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Science in the Social Media Age: Profiles of Science Blog Readers

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Abstract

Science blogs have become an increasingly important component of the ecosystem of science news on the Internet. Through a survey of 2,955 readers of 40 randomly selected science blogs, we created profiles of science blog users. Super users indicated reading science blogs for a wide range of reasons, including for community-seeking purposes. One-way entertainment users indicated reading blogs more for entertainment and ambiance. Unique information-seeking users indicated reading blogs more for specific information not found elsewhere. But regardless of science blog users' motivations to read, they are sophisticated consumers of science media possessing high levels of scientific knowledge.

Keywords

blog use, science blogs, science journalism, media use

Public understanding of science is vital to our ability to address pressing societal issues such as climate change and public health. The Internet has become a leading source of information on these and other scientific issues (Brossard, 2013), with 60% of Americans indicating it as their top source (Science and Engineering Indicators, 2012). Social media have become an increasingly important component of that Internet-sourced science information (Anderson, Brossard, & Scheufele, 2010; Brossard, 2013). Based on nationally representative online survey data (2,145 respondents), 84% of Americans rely on a mix of formats to acquire information and news about science, while 31% rely equivalently on traditional media channels and

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online-only sources (Su, Akin, Brossard, Scheufele, & Xenos, 2015). Among mixed media users, 7% rely primarily on online-only sources. Blogs have become a leading source of online news for both lay audiences and newsmakers (Colson, 2011), perhaps explained by high levels of perceived credibility (Johnson, Kaye, Bichard, & Wong, 2007; Su et al., 2015). Research on political blogs has shown that bloggers and journalists are interdependent on each other (Meraz, 2011), as opposed to blogs simply amplifying the agenda of traditional media (Heim, 2013; Jae Kook, 2007; Leccese, 2009). From the reader's perspective, blogs provide information and perspectives that are missing from or that supplement traditional media coverage (Anderson et al., 2010; Johnson et al., 2007; Su et al., 2015). These findings related to blog use fit well with updated conceptualizations of uses and gratifications theory (Katz, Blumler, & Gurevitch, 1974; Sundar & Limperos, 2016), where users seek out online content actively and often deliberately (Johnson & Kaye, 2003).

Despite the growing importance of blogs as sources of information and news for active audiences, we know little about science blog users. Scientists, writers, and students have increasingly taken to blogs and other forms of social media to talk about their research (Rainie, Funk, & Anderson, 2015), share expertise, and tell personal stories about science (Jarreau, 2015). The goal of this study was to investigate who reads science blogs and why, and ultimately to help assess the impact of the rise and professionalization of the science blogosphere within the last decade. Through a readership survey of 40 randomly selected science blogs, we sought to uncover the motivations that drive blog use and to create profiles of science blog users. This study addresses a gap in peer-reviewed literature on the reach, purpose, and impact of science blogs from the reader's perspective.

Related Literature

Overview of Science Blogs and Science Blog Use

Blogs are platforms and tools for online self-publication and interaction that "combine news and information with self-expression" (Kaye, 2005, p. 74). A science blog features content that disseminates, explains, comments upon, investigates, aggregates, or otherwise deals with science, scientific research, science communication, science policy, science in society, and/or other science-related concepts or events (Jarreau, 2015; Wilkins, 2008). Blogs allow scientists and science communicators to interact with subject experts as well as audiences outside of the scientific community (Batts, Anthis, & Smith, 2008; Bonetta, 2007; Colson, 2011) and to re-contextualize scientific discoveries for the public sphere (Luzón, 2013).

A small number of studies have investigated the potential audiences of science blogs. Researchers interviewed seven of the most popular science bloggers in 2011, concluding that they are generally writing first to please themselves and second for readers already interested in science (Ranger & Bultitude, 2014). Subsequent studies have broadened this perspective. A 2014 survey of more than 600 science bloggers revealed that a majority have in mind either a science-interested non-specialist

audience (53% of bloggers) or a non-specialist general audience (19% of bloggers; Jarreau, 2015). However, published literature on the subject of science blogs has focused on the content of these blogs as well as the characteristics and practices of the bloggers themselves (Kjellberg, 2010; Mahrt & Puschmann, 2014; Ranger & Bultitude, 2014; Shema, Bar-Ilan, & Thelwall, 2012; Trench, 2012; Walejko & Ksiazek, 2010) more often than it has focused on readers. Existing readership assessment has often come from science bloggers themselves via in-house surveys of readers (Thaler et al., 2012) and superficial web analytics (Blanchard, 2011). We seek to address this research gap with the present study.

Blog Use and Users

Previous literature on blog use in general provides context for our study of science blogs in particular. In 2008, a Pew Internet tracking survey found that a total of 33% of Internet users read blogs, with 11% of users doing so daily. A 2010 Pew Internet report (Zickuhr, 2010) found that 49% of teens and 43% of Millennials read blogs, and 61% of online adults above 18 years of age use social networking sites.

Kaye (2010) found that users of a wide range of blogs tend to be male and highly educated, with a majority reporting some degree of college education. "High end" users tend to find blogs significantly more credible than those who rarely use them (Sweetser, Porter, Chung, & Kim, 2008), and heavier users of blogs tend to be the early adopters of them (Quadir & Chen, 2015). Trust in specific sources is associated with media choice (Johnson & Kaye, 2004). Relevant to blogs written by scientific experts, "people place high expectations on science writers who possess the knowledge and skill to correct the myths and overgeneralizations that appear in less credible sources" (Su et al., 2015, p. 5). Science blogs are commonly authored by scientists, thus readers' perceptions of, and trust in, scientists may also influence reliance on science blogs for information and news about science.

Blog Uses and Gratifications

We use the uses and gratifications (U&G) theory to better understand science blog use. This user-based approach assumes that audiences have certain needs that dictate the types of media they select to fulfill those needs (Rubin, 2009). Katz et al. (1974) created the uses and gratifications taxonomy, which concerns

> (1) the social and psychological origins of (2) needs, which generate (3) expectations from (4) the mass media or other sources, which lead to (5) differential patterns of media exposure (or engagement in other activities), resulting in (6) need gratifications and (7) other consequences, perhaps mostly unintended ones. (p. 20)

Although media researchers have used the uses and gratifications approach for more than 40 years to study media use motivations, it became a central method in online studies as it became apparent that users seek out online content by *actively* accessing

the web (Johnson & Kaye, 2003; Sundar & Limperos, 2016). However, most research has not moved beyond using pre-existing measures designed for more traditional forms of media. Sundar and Limperos (2016) point out that newer forms of media may be creating new uses and gratifications and have called on researchers to focus on studying motivation factors that are central to emerging media. Accordingly, we adapt measures of blog use motivations developed by Kaye in 2010 to explore how science blogs may be creating and satisfying the needs of an active audience.

