Spring 5-2017

Fostering Scientific Discourse Through the Development of an Online Journal

James Robe
University of Maine

FOSTERING SCIENTIFIC DISCOURSE THROUGH THE DEVELOPMENT

OF AN ONLINE JOURNAL

by

James Robe

A Thesis Submitted in Partial Fulfillment
of the Requirements for a Degree with Honors
(Mass Communication)

The Honors College

University of Maine

April 2017

Advisory Committee:
Bridie McGreavy, Assistant Professor of Environmental Communication
Josh Roiland, Assistant Professor and CLAS-Honors Preceptor of Journalism
Linda Silka, Senior Fellow, Senator George J. Mitchell Center for Sustainability Solutions
Holly E. Schreiber, Assistant Professor of Communication & Journalism
Tyler Quiring, Ph.D. Student, Department of Communication and Journalism

ABSTRACT

Scientific information and data have become more readily available to populations that may not have had easy access to science content prior to increases in internet use and availability. Website creation platforms continue to be democratized by efforts to limit the amount of knowledge and money needed to launch, operate, and maintain websites. The internet also allows scientists to communicate with publics in more meaningful ways beyond education, such as scientific discourse.

The opportunities that accompany expanded internet and website capabilities creates need for a comprehensive guide to help scientists or scientific groups take advantage of the internet's unique ability to connect diverse populations with scientific discourse. Thus in this thesis I will share my research findings about website design methodologies and production team dynamics in order to explain how to successfully produce a website and foster scientific discourse.

The insights I share were produced in a multi-case participatory and explanatory study. The first case is participatory and involves the production of Spire: The Maine Journal of Conservation and Sustainability. This case aims to illuminate some of the opportunities and challenges that occur in a community of producers who collaborate to create a website for scientific discourse. The second case is explanatory and involves analysis of five website-based scientific communities to identify approaches to foster discourse, including the use of dialogic loops, strategic messaging, and interactivity. I conclude by describing how these and related web-based approaches can help foster scientific discourse for democratic engagement.

TABLE OF CONTENTS

LITERATURE REVIEW: WHY CREATE A WEBSITE?

Designing and implementing a website can be a difficult process and therefore it is important to understand what the benefits are for creating a website. According to Smith (2016), "In an age where we are saturated with online information, effective communication is more important than ever. Unfortunately, many scientists are ineffective, unskilled, and/or not interested at communicating their research to the general public" (p. 1). Within this mindset, there are at least two important ways in which to view the benefits of exporting scientific knowledge into the internet, including internal and external benefits. Internal benefits directly help a production community and external benefits can help a patron community or society as a whole.

These external and internal benefits are referred to as instrumental rationales and substantive rationales, respectively. Instrumental rationales are "hopes that engagement will benefit scientists themselves or their professional community" (Burke, Welch-Devine, Gustafson, Heynen, Rice, Gragson, Evans, & Nelson, 2015, p. 179). Substantive rationales focus on the external community, and are defined as "hopes that engagement and increased public understanding of science will contribute to broad social goods such as economic development, environmental decision-making, or other aspects of well-being" (Burke et al., 2015, p. 179).

<u>Instrumental Rationales</u>

<u>Building Support via Networking</u> – A scientific group can use internet networking to strengthen their support network. A prime example of this is an environmental activist organization that depends on volunteer or stakeholder support to complete its various goals. Such an organization tends to design its website to enhance dialogue with stakeholders more than an organization that does not depend on volunteer or stakeholder support (Kent, Taylor, & White, 2002).

1

Networking with the public can also benefit scientific groups by allowing them to gather political support. Environmental organizations may face difficulties pushing forward policy issues to lawmakers who meet in private meetings. By networking with other NGOs and the public, scientific agendas can be politically advanced by putting external pressure on the government, which relies upon public support through taxation (Takahashi, Edwards, Roberts, & Duan, 2015).

Lastly, networking via websites is important as it allows some scientific organizations to not only raise awareness but also obtain funding. Intercambio Climatico is an environmental education website based in Latin America that depends heavily on stakeholder support. The goal of this website is to help foster environmental protection in Latin America. Within Intercambio Climatico, networking was identified a great way to reach out to donors or potential funders of environmental projects (Takahashi et al., 2015).

Developing Trust – Interacting with publics can help alleviate alienation or mistrust in how the public sees scientists. Any alienation or divide between scientists and public can impede education. "For learners to be mobile and active, science should not appear alien, out-of-reach, opaque or more worryingly uninteresting but approachable, dynamic and accessible on the user's terms" (Watermeyer, 2010, p.3). Even off the web the benefits of interacting directly with the public can be seen in public meetings. For example, including the public in meetings involving environmental topics can increase public trust and lead to better decisions from the diversity of opinion (Lassen, Horsbøl, Bonnen, & Peterson, 2011).

Interacting directly with members of the public that use a scientific website also allows scientists to correct scientific falsehoods. Scientists depend heavily on public support and therefore must maintain a level of credibility in the eyes of the public. To maintain this

credibility and trust from the public, scientist must try to correct inaccuracies and misunderstandings within the public over scientific information (Evans 2010).

