)	0 (0.00)	20 (29.41)	0 (0.00)	38 (55.88)	35 (51.47)
	Native American	12 (2.26)	6 (50.00)	0 (0.00)	9 (75.00)	0 (0.00)	7 (58.33)	0 (0.00)	7 (58.33)	9 (75.00)
	Pacific Islander	8 (1.51)	3 (37.50)	0 (0.00)	3 (37.50)	0 (0.00)	2 (25.00)	0 (0.00)	2 (25.00)	4 (50.00)
Highest level of education in science (so far)	*None at all*	17 (3.21)	6 (35.29)	0 (0.00)	10 (58.82)	0 (0.00)	3 (17.65)	0 (0.00)	8 (47.06)	5 (29.41)
	I took/am taking science classes in school (e.g., K-12)	251 (47.36)	153 (60.96)	4 (1.59)	144 (57.37)	1 (0.40)	76 (30.28)	1 (0.40)	170 (67.73)	152 (60.56)
	I took/am taking science classes in college/university	178 (33.58)	78 (43.82)	3 (1.69)	80 (44.94)	1 (0.56)	34 (19.10)	2 (1.12)	81 (45.51)	71 (39.89)
	I studied/am studying science in graduate school	53 (10.00)	21 (39.62)	0 (0.00)	31 (58.49)	2 (3.77)	11 (20.75)	0 (0.00)	17 (32.08)	16 (30.19)
	I am a scientific researcher	23 (4.34)	11 (47.83)	0 (0.00)	12 (52.17)	0 (0.00)	1 (4.35)	1 (4.35)	11 (47.83)	9 (39.13)
Years of age	*under 12*	3 (0.57)	2 (66.67)	1 (33.33)	2 (66.67)	0 (0.00)	2 (66.67)	0 (0.00)	2 (66.67)	1 (33.33)
	12 to 17	233 (43.96)	135 (57.94)	3 (1.29)	134 (57.51)	1 (0.43)	73 (31.33)	1 (0.43)	154 (66.09)	137 (58.80)
	18 to 24	168 (31.70)	86 (51.19)	2 (1.19)	90 (53.57)	2 (1.19)	33 (19.64)	1 (0.60)	87 (51.79)	73 (43.45)
	25 to 34	82 (15.47)	31 (37.80)	0 (0.00)	37 (45.12)	1 (1.22)	12 (14.63)	1 (1.22)	33 (40.24)	31 (37.80)
	35 to 44	11 (2.08)	5 (45.45)	0 (0.00)	4 (36.36)	0 (0.00)	0 (0.00)	0 (0.00)	4 (36.36)	3 (27.27)
	45 to 54	13 (2.45)	6 (46.15)	0 (0.00)	6 (46.15)	0 (0.00)	2 (15.38)	1 (7.69)	5 (38.46)	6 (46.15)
	55 to 64	11 (2.08)	3 (27.27)	0 (0.00)	4 (36.36)	0 (0.00)	3 (27.27)	0 (0.00)	3 (27.27)	5 (45.45)
	65 to 74	7 (1.32)	3 (42.86)	1 (14.29)	1 (14.29)	0 (0.00)	1 (14.29)	0 (0.00)	0 (0.00)	0 (0.00)

Table A4. Results from voluntary viewer surveys on the impact of web-based (YouTube) videos about my research and career in science on public perception of science and scientists. Reported below are responses to the question "Did this video make you want to learn more about the science these researchers are conducting?", with raw numbers of respondents reported and percentages of totals for each group reported in parentheses.

			Did this video make you want to learn more about the science that these researchers are conducting?	
Category	**Group**	**Total**	**Yes**	**No**
None	*All*	530 (100.00)	501 (94.53)	25 (4.72)
Gender, race, ethnicity	*Non-female, non-minority*	177 (33.40)	167 (94.35)	9 (5.08)
	Female	320 (60.38)	304 (95.00)	14 (4.38)
	Minority	101 (19.06)	97 (96.04)	4 (3.96)
	African American	28 (5.28)	27 (96.43)	1 (3.57)
	Hispanic	68 (12.83)	65 (95.59)	3 (4.41)
	Native American	12 (2.26)	12 (100.00)	0 (0.00)
	Pacific Islander	8 (1.51)	8 (100.00)	0 (0.00)
Highest level of education in science (so far)	*None at all*	17 (3.21)	17 (100.00)	0 (0.00)
	I took/am taking science classes in school (K-12 for U.S.)	251 (47.36)	243 (96.81)	7 (2.79)
	I took/am taking science classes in college/university	178 (33.58)	171 (96.07)	6 (3.37)
	I studied/am studying science in graduate school	53 (10.00)	45 (84.91)	8 (15.09)
	I am a scientific researcher	23 (4.34)	19 (82.61)	4 (17.39)
Years of age	*under 12*	3 (0.57)	3 (100.00)	0 (0.00)
	12 to 17	233 (43.96)	224 (96.14)	8 (3.43)
	18 to 24	168 (31.70)	157 (93.45)	10 (5.95)
	25 to 34	82 (15.47)	76 (92.68)	6 (7.32)
	35 to 44	11 (2.08)	11 (100.00)	0 (0.00)
	45 to 54	13 (2.45)	11 (84.62)	1 (7.69)
	55 to 64	11 (2.08)	10 (90.91)	0 (0.00)
	65 to 74	7 (1.32)	7 (100.00)	0 (0.00)