Blog Use Motivations

Based on a series of open-ended and close-ended surveys measuring 56 specific blog use motivation items, Kaye (2010) proposed nine primary motivation factors among blog users. These factors include (a) convenient information seeking; (b) anti-traditional media sentiment; (c) expression/affiliation, or to feel involved and make social connections; (d) guidance/opinion seeking, or to find out about and evaluate one's stance on various issues; (e) blog ambiance, or reading for good writing and to access the personal accounts of the blogger(s); (f) personal fulfillment, or to relax and for entertainment; (g) political debate; (h) variety of opinion; and (i) specific inquiry. Kaye found that the top reasons for using blogs fall under convenient information seeking, where blogs are "a convenient way to actively seek up-to-date and in-depth information about current issues [provided by experts]" (Kaye, 2010, p. 199) and anti-traditional media sentiment. Other researchers have also established the desire for (efficient) information seeking as well as the desire for entertainment to be major motivations for blog usage (Liao, To, & Liu, 2013; Park, Soo Kyoung, & Hae Jung, 2010). Perhaps particularly applicable to science blogs, users access blogs purposively for specific inquiry on an issue or topic, often as a supplement to other media (Kaye, 2010).

For the current study, we have selected among Kaye's motivation items those that might apply particularly to science blog use. These include items classified under convenient information seeking, anti-traditional media sentiment, expression/affiliation, opinion seeking, blog ambiance, personal fulfillment, and specific inquiry.[1]

In the current study, we also seek to characterize and create user profiles based on motivations to use science blogs, and then to investigate demographic, media use, and scientific knowledge patterns across different groups of users. Previous research suggests that Internet users with different levels of education and other varying demographic characteristics have different motivations for accessing information online (Bonfadelli, 2002).

Scientific Knowledge and Media Use

In a nationally representative survey of U.S. adults in 2014, the Pew Research Center found that performance on a general science knowledge quiz depends on education level, gender, age, race, and ethnicity. Men and more educated adults (up to a post-graduate degree level) were able to answer a greater percentage of general science knowledge questions correctly (Funk & Goo, 2015). Previous research also provides

evidence of a relationship between Internet use and readers' levels of scientific knowledge (Anderson et al., 2010; Brossard, 2013; Cacciatore, Scheufele, & Corley, 2014; Su et al., 2015) although these studies have rarely focused on the users of specific media platforms such as blogs (Kershaw, 2010). Via a 2010 nationally representative online survey of more than 2,000 respondents, Su and colleagues (2015) found that general scientific knowledge is positively predicted by higher levels of education, being male, having a science background (science major), and using primarily online-only sources to access information about science. Respondents' science media preferences explained a little below 2% of the variance in scientific knowledge, while demographic variables explained roughly 8%, and scientific background explained a little more than 3% (Su et al., 2015). Subsequent research has shown that Internet use to access science information among low education groups may narrow science knowledge gaps that exist based on different levels of formal education, for example, raising scientific knowledge levels without concomitant increases in education (Cacciatore et al., 2014).

Research Questions and Hypotheses

The following are the primary research questions that this study addresses:

RQ1: Who reads science blogs?

To evaluate impact of science blogs, we need to know not just the scale of the readership, but who is reading. We asked blog readers to self-report various demographic and activity characteristics that are otherwise difficult to evaluate using web metrics, including education, employment status, occupational area, scientific experience, and broader science media use patterns.

RQ2: What motivations drive science blog use?

Although existing research has investigated motivations for blog use in general (Kaye, 2010), we believe it is worthwhile to investigate the motivations for science blog use in particular (Rubin, 2009; Sundar & Limperos, 2016). Science blogs feature content that is unique from the content of other types of blogs in its source, where a majority of science blogs are written by STEM subject experts, and its tone, where science bloggers express a strong commitment to scientific accuracy, transparency, and completeness (Jarreau, 2015). We adapt Kaye's (2010) motivation scales in a survey of the readers of 40 randomly selected science blogs. We also characterize science blog readers by overarching patterns in their motivations to use these blogs. We do this by investigating whether there is a typology of science blog use, and whether different types of users based on this typology differ in their scientific knowledge (see **RQ4**), their extent of blog use and their perceptions of scientists.[2]

RQ3: What is the relationship between science blog use and broader science media use?

According to media complementarity theory, audiences often rely on multiple platforms to get information on a specific topic, for example, science, and may use both traditional and new media as complementary sources of information (Chyi, Yang, Lewis, & Zheng, 2010; Su et al., 2015; Yuan, 2011). While some online science writers have previously suggested that science blogs may supplant, displace, or replace traditional science journalism (Brumfiel, 2009), others have found little evidence supporting this claim (Brown, 2014). In this study, we ask, what other sources are science blog readers turning to for science-related information, and to what degree? Kaye (2010) also found that blog users indicate relatively rarely using blogs for the purpose of gleaning information for their own blogs, busting the myth that most readers are simply other bloggers. However, science bloggers have regularly questioned whether blog readers are largely their fellow bloggers (Anthes, 2011; Yong, 2011). Do science blog readers tend to be content sharers and producers, or are they primarily acting as one-way consumers (Kershaw, 2010)? We asked science blog readers to provide information about their participation in science-related social media.

RQ4: What is the relationship between motivations to use science blogs and general scientific knowledge?
H1: Science blog use is positively associated with general scientific knowledge.

Previous research has established a relationship between the use of online-only sources to access information about science and greater scientific knowledge (Anderson et al., 2010). Yoo and de Zúñiga (2014) found that blog use among U.S. adults, but not Facebook or Twitter use, is directly associated with greater political issue knowledge. The authors attribute this increase in issue knowledge among less-educated groups to the fact that blogs "offer softened content of political news" (Yoo & de Zúñiga, 2014, p. 43). Based upon these findings and established associations between Internet use and scientific knowledge levels, we propose that science blog use is associated with greater general scientific knowledge (**H1**). We also investigate how science blog use motivations are associated with general scientific knowledge (**RQ4**), because different motivations may lead to different uses of science blogs with consequences for any associated changes in general scientific knowledge.

Method

Sampling

From a randomized list of 591 science bloggers collected via a previous study on science blogging habits (Jarreau, 2015), we randomly selected active blogs for which to survey readers. We considered a total of 87 bloggers for potential inclusion in this study, with the goal of capturing 40 to 50 unique blogs. Some bloggers declined to participate, and others were disqualified because of a lack of activity over the past 3 months. Of the 40 blogs in our final sample, including 43 individual bloggers, 18 were independently maintained blogs written by a single author, eight were independently

maintained blogs written by multiple authors, seven were news media network blogs (e.g., blogs hosted by a science magazine such as *Popular Science* or *Discover*; Jarreau, 2015), and seven were other network blogs (e.g., blogs from SciLogs.com, All-Geo blog network, PLOS Blogs network). For this study, we wanted to assess the readership of science blogs on a broad scale, not simply the readership of highly popular science blogs. Of the 43 bloggers participating in this reader survey, 33 self-reported getting 1,000 views on a typical blog post within the first one to two days after publication; five self-reported getting between 1,000 and 5,000 views; and two self-reported getting 5,000+ views. Of the 43 bloggers, 25 are female (58%), 24 were involved in academic or non-academic research at the time of the readership survey (56%), and 12 have earned money for their blogging (28%).