Knowledge Co-production – Knowledge co-production allows for various perspectives to come into contact, thus producing a much richer and more democratic product. Knowledge co-production is beneficial to the science community because since websites allow for the elimination of geographic and temporal barriers, people and communities without prior contact can merge their diverse perspectives. Knowledge co-production occurs in two fashions: scientific discourse and citizen science. In the former, the web serves as a way for the public to discuss science directly with scientists often in a social network style. For example, the website Especio Sciencio Viva included a section entitled "Science in Debate," where publics could learn and engage with science (D. Cavalcanti & C. Cavalcanti, 2009). Kouper (2010) stated further that many parts of the blogosphere also acted as a way for non-scientists to debate about science.

Secondly, citizen science is an emerging form of knowledge co-production. Within this practice, citizens are used as a resource in gathering or processing data, which can be facilitated through websites. There are benefits to this such as the "increased interest in and knowledge about a range of environmental issues, and increased capacity for people to assemble the tools and data needed to move toward a level of scientific understanding that promotes autonomous, informed choice" (Dickenson & Bonney, 2012, p.12).

<div align="center">Substantive Rationales</div>

Integrating Science into Public Life – Developing a website aimed at scientific discourse can help develop scientific literacy and improve scientific perception by integrating science into public life. Thus websites can increase access to scientific ideas and technologies, which can help improve the quality of living within a community by empowering the public with scientific

tools. A great example is the MC3 project, which was implemented to analyze the environmental efforts of 11 different communities that had developed environmental innovations. The researchers concluded they needed to communicate these environmental innovations to the public so that different communities could learn about and implement them (Newell & Dale, 2015).

Democratization of Science – As noted by D. Cavalcanti and C. Cavalcanti (2009), websites have the advantage of being able to permeate temporal and geographic barriers, thus scientific information can be democratized through this medium. Democratizing in this sense refers increasing the access the public has to scientific materials. For example, groups that prior to the internet may have had limited access scientific information now have access via the use of social networks and blogs (Kouper, 2010). According to Kouper (2010), a website could inform the readers about scientific news, explain complicated matters in a manner understandable by a layperson, evaluate research findings and claims made by others, and articulate their position towards controversial issues.

The use of websites also has the potential to de-silo scientific information. By exposing experts to different disciplines and other experts, the silos separating topics can often be dissolved. This was noted as a benefit of websites by D. Cavalcanti and C. Cavalcanti (2009), because the internet has "become the most well-known and most widely-used instrument of interaction in our globalized world, causing information to no longer be an area or a specialization" (p.1).

<center>The Philosophical and Technological Aspects of Websites</center>

Websites offer philosophical and technological benefits compared to traditional print media, including breaking down of temporal, geographic, and monetary barriers (D. Cavalcanti & C.

<center>4</center>

Cavalcanti, 2009). Yet, philosophically speaking the internet does not just offer more advanced methods of communication, but entirely different discursive methods.

The advantages of websites include large storage capacity, the elimination of geographical and temporal barriers, and the ability for websites to be dynamic in terms of uploading and updating content. According to D. Cavalcanti & C. Cavalcanti (2009), "a website increases the capacity to store and disseminate large quantities of information without geographic limits or time barriers" (p.1) and further "most well-known and widely used instrument of interaction in the globalized world" (p.1). The immediate technological advantages of websites are the storage of large quantities of information, immediate updating of documents, and integration of diverse forms of media (D. Cavalcanti & C. Cavalcanti, 2009).

Websites that attempt to foster scientific discourse should be designed to avoid the all-too-familiar technological pitfall, referred to as shovel-ware or shovel media. Shovel-ware is defined as "software ported over to different computer platforms or medium with little consideration of adapting it to that medium. This term has been applied to news organizations during the early days of the Web to describe taking legacy content and 'shoveling it' online" (Hernandez & Rue, 2016, p. 4). Therefore, if at all considering building a website, a scientist should consider not simply how to upload the same information they could have produced in print, but how to make it meaningfully different.

Breaching Geographic Barriers – A website may be held within a server, but individuals can access it essentially from anywhere around the world if they have access to a computer. Therefore, one substantial benefit of a website is that it often greatly reduces geographic barriers in communicating and obtaining information. In the redesign of a website for a science center called Espaco Ciencia Viva (Live Science Space) in Brazil, the potential reduction of geographic

barriers was central to the project. According to D. Cavalcanti and C. Cavalcanti (2009), the website was designed not just to represent the science center, but also to "be an extension of the visit to the museum, without geographical barriers or time limits, thus making it possible for all to access information, experiments and debates" (p. 6).

Interactivity and New Ways to Display – Websites themselves can be programmed to be interactive in nature, using various forms of media such as video, photography. Interactivity was a more effective strategy for gaining support than traditional text for the James Webb Telescope Website because it was found that "Interactive media outperformed traditional texts in increasing levels of support for JWST construction" (Weber, Dinc, & Williams, 2016, p. 1).

Other sources did not mention the use of interactive media, but commonly cited them as significant parts of their websites. Within the museum extension website Espacio Ciencia Viva, the online exhibit includes multimedia sources such as a "do it yourself" interactive section, photo galleries, calendars, and other written material (D. Cavalcanti & C. Cavalcanti, 2009). The Meeting the Climate Change Challenge project (MC3) was another website that aimed to communicate environmental innovations to groups of people willing to implement them. The use of E-dialogues, social media, and virtual conversations were used in the website to help communicate the MC3 project. The MC3 project further solidifies the various ways the internet can support many sources of media (Newell & Dale, 2015).