Data Collection

We collected data on science blog readership via a survey launched on each of the 40 blogs included in this study, with the help of the bloggers. The bloggers posted the survey link with a brief endorsement of our study for the duration of data collection (October 19, 2015, to November 20, 2015). We also encouraged bloggers to email the survey announcement to their subscribers if possible, to share it via social media channels connected to their blog, and to include a survey announcement/link in the sidebar of their blog site if appropriate. At least 33 of the 40 blogs posted a notice about the survey at the bottom of multiple blog posts over the course of the data collection period. To account for cross-over of readership between these blogs, we encouraged respondents, in our survey questionnaire introduction text, to respond to our survey more than once if answering for different blogs.

Upon survey closing, we had 2,747 completed survey responses and 229 partial responses. Following data cleaning,[3] we were left with a total of 2,955 responses (including all completed responses as well as partial[4] but substantially completed responses) for final data analysis.

Response Rate Estimate

Halfway through our period of data collection, and again at the conclusion, 29 bloggers sent us their page-view statistics. Based on these statistics and the number of submitted survey responses for each blog, we estimated an average response rate of 12% across all blogs, ranging from less than 1% to more than 50%. The wide range in individual response rates is likely due to the wide range of traffic to the 40 different blogs. For blogs with large numbers of post views, the response rate may be low and/or an underestimate due to many readers clicking through but not spending enough time to see a notice about the readership survey. A complication in calculating response rate to our survey was the possibility of duplication of users reading multiple blogs promoting our survey. However, we had only 34 survey responses total where a respondent indicated having previously answered our survey for another blog (with nine missing responses). Thus, duplication of survey respondents across the science blogs we sampled is minimal.

Survey Design

Via an online questionnaire administered in Qualtrics, following an online institutional review board (IRB) consent form, we prompted respondents to select the blog for which they were completing the survey from a pull-down menu (see online supplementary data file for a list of blogs included in the survey). Based on their selection, respondents then answered a series of blog-specific questions, including motivations, and non-blog-specific questions measuring their media and social media use, perceptions of scientists, general science knowledge, and demographic characteristics. We extensively tested all survey questions prior to the official data collection period. We pilot tested the survey on the astronomy and fashion blog STARtorialist written by Summer Ash and Emily Rice (270 completed responses; Ash, Rice, & Jarreau, 2016) and on the physics blog FYFD (f. yeah fluid dynamics) written by Nicole Sharp (359 completed responses).

Measurement

Demographics. We asked respondents to self-report their sex, age, ethnicity, country/region of residence, level of education, occupational status, and occupational area. Each respondent was classified in a single occupational area, according to the primary occupational area code assigned to their open-ended response.

Science blog use motivation items. We asked respondents to indicate their agreement (five-point scale, from *strongly disagree* to *strongly agree*) with a series of 15 different motivation statements adapted from Kaye's (2010) instrument.

Science media use. We asked respondents to indicate on a five-point scale from *never* to *always* how often they actively seek out science-related information online and how often they read news stories related to science. We also asked respondents to rank their primary source of science-related information and to indicate how many blogs they follow on at least an occasional basis. Finally, we asked respondents how often they create their own social media content for a variety of platforms.

Perceptions of scientists. We asked respondents to rate three different word pairs, based on N. T. Feather's scale for measuring attitudes toward high achievers (in Marques, 2010), on a seven-point bipolar adjective scale as to how representative they are of scientists. The word pairs included sociable/unsociable, in touch/out of touch with the average person, and trustworthy/untrustworthy.

Science knowledge. We selected seven different questions from previous Pew Research Center Internet, Science & Tech reports on the U.S. public's knowledge of science (Funk & Goo, 2015) for a quiz of respondents' general scientific knowledge. We asked respondents to rate seven different scientific statements as either true or false, with an additional "I don't know" option. All responses were recoded as either correct or incorrect (including "I don't know").

Results

In the following "Results" section, we first address **RQ1** by describing the demographic and other individual characteristics of science blog readers before further characterizing readers by their science blog use patterns.

Science Blog Reader Demographics

Of 2,912 total survey respondents[5] (not counting duplicate responses from users reading multiple blogs), 55% of respondents indicated they were male (n = 1,604) and 37% indicated they were female (n = 1,089), while a total of 14 respondents indicated "other [sex]" and 26 indicated that they would prefer not to answer. A majority of respondents, or just over 50%, indicated they were 40 years old or older. See Table S1 in our online supplementary data file for a breakdown of respondent age. A majority of respondents indicated a Caucasian ethnicity (n = 2,213, 76%). Of all survey respondents, 58% indicated that they currently reside in the United States (n = 1,700), 6% in Canada (n = 167), 11% in the United Kingdom (n = 323), 7% in Europe (n = 212), and 11% in other countries (n = 315). Respondents tended to be highly educated, with 24% having a master's degree and 21% having a doctorate. Of respondents with at least a 2-year degree, 58% indicated having a degree in a science-related field. See Table S1 in our online supplementary data file for a breakdown of respondent education and professional activity.

A majority of respondents indicated they were either interested in pursuing a career in science (n = 472, 16%) or already pursuing a career in science (n = 1,223, 42%). Only 23% of respondents (n = 674) indicated they were not interested in pursuing a career in science. In an analysis of open-ended responses (n = 2,123) to a question about occupational area, we found that roughly 25% of respondents (n = 736) identified themselves as a scientist, researcher, research professor, or student in a scientific field. Another 9% (n = 257) identified their occupational area as teaching and/or higher education. Other coded occupational areas were computer science or information technology (7%), writing/communications (4%), medicine/public health (3%), engineering (3%), media/journalism (1%), and policy/government (1%).

Motivations to Use Science Blogs

To investigate why people read science blogs (**RQ2**), we asked survey participants who indicated reading the blog for which they were participating in the survey at least a few times a year (n = 2,324) to rate how much they agreed with a list of 15 statements regarding their motivations to read a given blog. Across those who read a given blog at least a few times a year (n = 2,324), the leading motivations to read included "because it stimulates my curiosity" (M = 4.36, SD = 0.67), "as an educational tool" (M = 4.18, SD = 0.90), and "for information I don't find in traditional news media" (M = 4.15, SD = 0.85). Topline means for our motivation items are listed in Table 1.

Table 1. Topline Means of Motivations to Use a Given Science Blog.

Motivation item	*M*	*SD*
Because it stimulates my curiosity	4.36	0.67
As an educational tool	4.18	0.90
For information I don't find in traditional news media	4.15	0.85
For the author(s)'s perspective	3.94	0.90
Because of the good writing	3.92	0.83
To keep up with current events in science	3.90	0.95
For expert opinions on science issues of the day	3.86	0.94
To keep up with scientific research	3.76	1.03
For entertainment	3.75	1.02
To check the accuracy of other media	2.80	1.18
To feel involved in an online community	2.62	1.15
To research for work or school	2.37	1.21
For advice or emotional support	2.12	1.13
Because my friends/colleagues do	2.00	1.04
For information for my own blog	1.90	1.09

Note. Items measured on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

Factor Analysis of Science Blog Use Motivation Items

Based on the same list of 15 statements measuring motivations, we conducted a factor analysis (principal components analysis using Varimax rotation with Kaiser normalization) to consolidate these statements into overarching factors. The Kaiser-Meyer-Olkin measure of sampling adequacy was .80, and Bartlett's test of sphericity was significant, $\chi^2(105) = 7{,}354.10$, $p < .001$. Rotation converged in six iterations. The extraction resulted in four factors explaining 56.4% of the variance. All items except one, which had a primary loading of .46, had primary loadings above .5. Each item loaded strongly onto only one of the four different factors. The factor loading matrix is presented in Table 2. The factor labels were informed by the original blog use motivations literature as well as by observations from our principal components analysis. Correlations between all items are presented in Table S2 in our online supplementary data file.

We examined internal consistency for each of the factors using Cronbach's alpha (or Spearman-Brown coefficient for two-item scales): .77 for "unique science information seeking" (six items; $M = 3.78$, $SD = 0.67$), .72 for "community seeking" (five items; $M = 2.2$, $SD = 0.78$), .46 for "entertainment" (two items; $M = 4.05$, $SD = 0.70$), and .53 for "ambiance" (two items; $M = 3.93$, $SD = 0.72$). Reliability statistics are not improved by deleting any items from each of these four factors. The individual items loaded onto our factors similarly to how these items are classified by Kaye (2010), with some collapse among the seven different factors we adapted items from. We created composite scores for each of the four science blog use motivation factors, based on the mean of all their component (primary loading) items.

Table 2. Factor Loadings for Factor Analysis With Varimax Rotation of Blog Use Motivation Items.

Motivation items	Unique info seeking	Community seeking	Entertainment	Ambiance
To keep up with research	**.82**	.10	.01	−.15
To keep up with current events	**.77**	.07	−.002	.001
For expert opinions	**.71**	.09	−.19	.33
As an educational tool	**.61**	.02	.50	−.15
To check accuracy of other media	**.54**	.41	−.21	.09
For info I don't find in traditional media	**.46**	.01	.32	.23
For info for my own blog	.04	**.73**	.06	−.17
Because my friends/colleagues do	.01	**.69**	.08	.12
To feel involved	.08	**.68**	.08	.19
For advice or emotional support	.01	**.64**	−.17	.32
To research for work or school	.30	**.62**	−.03	−.07
Because it stimulates my curiosity	.19	−.01	**.75**	.14
For entertainment	−.25	.05	**.68**	.17
For the author(s)'s perspective	.001	.11	.07	**.81**
Because of the good writing	.09	.09	.34	**.65**

Note. Primary factor loadings are boldface.

Cluster Analysis Based on Science Blog Use Motivations

In addressing **RQ2**, we also characterized science blog readers by their blog use patterns. We used cluster analysis to explore patterns of science blog readership using the four motivation factors described above, identified via factor analysis, as grouping variables. A two-step automatic clustering algorithm using Schwarz's Bayesian Criterion and a log linear distance measure to assign clusters resulted in three user clusters. The entertainment factor was the most important predictor of cluster grouping (predictor importance = 1.00), followed by the community-seeking factor (.71), the ambiance factor (.47), and finally the unique information-seeking factor (.40).

Below, we describe scores on each motivation factor for each user cluster with reference to the overall mean and standard deviation of the factor. We divided the total sample distribution on each factor into thirds (e.g., low, moderate, high). A user cluster's score on a factor is "high" if the score falls within the upper third of the overall distribution of scores on that factor (at least 0.43 *SD* above the mean), "low" if the score falls below the lower third (at least −0.43 *SD* below the mean), and "moderate" if the cluster's score falls in between. See Figure 1 for a visual representation of blog use motivation scores by cluster.

Cluster 1—One-way entertainment users. The first and largest cluster of science blog users (n = 1,064) is characterized by moderate scores on the entertainment motivation factor (M = 4.30, SD = 0.43) and the ambiance factor (M = 3.78, SD = 0.67), but low

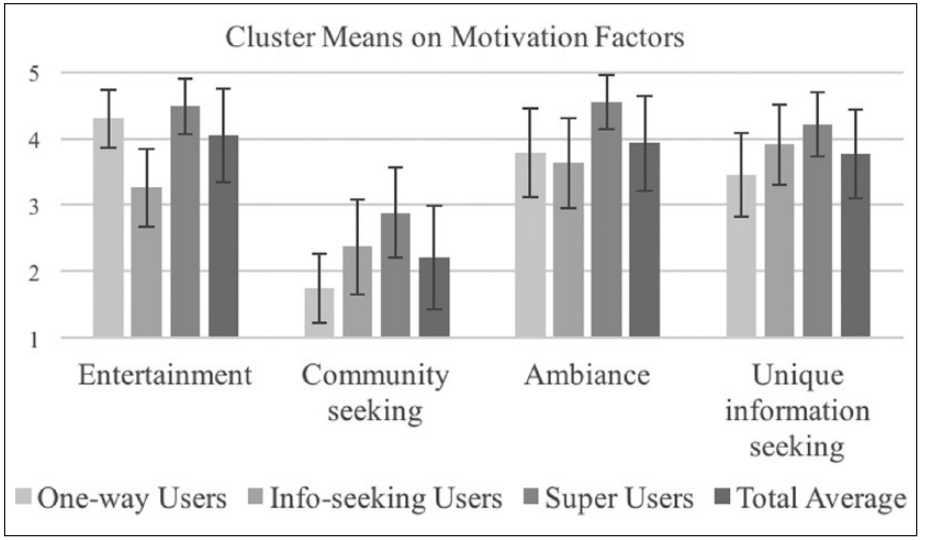

Figure 1. Motivation factor means by cluster.
Note. Error bars represent standard deviation (±1 *SD*).

scores on the community-seeking factor ($M = 1.75$, $SD = 0.52$) and the information-seeking factor ($M = 3.45$, $SD = 0.63$).

Cluster 2—Information-seeking users. The second cluster of users ($n = 650$) is characterized by low scores on the entertainment factor ($M = 3.26$, $SD = 0.59$) and moderate scores on the community-seeking ($M = 2.37$, $SD = 0.71$), ambiance ($M = 3.63$, $SD = 0.69$), and information-seeking ($M = 3.91$, $SD = 0.6$) factors.

Cluster 3—Super users. The third and smallest cluster of users ($n = 557$) is characterized by consistently high scores on all blog use motivation factors: entertainment ($M = 4.49$, $SD = 0.42$), community seeking ($M = 2.88$, $SD = 0.68$), ambiance ($M = 4.55$, $SD = 0.41$), and information seeking ($M = 4.21$, $SD = 0.48$).