Issues of Accessibility – These technological benefits often have downsides. Despite being able to breach geographic barriers and contain large amounts of information (D. Cavalcanti & C. Cavalcanti, 2009), the internet inherently has a monetary barrier. Many people may not have access to internet-connected devices because the inability to afford them. In trying to communicate relevant scientific information to citizens in Appalachia researchers noted that it

was difficult to reach their audience over the internet because of lack of internet usage in the area. So the researchers trying to communicate this information decided to use the format of a bi-weekly newspaper column because of low internet usage in the area (Burke et al., 2015).

Computing skills in graphic design and information management are all needed to properly run a website and all serve as knowledge barriers to operating a website (Denison, Williamson, 2012). Production and management can all be outsourced to a professional company, but this requires funding that academics may not have. Thus a team must have ongoing technical support if they do not have proper training, something that can be timely and difficult to supply in volunteer-based organizations (Farooq, Ganoe, Liaxo, Markel, Rosson, & Carrol, 2011).

Issues of Credibility and Simplification – Despite being able to reach many people with non-scientific backgrounds, when scientific information leaves the often protective sphere of print academia to a website a "runaway" effect can occur. Because of the vast amount of information available online the "complex and infinite fabric of the web creates operational difficulties in selecting and editing the vast amount of material available" (D. Cavalcanti & C. Cavalcanti, 2009, p.6). Thus scientists and producers are given the insurmountable challenge of attempting to correct the inaccuracies in this vast amount of online scientific information (Evans 2010).

When creating a bi-weekly newspaper column, environmental scientists feared getting involved in public controversy of environmental topics (Burke et al., 2015). But according to Evans (2010), a scientist has the responsibility not just to communicate information but to rectify any misinterpretations on the internet. Evans (2010), also acknowledges the fear scientists have with of their work being misinterpreted, claiming "However, badly communicated, misunderstood or willfully misinterpreted science can have substantial negative consequences.

This can be in the form of bad policy decisions, the perpetuation of harmful false beliefs, or general panic" (p. 1). Thus a scientist can create a website to help the public avoid bad policy decisions and harmful beliefs by providing a source of credible and up to date information.

Because of the vast amount of patrons may not have scientific backgrounds (Watermeyer 2010), there is often a need for scientists to put ideas into layman's terms, thus creating overly simplified explanations of science. Because information is easily shared and copied throughout the internet, problems of credibility and accuracy can become an issue (D. Cavalcanti & C. Cavalcanti, 2009). Kouper (2010) also mentions that scientific blogs and websites can often contain inflammatory or unrelated commentary or material, such as personal opinions and feelings which can further tarnish the credibility of information.

<u>The Potential for Discourse on Websites</u>

One form of communication that websites allow for is democratized and interdisciplinary scientific discourse. Discourse is democratized because websites break some geographical, temporal, and some monetary barriers (D. Cavalcanti & C. Cavalcanti, 2009). Because of this individuals whom might not have contact with each other can connect through websites. Websites can also include aspects of networking, such as social networks (Kouper 2010), hyperlinking (Ackland & O'Neil, 2011), and even comment sections (Kouper 2010). Patrons from different areas are thus able to interact with each other and have a dialogue around science because of these interactive features. Further, this attraction of people from various disciplines, geographic regions, and social backgrounds helps to de-silo scientific information as individuals expose each other to the commonalities between fields, thus allowing for online discourse to become interdisciplinary (D. Cavalcanti & C. Cavalcanti, 2009).

8

But it is important to avoid the illusion that engaging the public and scientists in an online discourse is just nice to do, but rather to view it as a tool like education. As mentioned before, scientific discourse can be beneficial because it de-silos scientific information through exposure to a broad audience (D. Cavalcanti & C. Cavalcanti, 2009). Involving publics in a scientific discourse can also help with incidental learning (Kouper, 2010), where publics can indirectly learn about science through the process of a discourse. But ultimately discourse is powerful because it can foster trust between scientists and public through interpersonal connection. Whether talking directly to a scientist on a social network, or taking part in an interdisciplinary expansive discourse, publics will be exposed to scientists. For science to be engaging and interesting it needs to be opaque and not alien to the public (Watermeyer 2010).

<u>Defining Community and Engagement</u>

Within the literature the goal of developing an online community is to involve potentially geographically isolated publics in scientific discourse and/or to educate the public. This discourse and/or education can often be politically motivated, in the case of NGOs in Latin America using websites to foster public pressure to advance scientific goals in government (Takahashi, Edwards, Roberts, Duan, 2015), to help advance knowledge co-production between scientists in the community in Appalachia (Burke et al., 2015), or simply to help involve and get citizens excited about science with an interactive online extension of a museum (D. Cavalcanti & C. Cavalcanti, 2009).

Yet while many sources mention online communities, very few mention how to measure or assess community and participation in an online context. Few, Brown, and Tompkins (2011), warn in an analysis of public meetings revolving around climate change to avoid the illusion of inclusion. For example, how can you tell if your audience is actually participating in a

community or discourse or just being informed or educated? This term is coined as passive participation, and it can further reinforce social stratification (Few et al., 2011).