Cluster User Descriptives

Through a cluster analysis based on survey respondents' scores on four different motivation factors, we found three primary clusters of science blog users. Further investigation via chi-square analysis (for differences among the clusters for categorical variables) and analyses of variance (for differences among the clusters for continuous variables) reveals particular patterns across these user clusters. The info-seeking users are the oldest cluster of science blog users, while the super users are the youngest ($F = 12.06$, $p < .001$). The super users are significantly younger than the unique info-seeking users (M *difference* $= 0.571$, $p < .001$), with 43% of super

Table 3. Demographic Descriptives by Cluster.

Demographic variables	User cluster			χ^{2a}	*p*
	Info-seeking user	One-way entertainment user	Super user		
Gender					
Male	389 (59.8%)	614 (57.7%)	297 (53.3%)	8.37	.015
Female	204 (31.4%)	355 (33.4%)	220 (39.5%)		
Degree in science					
No	193 (29.7%)	364 (34.2%)	172 (30.9%)	4.8	.09
Yes	405 (62.3%)	618 (58.1%)	352 (63.2%)		
Employment status					
Employed for wages	322 (49.5%)	590 (55.5%)	297 (53.3%)	33.68	.002
Self-employed/ freelance	78 (12%)	107 (10.1%)	66 (11.8%)		
High school/ undergrad	25 (3.8%)	39 (3.7%)	26 (4.7%)		
Grad student	55 (8.5%)	66 (6.2%)	60 (10.8%)		
Retired	89 (13.7%)	110 (10.3%)	44 (7.9%)		
Education					
Some high school	6 (0.9%)	10 (0.9%)	6 (1.1%)	$F = 1.61$	.201
High school graduate	13 (2%)	25 (2.3%)	13 (2.3%)		
Some college	68 (10.5%)	124 (11.7%)	85 (15.3%)		
Bachelor's degree	122 (18.8%)	208 (19.5%)	100 (18.0%)		
Some postgraduate	58 (8.9%)	84 (7.9%)	56 (10.1%)		
Master's degree	151 (23.2%)	248 (23.3%)	122 (21.9%)		
Doctorate	181 (27.8%)	286 (26.9%)	146 (26.2%)		
Interested in career in science					
Yes	94 (14.5%)	125 (11.7%)	140 (25.1%)	73.19	.000
No	120 (18.5%)	280 (26.3%)	83 (14.9%)		
Maybe	65 (10%)	123 (11.6%)	58 (10.4%)		
Already pursuing	319 (49.1%)	444 (41.7%)	245 (44.0%)		

[a]Statistical test is Pearson chi-square unless otherwise noted.

users being below 34 years compared with 30% of info-seeking users, and 38% of the latter being above 50 years compared with 25% of super users. The education breakdown, however, is approximately equivalent across the three user clusters (see Table 3). The gender breakdown is approximately equivalent across the three user clusters, with the super users being slightly more female than the other clusters (see Table 3). A higher percentage of super users than users in other clusters indicated that they were students and that they were interested in pursuing a career in science. In comparison, a higher percentage of unique info-seeking users, who also tend to be older

Table 4. ANOVA Results for Use of a Given Blog and Science Media Use by Cluster.

Evaluation variables	User cluster			*df*	*F*	η^2
	Info-seeking user	One-way entertainment user	Super user			
Motivations						
Unique info-seeking factor	3.91_a (0.60)	3.46_b (0.63)	4.21_c (0.48)	2, 2,268	322.61***	.22
Ambiance factor	3.63_a (0.68)	3.78_b (0.67)	4.55_c (0.41)	2, 2,268	386.00***	.25
Entertainment factor	3.26_a (0.59)	4.3_b (0.43)	4.49_c (0.42)	2, 2,268	1,267.68***	.53
Community-seeking factor	2.37_a (0.71)	1.75_b (0.52)	2.88_c (0.68)	2, 2,268	637.74***	.36
Specific blog use						
Frequency of reading blog	5.79_a (1.51)	5.58_b (1.4)	5.84_a (1.4)	2, 2,268	7.83***	.01
Sharing content via social media	2.37_a (0.97)	1.96_b (0.91)	2.68_c (1.03)	2, 2,258	108.01***	.09
Intention to continue reading blog in future	4.45_a (0.66)	4.46_a (0.59)	4.82_b (0.44)	2, 2,241	80.3***	.07
Blog is overly technical	1.98_a (0.76)	1.81_b (0.69)	1.98_a (1.02)	2, 2,250	12.75***	.01
Blog and media use						
Frequency of seeking out science info online	4.45_a (0.7)	4.28_b (0.81)	4.58_c (0.65)	2, 2,147	30.76***	.03
Frequency of reading science news stories	4.18_a (0.81)	4.2_{ab} (0.77)	4.3_b (0.76)	2, 2,147	3.85*	.004
Frequency of creating social media content	2.59_a (2.02)	1.88_b (1.6)	2.9_c (2.13)	2, 2,123	59.85***	.05
Number of blogs followed	1.63_a (1.36)	1.69_a (1.5)	1.87_b (1.47)	2, 2,268	4.67*	.004

Note. Standard deviations appear in parentheses bellow means. Means with differing subscripts within rows are significantly different at the $p < .05$ level based on Bonferroni post hoc paired comparisons. *df* = degrees of freedom (between, within).
*$p < .05$. ***$p < .001$.

than users in the two other clusters, indicated having already pursued a career in science. The one-way entertainment user cluster has the highest percentages of users who indicated not having a degree in science (despite similar levels of education across the user clusters) and not being interested in a career in science.

In a test of the accuracy of our cluster analysis, we confirmed via ANOVAs that differences in motivations to use a given science blog across our user groups were consistent with the patterns we identified via cluster analysis (e.g., that super users are significantly more likely to be using a given blog for community seeking). We found significant differences across the three different user groups for each of our four primary blog use motivation factors. See Table 4 for results.

Science Media, Sharing, and Blog Use by Cluster

We address **RQ3** by investigating the relationship between science blog use and broader science media use, including media creation. Based on our survey data, science blog readers are heavy consumers of science news and science-related

information online. A majority indicated they very often (n = 1,488, 51.1%) or often (n = 909, 31.2%) actively seek out science-related information online, while less than 2% rarely or never do so. A majority very often (n = 1,176, 40.4%) or often (n = 1,141, 39.2%) read news stories related to science, while less than 3% rarely or never do so. Related, 23% of respondents (n = 669) ranked online news media (online newspapers and magazines) as their top source of science-related information, and another 23% ranked academic journals as their top source, while 12% (n = 343) ranked blogs as their top source. A majority indicated they read multiple science blogs on at least an occasional basis.[6]

We also investigated science media and blog use by user cluster. In a series of ANOVAs, we found that in terms of using a given science blog (the blog for which readers answered our survey), super users read the blog significantly more often than one-way entertainment users and are significantly more likely than both other user groups to share content from the blog via social media. However, one-way entertainment users are significantly less likely than unique info-seeking users or super users to describe the blog as overly technical. Results from these ANOVAs can be found in Table 4.