In a study of social network science within the environmental communication sphere an effective criterion for measuring and assessing public engagement is that if both scientists and nonscientists are involved in blogging and the majority of content in posts or commentary is concerned with scientific issues (Kouper 2010). Four units of public engagement were identified, including contribution to the topic, deviation from the topic, expression of attitudes and emotions, and attempts to influence the actions of others (Kouper 2010). These units were ways in which the public responded within comments and served as evidence of meaningful interaction.

Another criterion for measuring and assessing community within a website is to search for expressions of homophily. In attempt to define and analyze online collective identity Ackland & O'Neil (2011) surmised that homophily was necessary in the formation of successful online communities and discourses. Homophily "refers to actors having a preference to be connected to similar actors" (Ackland & O'Neil, 2011, p.181). Examples of this can include similarities in expressed purpose such as a rallying point or mission statement, similarities in wealth, social class, and physical characteristics (Ackland & O'Neil, 2011).

Though a community can be identified by expressions of homophily, when it comes to websites there is a need to recognize both the production community and the patron community. A patron community is the population that interacts with the website but does not help with its production. The production community is composed of individuals that directly have a hand in building and producing a website.

Many sources exclusively focused on the patron community as the driving force behind the success of a website. A book entitled *Building Successful Online Communities* states a series of psychological design methodologies that can be implemented into a website to encourage contribution from patrons (Kraut, Resnick, & Kiesler, 2012). These tactics focus on message design such as encouraging visitors to contribute through external communication, feedback and rewards, and presentation and framing.

In the case of the museum extension website *Espaço Ciência Viva*, researchers focused almost exclusively on the design of the website in relation to its potential success. When redesigning the website to include interactive sections such as a bulletin board and current events it was found that "The most significant result of the remodeling of the *Espaço Ciência Viva* website was the increase in the number of visits…Access to the site grew 200% in 2006 and 615% in 2007, in comparison to 2005" (D. Cavalcanti & C. Cavalcanti, 2009, p.6). This study shows an exclusive focus on the patron community by correlating a website redesign to the increase in patron visits.

However, though the patron community is incredibly important in the success of a website, the production community also contributes to its success or failure. The producers of a website, whether composed of volunteers, third party organizations, and stakeholders are a substantial part of the community. In fact, problematic production community dynamics directly inhibit the success of the website. Issues within the production community dynamics can arise within the categories of editorial timelines, volunteerism, and ownership.

<div align="center">Production Community Dynamic Conflicts</div>

Editorial Timeline – When producing online content, a scientist will come into contact with journalistic elements such as the editorial timeline required to publish with quick turnover. For

example, in Southern Appalachia a science writing collective that sought to release a bi-weekly newspaper column came into direct conflict with editorial deadlines (Burke et al., 2015). In the project natural scientists would often not come to scientific consensus, leading to social scientist to mediate and arrange face-to-face meetings between the conflicting parties. This struggle represents the difficulties of compressing environmental topics into easily understandable written material for a public that editorial timelines can require (Burke et al., 2015).

On a broader level, the journalistic workflow of publishing came into conflict with the academic timeline the researchers were used to. According to Burke et al. (2015) "the tight deadlines of journalism are a challenge for scholars accustomed to slower, longer writing projects that accommodate their other professional responsibilities" (p. 179). Professional responsibilities include exam schedules and the time it takes to actually conduct research.

Outsourcing Production – In some cases it may be more appropriate to outsource the production of the website because of a lack of production skills and knowledge among a volunteer workforce. This is because a professional website production company will have technical expertise that science communicators may not have. Therefore, science communicators should consider the expertise they might not have as a reason to use a production company. These teams might have to adapt to ownership and authorship issues when dealing with professional production organizations. For example, in the case study of a geographical community organization building its website, researchers found it difficult to work with a website production vendor because they created a website that communicated a stereotypical version of the environmental group (Farooq et al., 2011). In an effort to alleviate this tension the production team decided to build with an open source and user friendly platform. The production

community used a system called Mambo, which was open source and allowed non-skilled users to build websites without much knowledge of HTML (Farooq et al., 2011).

Even if a website is made by a third party vendor, science communicators need to consider exactly how to maintain the website, because "of those that had outsourced the original development of their websites, most recognized that access to ongoing design or technical-level support would be useful but, with few exceptions, they had not put any formal arrangements in place to secure such advice" (Denison & Williamson, 2012, p. 1084). Using an open source or easy-to-operate website building system can also alleviate this because open source can help in "achieving sustainability because of the wide user base and helpful online resources like forums." (Farooq et al., 2011, p.13).

Volunteerism – Production communities that are imbedded in a higher education system or that have limited funds may sometimes depend on volunteerism to create their website. This was the case in the instance of *Spring Creek*, which is an environmental organization that re-designed their website. The researchers behind this project found that volunteerism was beneficial because it allowed the team to not outsource their production. Therefore, they had a high level of control over the information the website exhibited (Forooq et al., 2011). Another benefit to this model is that volunteer labor does not require compensation and can greatly decrease the money needed to fund a project (Forooq et al., 2011).

Despite the benefits of volunteerism, conflicts can also arise such as quick turnover, lack of commitment, lack of time, and conflicts of ownership (Farooq et al., 2011). Knowledge needed to operate a website can be difficult to maintain "because of volunteer turnaround and organizational leaders being more absorbed in coping up with fulfilling the organization's mission" (Farooq et al., 2011, p. 16). Because of this it was recommended that an operating

13

system for the website is chosen on the basis of being open source and easy to learn, along with having a variety of online resources to consult. Time continued to be an issue with volunteers because "members of community organizations often do not have ample time and resources (e.g. access to training) to learn and use technology" (Farooq et al., 2011, p.16). Members of the production team recognized this and identified concerns with "volunteers who might not fully understand their mission in their limited participative time, and how this might have adverse effects on their organization" (Farooq et al., 2011, p.13).

<u>Common Science Website Structure</u>

Since scientific websites seek to convey information and institutional credibility, there are a number of common design methodologies that accompany this. In a mass analysis of European research institutions' websites, 66 websites were analyzed for common structures. Key themes in website design were identified as follows: institutional identity, scientific credibility, public relations, and user friendliness and accessibility (Massoli 2007).

<u>Conveying Institutional Identity and Scientific Credibility</u> – Institutional identity was essentially an alternate term for cohesive branding within a website, and methods were recommended such as including a landing page that contained information similar to a business card, clear style and logo type, and a communications approach geared towards communicating institutional purpose, identity, history, and structure (Massoli 2007). Conveying scientific credibility was a clear goal with the websites of research organizations, and a number of content strategies were included such as being authoritative in scientific claims with data on institutional productivity, and presenting the goals and scientific data in a transparent manner. To maintain credibility, scientific information needs to include a clear indication of when it was last updated (Massoli 2007). Transparency and credibility could also be achieved by including information about the

scientists involved (Massoli 2007). Creating a network by hyperlinking to other scientific websites can further convey scientific authority, as such actions can be perceived as endorsements (Ackland & O'Neil, 2011). In terms of credibility even considering the name of the website can have advantages. One study concluded that students thought websites ending in .edu or .gov were much more credible than websites ending in .com (Treise, Walsh-Childers, Weigold, & Friedman, 2003).

User friendliness and Public Relations – To convey authority a website should include a number of common structural components to create ease of use. These are often unnoticed by visitors because they are simple navigation tools. These included sitemaps, alternative text to images objects, pages with information about accessibility, search engine optimization, and link recognition (Massoli 2007). On a management level a website must have a PR plan or set of PR materials ready and accessible for patrons and the media. This can include brochures, press releases, contact information, and other communications material (Massoli 2007).

<div align="center">Design Strategies That Foster Scientific Discourse</div>

As earlier mentioned the literature does delve into proper design methodologies on websites. Philosophically and technically, the literature is clear on what the drawbacks and benefits of website usage are for scientists. However, literature on website design tends to focus on educational communication, rather than the goal of this thesis, which is fostering online discourse. Since many sources did not address this idea directly, examples of how to build community and discourse are unfortunately few and far in-between. However, a couple of key themes emerged, such as the use of dialogic design, strategic messaging, and interactivity as a way to build community and discourse.

Dialogic design – Dialogic design is a strategy of incorporating elements that specifically enhance or encourage dialogue between patrons and producers. Dialogic theory states that "for organizations to create effective organization–public communication channels, they must be willing to interact with publics in an honest and ethical way" (Kent et al., 2002, p. 67). Furthermore, dialogic design can be defined as utilizing the ability of the internet to build relationships based on dialogue with publics (Taylor et al., 2002). A number of design methodologies are recognized as effective parts of dialogic design such as ease of use, dialogic loops, usefulness of information, and retaining viewership (Taylor et al., 2002).

Firstly, ease of interface is important in encouraging dialogue, and includes design strategies such as site maps, links to rest of site, and search engine optimization (Kent et al., 2002). The analysis of European scientific institution's websites emphasizes including materials that are also useful to media as a method to foster dialogue such as press releases, speeches, downloadable graphics, audio/visual capability, and clearly stated positions. (Massoli 2007). A website should also remain useful to volunteers and interested parties, and this can be achieved by including a statement of philosophy, how to join, how to contribute money, and links to help an individual contact political leaders to mention their support of the website's cause (Kent et al., 2002). A website should also retain the viewership of those who decide to visit it, enlisting strategies such as explicit invitation to return, news forums, FAQs or Q&As, bookmarks, links to other websites, calendar of events, downloadable information, accessible information, and news items posted within the last 30 days. Most importantly, to reach effective dialogic design a website should include dialogic loops (Kent et al., 2002). These loops allow direct interaction from patrons of the website with the producers of the website, and include opportunity for user response, opportunity to vote on issues, and surveys to voice opinion on issues (Kent et al.,

2002). Common examples of dialogic loops include pop-up surveys that may appear on some

websites. These surveys ask for the user's opinion about their experience with the website, and

offer an opportunity for the patron community to directly voice their concerns to the production

community.

Strategic Messaging for Homophily – Effective marketing strategies rely heavily on establishing

feelings of homophily so that an individual does not only feel part of a community, but similar to

other group members. One method of establishing this is to make a clear statement of the goal of

the community, allowing members to have an objective to rally behind. Tactics associated with

website branding are a great example of strategic messaging to create feelings of homophily,

such as organizations including mission statements and clear objectives (Kent et al., 2002).