In other ANOVAs investigating general science media and blog use across user cluster groups, we found that super users indicated seeking out science information online significantly more often than the two other user groups, and that unique info-seeking users indicated doing so significantly more often than one-way entertainment users. Super users also indicated reading a significantly greater number of science blogs than the two other user groups did. See Table 4 for results of these ANOVAs.

Super users reported creating their own social media content significantly more often than both info-seeking users and one-way entertainment users, and info-seeking users reported doing so significantly more often than one-way entertainment users (Table 4). Nearly 55% of super users indicated that they create their own science-related social media content at least every few months. This is compared with 46% of unique info-seeking users and only 29% of one-way entertainment users. See Table 5 for a breakdown of frequencies of social media creation for a variety of platforms by cluster.

Perceptions of Scientists

In an exploratory ANOVA, we also investigated whether our three different user clusters differed in their perceptions of scientists, which may be related to science blog use. We found that the three user cluster groups did not differ significantly in their perceptions of how sociable scientists are or how "in touch with the average person" they are. However, super users rated scientists as more trustworthy, to a significant degree, than did info-seeking users or one-way entertainment users. For the ANOVA results, see Table 6.

Scientific Knowledge and Blog Use

Next, we test **H1**, the hypothesis that extent of science blog use is associated with greater general scientific knowledge. Science blog readers who responded to our

Table 5. Frequencies of Social Media Creation, by Cluster.

	User cluster		
	Info-seeking user	One-way entertainment user	Super user
How often do you create your own science-related social media content?			
Daily	37 (5.7%)	23 (2.2%)	46 (8.3%)
1-3 times a week	99 (15.2%)	82 (7.7%)	93 (16.7%)
1-3 times/month	96 (14.8%)	107 (10%)	91 (16.3%)
Every few months	67 (10.3%)	99 (9.3%)	74 (13.3%)
Less often/never	307 (47.2%)	680 (63.9%)	255 (40.4%)
If ≥ every few months			
Maintains a Twitter account	190 (29.2%)	179 (16.8%)	215 (38.6%)
Maintains a science blog	117 (18%)	103 (9.7%)	122 (21.9%)
Creates science-related videos	43 (6.6%)	26 (2.4%)	64 (11.5%)
Creates science-related visual content	99 (15.2%)	102 (9.6%)	130 (23.3%)
Contributes answers to forums	100 (15.4%)	93 (8.7%)	131 (23.5%)
	N = 650	*N* = 1,064	*N* = 557

Note. Where percentages do not add up to 100%, remaining percentages represent system missing values. All percentages are percentages of cluster total frequencies.

Table 6. ANOVA Results for Perceptions of Scientists by Cluster.

	User cluster					
Evaluation variables	Info-seeking user	One-way entertainment user	Super user	*df*	*F*	η^2
Sociable	4.75_a (1.35)	4.79_a (1.34)	4.87_a (1.51)	2, 2,117	1.19	.001
In touch with the average person	4.31_a (1.38)	4.44_a (1.39)	4.48_a (1.60)	2, 2,114	2.27	.002
Trustworthy	6.03_a (1.01)	6.04_a (0.97)	6.22_b (0.95)	2, 2,118	7.30**	.007

Note. Standard deviations appear in parentheses bellow means. Means with differing subscripts within rows are significantly different at the $p < .05$ based on Bonferroni post hoc paired comparisons. Evaluation variables measured on a bipolar scale from 1 to 7. *df* = degrees of freedom (between, within). *$p < .05$. **$p < .01$. ***$p < .001$.

survey scored a mean of 6.11 on a seven-question science knowledge quiz (*SD* = 1.16). In Table 7, we contrast the percentage of science blog readers who answered each question correctly with the percentage of U.S. adults who answered the question correctly in Pew surveys conducted either in 2009, 2013, or 2014, where U.S. adult percentages on matching questions are available (Funk & Goo, 2015). The science

Table 7. Science Blog Readers' Science Knowledge Compared With U.S. Adults.

	% answering each item correctly		
Science quiz statement	Blog users (n = 2,912)	U.S. adults	U.S. adults with postgrad degree
Lasers work by focusing sound waves.	82	65 (2,014)	79 (2,014)
Antibiotics kill viruses as well as bacteria.	86	54 (2,009)	76 (2,009)
All radioactivity is man-made.	90	66 (2,013)	89 (2,013)
Father's sex chromosomes decide child sex.	76	—	—
Electrons are smaller than atoms.	86	47 (2,013)	67 (2,013)
Water boils at higher temperature at higher altitudes.	64	34 (2,014)	47 (2,014)
Oxygen makes up most of the Earth's atmosphere.	85	—	—

Note. U.S. adult percentages via Funk and Goo (2015).

blog readers we surveyed consistently outperformed U.S. adults, and in most cases outperformed U.S. adults with postgraduate degrees. Because we compared our respondents' scores with Pew data for U.S. adults, we checked whether there were significant differences in blog readers' quiz scores based on region of residence. In a one-way ANOVA test, $F(4, 2{,}732) = 2.19$, $p = .067$, with Bonferroni post hoc analysis, there was no significant difference in quiz scores based on location of residence (the United States, Canada, the United Kingdom, Europe, or other). Non-U.S. respondents only scored slightly higher than U.S. respondents (U.S. $M = 6.09$, $SD = 1.22$, $n = 1{,}712$; Canada $M = 6.18$, $SD = 1.08$, $n = 171$; U.K. $M = 6.22$, $SD = 0.97$, $n = 325$; Europe $M = 6.24$, $SD = 0.99$, $n = 212$; other $M = 6.03$, $SD = 1.17$, $n = 317$).

We investigated science knowledge by blog use. In a hierarchical linear regression analysis including previously known predictors of science knowledge including age, gender, education, and online science information use (Su et al., 2015), the number of blogs a reader followed was an independently significant predictor ($\beta = .1$, $p < .001$) of science knowledge, *model summary:* $R^2 = .157$; $F(7, 2{,}655) = 70.48$, $p < .001$. Regression analysis results are shown in Table 8. Thus, **H1** was supported, where science blog use is operationalized as number of science blogs read/followed on an ongoing basis.

In an exploratory regression analysis including all the factors listed above and in Table 8, we also investigated whether any of our blog use motivation factors also predicted science knowledge (see Table 9). We found this to be the case, *model summary:*

Table 8. Results of Hierarchical Regression Analysis Predicting Scientific Knowledge.