Further, in a study analyzing collaboration tools for teachers, educators needed a common

purpose otherwise they would likely not collaborate, (Brazelton & Gorry, 2003).

There are many strategic messaging strategies to assert homophily within a group

according to *Encouraging Contribution to Online Communities* by Kraut et al. (2012), including

"People will be more likely to comply with requests if they come from others who are familiar to

them, similar to them, are attractive, are of high status, or have other noticeable socially desirable

characteristics" (p. 33), and "People are more likely to comply with a request when they see that

other people have also complied" (p.35).

Sometimes techniques associated with product marketing can be deployed as part of a

community building effort. One such technique is audience segmentation and targeting to gather

multiple demographics to a website (Domegan, Davison, & McCauley, 2010). An example of

segmentation is the website of MC3, which used social media, virtual conversations, e-dialogues,

and case studies to go after their various audiences separately, which included the general public, academics and researchers, and practitioners and local governments (Newell & Dale, 2015).

Interactivity – Interactivity includes networking and social media with an emphasis on interpersonal and intercommunity interactions. The choice to group these together was made to unify the chances to "interact" on a website in any way. On a structural level, hyperlinking is one way to network throughout various communities and gather support within an online community. Hyperlinking can further serve as an endorsement of a website by conveying authority, credibility, and trust (Ackland & O'Neil, 2011).

Social media sites and programs can be deployed in order to reach a large audience, ranging from simple e-dialogues to Facebook. These sites or programs serve as a way to encourage groups to interact in their online communities. A series of different interaction methods were used in order to allow their audiences to network and discuss information on the website of MC3, such as E-Dialogues, social media, and virtual conversations (Newell & Dale, 2015). In another instance, creating a series of digital tools for teacher to collaborate and network, Brazelton & Gorry (2003) used emails, chatrooms, and forums. The comments sections of blogs and other websites is another way to encourage patrons to interact with each other.

CASE STUDY METHODOLOGY

In the attempt to understand how to effectively foster scientific discourse and develop communities around scientific discourse via websites, a dichotomy that is addressed by the design of this project must first be recognized. First, to foster scientific discourse a communicator must facilitate the production of a website using a team of content producers. Therefore, the production community must be critically studied as part of the process of fostering scientific discourse. Second, the ways in which a website can be designed to facilitate interaction and discourse within the patron community must also be studied. To fully be able to successfully use websites to foster scientific discourse, both communities must be considered separately, as one case with a singular unit of analysis could not be used to fully understand either process. Though the health of these communities is interdependent and the lines between production community and patron community may blur, in order to study them appropriately a different approach and separate set of protocols must be used for each.

This study aims to serve as a guide for science communicators looking to own their communication on the web and who may be unfamiliar with the methods for doing so. Though the importance of online scientific discourse was mentioned within the literature review, there were very few examples of guidelines or frameworks that explained how to actually foster scientific discourse. This thesis aims to fill a critical gap in knowledge between literature reinforcing the importance of online scientific discourse, and the practice of fostering online scientific discourse. Thus this case study is designed to support and inform science communicators with one or more of the following qualities: involvement in organized academia such as colleges or universities, non-profits or NGOs, and independent researchers looking to broaden dialogue around scientific issues. This case study is not designed to cater to for-profit

companies or larger corporations with the ability to outsource production, though some of its content may be useful to such entities.

<u>Research Questions and Framework</u>

This case study is defined as a multi-case participatory and explanatory study. The study is multi-case because two cases are needed to approach the production community and the patron community separately. The first case is participatory and involves the production of *Spire: The Maine Journal of Conservation and Sustainability,* as a way to study the production community behind a website. The second case is explanatory and involves analysis of website based scientific communities in order to understand how to use design to foster scientific discourse.

This multi case study aims to answer the following research questions:

1. **What communication factors shape the website development? What tradeoffs between design choices shape the development of this website?**

2. **How do websites of popular online scientific communities implement design strategies to address Dialogic Design, Interactivity, and Strategic Messaging, all strategies recognized as important to fostering scientific discourse within a patron community?**

3. **Based on the communication factors that shaped Spire and on the website review, what recommendations can be made to foster scientific discourse through academic journal production contexts?**

Case #1: Participatory Case

When conducting the literature review I immediately recognized the importance of the production community in the success of fostering scientific discourse. The opportunity came to participate in the production of an online journal based at UMaine named *Spire: The Maine Journal of Conservation and Sustainability*. Having experience in graphic design and website design, I serve as the lead designer and communication expert within the Spire team. Spire aims to expand the dialogue around conservation and sustainability by including multidisciplinary works including scientific studies, photography, artwork, and creative and journalistic writing. This case offers the opportunity for a unique look at the inner workings of website production in terms of the production community by acting as an actual producer.

Unit of Analysis – The unit of analysis are documents created by the Spire Editorial Team that contain direct participant observation and documentation. These forms of evidence are all digitally typed documents and are composed of communication materials and notes. The authorship of communication materials may vary but all notes are produced by me.

Participant Observation – Participant observation includes meeting notes that contain both direct observation and participant observation. Notes were always taken during meetings with the Spire Team, individuals members, or individuals outside of Spire. These notes document the meeting agenda, team member discussion and ideas, goals for future meetings, and personal observations.

Documentation – Documentation is composed of communication materials such as emails sent between the Spire Editorial Team and I discussing Spire related information. Documentation also includes advertising related materials such as promotional emails, posters, and explanatory webpage content such as mission and purpose statements.

Process of Gathering Data – The process of gathering the data is fairly simple within this case, as all Spire related documents are stored underneath the Spire Google Drive account so that all members of the Spire team can easily access them. During meetings I acted as the secretary in recorded the meeting agenda, team member's thought and ideas, and goals for next week. All other materials, such as communication materials are either stored within the Spire Google Drive or stored on the Spire webpage. To further organize data and evidence collected, a case study data base will be created to store files.

Case #2: Explanatory Case

As identified within the literature review, there were many issues identified within the production community that limited group's ability to produce a website. The production team producing Spire was also subject to these setbacks, such as conflicts between journalistic timelines and academia, lack of resources, conflicts of interest, and volunteerism. Because websites also take potentially years to become established as communities, it was recognized early on in the design process that Spire could offer a look into the production community, but provide very little information on the patron community. The descriptive case seeks to fill in this gap by analyzing 5 scientific communication websites for tactics that have been identified as methods for fostering discourse.

Unit of Analysis – The unit of analysis within this case is the content contained within 4 websites including wwf.org, 350.org, plos.org and science.sciencemag.org. This content is narrowed into three strategies that are not exclusive of each other, and some overlap is to be expected. These categories go as follows: Dialogic Design, Strategic Messaging, and Interactivity. Many different design methods can fit within the categories, but for the purpose of being cohesive, only specific elements from each category will be chosen. The goal of this case will be to directly observe how

these various websites address the strategies of Interactivity, Strategic Messaging, and Dialogic Design with website design methods.

Dialogic Looping – Dialogic looping is a strategy that aims to foster a feedback loop between patrons and producers. Dialogic loops are opportunities for user response, opportunities to vote on issues, and surveys to voice opinions on issues, and thus give feedback to the production community. Methods of designing websites to achieve this strategy include the use of pop-up surveys and "contact us" sections. When analyzing websites, methods identified as contributing to the strategy of Dialogic loops must in some way aim to foster feedback loops.

Strategic Messaging – Strategic messaging involves the clear use of a marketing strategy to enhance dialogue within a website by creating a feeling of homophily within the patron community. Homophily is a feeling where patrons believe they share characteristics with the rest of the community. Such characteristics can be physical, status based, geographic, and purpose similarities. Methods that contribute to this strategy include messages of common purpose or messages that reinforce the idea of a group or community.

Interactivity – Interactivity was interpreted liberally in the literature review as containing content interactivity, social media, and networking. Within this case study the strategy of interactivity will only include opportunities to interact and network within the patron community. Thus messaging that encourages networking or interaction that does not include a pathway to complete such an interaction will not be considered interactive. A pathway to interaction can include linked social media icons, buttons to enter email, or buttons to engage with the greater community. Common mediums of interaction include social networks, comment sections and user membership options.

Process of Gathering Data – Direct observation was used as a method for gathering data for this case. Content analyses sought to find design methods that contribute to the strategies of Dialogic Loops, Strategic Messaging, and Interactivity. Extensive notes were taken on how the website uses design methodology to approach these categories. Screenshots, text excerpt, and other pieces of the websites were used as further evidence to corroborate notes. All notes and evidence were stored in the case study database.

Only specific webpages were analyzed within the greater domain of a website. Larger more corporate scientific online communities follow a common set of design methods such as brand standards. Therefore, a smaller selection of representative webpages were sampled to understand the design trends of the entire website. On each website, the landing page (referred to as a home page), the about page, two articles or blog posts were analyzed. Social networks will be analyzed if pathways to access them are present on any of these pages. Blog posts or articles were chosen on the basis of ease of access, and the first two on the landing page were often chosen. Methodology identified within these pages followed a strict analysis by presentation protocol. A presented design methodology was only analyzed if it was readily available to the user and contained a clear purpose or intent. This is because all of these strategies depend on user engagement, and if a method is difficult to find or slightly inaccessible, it limits the ability of a patron to engage with it. The definition of accessible was defined by the following criteria: Does the method have a clear purpose? Is the method visually prominent to the point of being noticeable?

RESULTS AND ANALYSIS OF SPIRE: THE PARTICIPATORY CASE

Relevant research question: What communication factors shape the website development? What tradeoffs between design choices shape the development of this website?

<u>Introduction: Why Spire?</u>

Spire came as a fascinating opportunity to study communication dynamics within a production team not only because of its accessibility but also because Spire aims to be meaningfully different than many scientific journals. This meaningful difference is that the very design of Spire is designed to inherently break the silos of disciplines and allow for interdisciplinary and expansive discourse. Such design decisions include the format of the website, which displayed abbreviated versions of the interdisciplinary pieces directly next to each other. This design created a visual rhetoric of cohesive combination, where artwork would be visually blended with scientific articles. Another structure of Spire is the makeup of the Editorial Team, which is composed of members representing various disciplines such as digital art, copy writing, communication, and the life sciences. The Spire Editorial Team only accepted pieces that were deemed intellectually accessible to non-experts to not create an education barrier to the journal. Lastly the journal is named the Maine Journal of Conservation and Sustainability to include members of UMaine, private companies and institutions, and even stand-alone citizens.