	Model 1	Model 2	
Models	(β)	β	95% CI of *B*
Constant			[3.66, 4.27]
Gender	−.11***	−.11**	[−0.33, −0.16]
Age	.12***	.13***	[0.05, 0.09]
Education	.11***	.11***	[0.05, 0.11]
Science degree	.15***	.15***	[0.26, 0.46]
Frequency of seeking science info online	.20***	.16***	[0.19, 0.30]
Frequency of reading the blog		−.02	[−0.03, 0.01]
Number of blogs followed		.1***	[0.05, 0.11]
F total	93.00***	70.48***	
Δ*F*		12.23***	
R^2	.149	.157	
ΔR^2		.008	

Note. Degrees of freedom for the two regression equations are *F*(5, 2,657) for Model 1 and *F*(7, 2,655) for Model 2. β = standardized coefficient. *B* = unstandardized regression coefficient. CI = confidence interval. Frequency of seeking science info online and frequency of reading the blog are not correlated to any meaningful degree. Frequency of reading the blog and number of blogs followed are only weakly correlated (Pearson coefficient = 0.24, $p < .001$). Frequency of seeking science info online and number of blogs followed are weakly correlated (Pearson coefficient = 0.33, $p < .001$).
*$p < .05$. **$p < .01$. ***$p < .001$.

$R^2 = .203$; $F(11, 2{,}023) = 51.39$, $p < .001$. The community-seeking motivation factor (β = –.26, $p < .001$) emerged as a significant negative predictor of science knowledge. The entertainment motivation factor (β = .044, $p < .05$) emerged as a significant positive predictor. The unique information-seeking and ambiance motivation factors were not significant predictors. Overall, we found demographic variables (gender, age, education level, and science degree) explained a little above 11% of the variance in scientific knowledge, while online science media/blog use explained a little above 4% of the variance. These numbers are similar to those found by Su et al. (2015), who reported that respondents' science media preferences explained a little below 2% of the variance in scientific knowledge. However, in our analyses, blog use motivation factors explained at least an additional 5% of the variance in scientific knowledge. Correlations between the motivation factors are provided in Table S3 in our online supplementary data file.

We also looked at science knowledge by user cluster. In an ANOVA analysis, we found that one-way entertainment users scored highest on the general science knowledge quiz, significantly higher than info-seeking users and super users. Super users scored lowest relative to the two other user clusters. ANOVA results are shown in Table 10.

Discussion

The readers of science blogs as a whole are an elite, highly educated group of mostly scientists and future scientists who actively seek out science media content. They are

Table 9. Results of Exploratory Hierarchical Regression Analysis Predicting Scientific Knowledge.

	Model 1	Model 2	
Models	(β)	β	95% CI of *B*
Constant			[3.77, 4.80]
Gender	−.09*	−.07**	[−0.26, −0.07]
Age	.16***	.14***	[0.06, 0.10]
Education	.1**	.09***	[0.03, 0.10]
Science degree	.15***	.17***	[0.29, 0.52]
Frequency of seeking science info online	.15***	.17***	[0.20, 0.33]
Frequency of reading the blog	−.02	.01	[−0.03, 0.04]
Number of blogs followed	.1***	.1**	[0.04, 0.11]
Unique info seeking		−.04	[−0.14, 0.02]
Community seeking		−.22***	[−0.39, −0.26]
Ambiance		.02	[−0.03, 0.11]
Entertainment		.04*	[0.004, 0.14]
F total	51.39***	46.96***	
Δ*F*		33.45***	
R^2	.151	.203	
ΔR^2		.053	

Note. Degrees of freedom for the two regression equations are *F*(7, 2,027) for Model 1 and *F*(11, 2,023) for Model 2. β = standardized coefficient. *B* = unstandardized regression coefficient. CI = confidence interval. Community-seeking and unique information-seeking factors are independently significant negative predictors in the model even when the other three factors are removed from the model.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 10. ANOVA Results for Science Knowledge by Cluster.

	User cluster					
Evaluation variables	Info-seeking user	One-way entertainment user	Super user	*df*	*F*	η^2
Science knowledge (quiz score)	6.12_a (.05)	6.28_b (.04)	5.95_c (.05)	2, 2,107	14.8***	.014

Note. Standard deviations appear in parentheses bellow means. Means with differing subscripts within rows are significantly different at the $p < .05$ based on Bonferroni post hoc paired comparisons.
df = degrees of freedom (between, within).
*$p < .05$. ***$p < .001$.

the epitome of the active audience, seeking out niche media sources online to fulfill their psychological and information needs (Rubin, 2009; Sundar & Limperos, 2016). They are coming to science blogs to seek out information they cannot find other places (Johnson et al., 2007; Kaye, 2010), but also to be entertained, to interact with a community of like-minded users, and to seek out the specific perspectives and expertise

offered by their "favorite" science bloggers (Kaye, 2010). These motivations correspond with previously described blog use motivations based on a uses and gratifications framework (Kaye, 2007, 2010) and social media use motivations based on a psychological needs framework (Chen, 2015). Chen found three motivation factors for women bloggers' use of social media, including recreation, information, and engagement. Chen also found that the psychological needs for affiliation and self-disclosure are associated with the information and engagement motivations, but that recreation is the strongest predictor of social media use followed by information and then engagement. These motivation factors and their relative importance mirror our entertainment, unique information-seeking, and community-seeking factors.

We found three types of science blog readers, the smallest group consisting of high-frequency "super users." These users indicate that they believe scientists are more trustworthy than the other two user groups do, an attitude that may be associated with their heavy use of science blogs. They are significantly more likely than the other groups to share content from a given blog via social media and to create their own science-related social media content, which includes writing their own science blogs. Super users could be seeking community among science bloggers in an attempt to gain deep insights into science and to gain experience in online science writing, which would have implications for how science bloggers might expand their reach. In today's news feed-dominated media environment, audiences are less likely to access content that does not spread through social media. Science bloggers seeking to maximize the spread of their content via readers' social media channels might cater to the community-seeking motivations of these super users. To do so, science bloggers might focus on creating a collegial atmosphere, being responsive to comments, offering career advice, and creating opportunities for reader involvement. In addition, bloggers might go the extra mile to make sure that their content is easily shareable by incorporating the sharing functionality offered by the top social media platforms.

The one-way entertainment users, the largest group of users, read blogs primarily for ambiance (entertainment and the blog author's perspective) and share significantly less content than the other two groups do. Although they have similar levels of education as these other groups, they are less likely to hold a degree in science. Even so, they are less likely to find science blogs overly technical. Entertainment users may be less confident in their ability to engage with scientific research, consequently choosing to read less technical blogs or the less technical posts on a given blog. These users may be fulfilling particular uses and gratifications that lead them to less technical blog posts. Either way, these results complement previous evidence that people with higher levels of education tend to be information seekers online, while people with lower levels of education and younger people tend to be entertainment seekers (Bonfadelli, 2002). However, we find that when it comes to science blogs, STEM-specific education as opposed to general education level may predict this usage pattern. To cater to entertainment users, bloggers can focus on offering, in at least some of their posts, less technical and more entertaining content that fulfills a popular science type of function. Examples of blogs included in this survey that offer such content are Inkfish at *Discover* magazine and Vintage Space at *Popular Science* magazine. These blogs also had higher percentages of entertainment users reading them.

The active motivation to find information outside of that offered by traditional media (Su et al., 2015) is a strong motivation for science blog readers, particularly the information-seeking users. This group features the highest concentration of current scientists. To cater to this group, bloggers should strive to balance their community building efforts with a focus on highlighting the uniqueness of the information that they offer on their respective blogs. Moreover, given findings that this group tends to use science media sources in a way that supports media complementarity theory, obtaining information from a mix of traditional and online sources (Su et al., 2015), science bloggers could increase their indexing of, and linking to, outside sources on the topics they cover. This would make it easier for unique information seekers to find that special piece of information that they are pursuing. As previous research shows, neither blogs nor traditional media are likely to completely set the traditional media agenda, but they are interdependent on each other. By highlighting these interdependencies in the design of their blogs, bloggers can help set the science agenda.

A highlight of our study is that science blog readership shows a significant relationship with knowledge. The more science blogs readers follow, the more knowledgeable about science readers are. However, our three groups of users do not share that knowledge equally. In a seeming contradiction, our super users score lower on a general science knowledge quiz than the other user groups do. Our one-way entertainment users score the highest on this test. Investigating this trend further and controlling for demographic and media use factors, we found that the community-seeking motivation was a relatively strong negative predictor of general science knowledge, while the entertainment motivation was a positive predictor.

We cannot fully explain and interpret these findings without further research. The findings should be interpreted cautiously given that the raw differences in test scores between the three user groups are very small and that all three groups scored extremely high, far higher than even the most educated groups surveyed by Pew. However, previous research investigating social media use from uses and gratifications and psychological needs perspectives may offer clues for explaining these findings. For super users who hold higher perceptions of scientists and who are motivated by community seeking, needs for affiliation (Chen, 2015) may drive users to interact with individuals who share their own views and science interests. For information-seeking users, the motivation to seek specific pieces of information about science (Su et al., 2015) may drive consumption of blog content covering deep and specialized but narrow scientific topics. Super users and unique information-seeking users might not be exposed to the broad scientific topics contained in entertainment-driven popular science media that could result in higher scores on a general science knowledge quiz. This is only one possible explanation of our findings that takes into account the role of motivations in driving science media use and that assumes that science media use plays a role in knowledge. However, other confounding factors may better explain the observed differences in science knowledge between our user groups. Future research must tease apart these factors.

Our findings may also have implications for better understanding how people find and/or learn about science through media. Based upon a prominent motivation to read science blogs to find information not found elsewhere and respondents' frequent use of online news media in addition to blogs, blogs appear to be complementing

mainstream media in terms of providing scientific information for users wanting to learn about science. However, some readers may have combinations of blog use motivations that contribute more toward learning new and broad information about science. Entertainment users may be exposed to a broad range of scientific information they would not otherwise directly seek as a product of reading popular entertainment-focused science blogs they encounter via magazines or social media. We have found that reading science blogs for entertainment predicts higher scores on a general scientific knowledge quiz. Science bloggers seeking to improve public science literacy might focus on content that combines entertainment with broad information and lessons related to the scientific process. A uses and gratifications perspective would suggest unique information seekers would be using blogs to actively seek information on subjects they are already interested in, and super users may be seeking community and ideas among individuals similar to themselves. The potential role of blog use motivations in mediating informal science learning via online media warrants future research, especially related to how entertainment-driven use may promote science learning among people with lower levels of formal science education.

Limitations and Future Research

We wish to draw attention to several limitations of this study. We considered brevity of our survey questionnaire to be very important to collecting responses from a broad range and large number of readers. We chose to include only a limited number of previously proposed blog use motivation measurement items (Johnson & Kaye, 2004; Kaye, 2005, 2010; Kaye & Johnson, 2011). We did not include the political debate motivation factor because we were not focusing on blogs covering political topics (Kim & Johnson, 2012), but future research should investigate a broader set of motivation factors. Likely also a result of including only a limited sample of motivation items in our questionnaire, the reliability scores of our entertainment and ambiance factors were relatively low. However, the items loading onto the ambiance factor match items loading onto this factor in Kaye's (2010) study, and the entertainment items loaded strongly together in our factor analysis (above .68). Also, if we re-run our cluster analysis with an entertainment motivation factor consisting of only one item ("for entertainment"), the cluster outcomes do not differ substantially. Another limitation of note is that the R^2 values in our regression models explaining general scientific knowledge are relatively low, although we believe the models to be robust and in line with previous research findings.

Future research could explore different types of science blogs. Researchers could use content analysis to look at different types of blogs and blog posts. Qualitative work such as in-depth interviews could get at the heart of what science blog readers get out of reading these blogs. In the other direction, we could use quantitative experimental methods to get at the actual effects of reading these types of blogs.

This study contributes to our understanding of how science media audiences use an important component of the web 2.0 media environment. Although social networking

sites such as Twitter and Facebook have taken on some of the former functions of blogs, science blogs remain an established source of long-form, analytical, and niche science information in an ecosystem of more temporary micro-blog content (Jarreau, 2015; Su et al., 2015). Blogs continue to heavily influence science news content (Vestergaard, 2016), as they give experts space to discuss science information, news and up-to-date research in depth. Social networking sites may even further expand the reach of science blogs today, and their users may seek content based on similar motivation patterns as we have investigated here.

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Notes

1. We chose not to include items classified under the variety of opinion factor, because we were not measuring motivations to use blogs plural, but rather motivations to read a given individual science blog. However, we did include an item measuring the motivation to read "for the blogger's perspective."
2. We chose not to focus this study on the perceived credibility of science blogs, and thus did not ask survey questions related to credibility. However, we measured readers' perceptions of scientists as variables that might provide context as to how and why readers use blogs written by scientists (e.g., because they find scientists to be trustworthy). We include information related to survey results on these variables for what we find to be valuable context.
3. Some respondents (~n = 80) appeared to have selected the incorrect blog. In most of these cases, the respondent-selected blog variable was recoded to reflect the referrer site, and answers to blog-specific questions were recoded as missing to prevent incorrect data.
4. These partial survey responses were nearly completed, included a substantial amount of useful information, and were deemed not to be "spam" or "trash" responses, and thus were included in the final data analyses. However, individual statistical analyses are based only upon responses where data were available for all variables included in those analyses.
5. For reporting topline results on our survey questions not specific to a particular blog (such as demographics and general science media use questions), we used a data set filtered of duplicate responses from users who responded to our survey for multiple different science blogs, or a data set of n = 2,912 respondents. However, for all statistical tests involving blog-specific questions (such as blog use motivations), we use the full data set (n = 2,955) as duplicate users would have responded differently to these questions dependent on the blog for which they were answering the survey.
6. Number of science blogs following other than surveyed blog: no other blogs (n = 957, 33%), one to two blogs (n = 507, 17.4%), three to five (n = 759, 26.1%), six to 10 (n = 376, 12.9%), 10+ (n = 189, 6.5%), 20+ (n = 124, 4.3%).

Supplemental Material

Supplementary data is available online at http://journals.sagepub.com/home/jmq.

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