As a graphic designer and Mass Communication major the website design process of Spire was fascinating. Since Spire aims to encourage interdisciplinary discourse by the very nature of its design, I was given the challenge to not only make the design of Spire visually pleasing but also meaningful and strategic. Therefore, the design of the website became an

exercise in interaction design and strategic visual rhetoric, both tools that were used to reinforce interdisciplinary discourse.

Understanding the Mission of Spire – The official mission statement of Spire is "To galvanize action for conservation and sustainability by promoting impactful, awareness-raising dialogue" (Umaine.edu/spire). Including with this statement the "vision" of Spire, which states "A publication that unites communities across the state of Maine to effect profound environmental change" (Umaine.edu/spire). In order to support these statements Spire accepts submissions from around the entire state of Maine. Even though the journal itself is associated with the University of Maine (UMaine), and hosted under the domain name umaine.edu, the journal also accepts sources from outside UMaine. In order to expand the dialogue around conservation and sustainability, the journal is interdisciplinary, and accepts essays on environmentally-relevant topics, articles detailing a project or study in which the author has participated, collections of data gathered by the author, journalism pieces highlighting a specific organization, group or event, artwork, photography or other digital media, and narratives or poems (UMaine.edu/spire). Further according to the Spire home page:

> Spire is arriving at an exciting time: given its interdisciplinary nature, the journal will fill a need by informing Maine residents on pressing environmental issues while also providing an expert forum for vital discussions about conservation and sustainability. Spire's ultimate aim is to create opportunities for innovation and action across disciplines as well as communities, further establishing Maine as a leader in sustainability and conservation (Umaine.edu/spire).

Thus Spire was designed as an interdisciplinary journal in order to invite a larger audience to join in the conversation about about conservation and sustainability, further breaking down the silos between disciplines.

Production Team: Key Details – All names or other personally identifying information are not included in this project to maintain confidentiality. This project does not comment on any individual or entity, and instead seeks to understand production team dynamics as a generalizable phenomenon that can be applied to similar projects. However, group titles that are public knowledge, such as the University of Maine, its associated departments, and general group names and generic titles will be used as identifiers.

Further in order to understand the scope of Spire, certain aspects of the Spire team must be quantified. The Spire Editorial Team is composed of 8 members, including 6 graduate students, 1 faculty advisor, and 1 undergraduate. The Editorial Team represented disciplines including english, communication, economics and the natural sciences. Graduate and undergraduate students held specific roles such as lead editor and web designer. An advisory board of 7 professors was established early on in the process, with disciplines of english, psychology, communication and the natural sciences. The diversity in discipline in the Editorial Team and Advisory Board was purposeful since we were creating an interdisciplinary journal and thus we needed interdisciplinary solutions. However, despite the differentiation in discipline and title, members of the Editorial Team remained fluid in their role and supported a variety of tasks. The Spire Editorial Team was further supported by UMaine Marketing and Communications, and occasionally sought the help of independent individuals about specific issues.

Spire Timeline and Key Dates – The formal process of developing the online aspect of Spire started on September 16, 2016, when with the Editor-and-chief approached me about a potential role as a web developer. However, the project had officially started spring semester 2016, when the Editor-and-chief approached the advisor with the idea of an interdisciplinary journal of

conservation and sustainability at UMaine. During the time between these two dates, progress was made in establishing Spire within the UMaine system, such as gathering staff support, applying for funding, and obtaining domain space under the UMaine.edu webpage.

Semi-regular meetings were held after September 16th, and the website was officially launched October 3, 2016. At this point the website only contained informational content so that visitors could learn about the journal and how to submit. Spire promotional content started to be sent out around the date of November 14, 2016. Promotional content included emails to all current UMaine students and staff. At this point, the full Spire Editorial Team was formed, and regular weekly meetings started to occur on Wednesdays at 4:00 p.m. in a regular location.

The Editorial Team also ran a cover design contest to further foster interest in the journal. This design contest officially stopped accepting submissions January 10, 2017, and a winner was decided around March 10, 2017. Spire accepted general submissions on a rolling basis in order to obtain as many submissions as possible, but stopped receiving submissions around March 1, 2017. Acceptance letters as well as some rejections were sent out around the date of March 15, 2017. Lastly the inaugural edition of Spire was officially launched on May 4, 2017, and accompanied by a launch party that same day.

<u>Communication Dynamics, Factors, and Trade-offs</u>

There was rarely ever a factor that had an exclusively negative or positive impact on the Spire Editorial Team. Instead in the context of Spire multiple trade-offs were identified, where an issue could be beneficial yet have key downsides. Thus the communication dynamics that were identified are not composed of things to avoid or accept, but rather of sets of tradeoffs that need to be navigated differently depending on the production community. The first trade-off is derived from the tension in who should own/author electronic systems such as the Spire website.

Also, ownership/authorship of the email address in terms of promoting Spire and responding to questions offered various trade-offs. Lastly team management offers a series of trade-offs, such as volunteerism, fluid democratic roles, and meeting structure and time.

<u>Issues with Ownership/Authorship of Electronic Systems</u>

Issues of ownership/authorship were common during the initial stages of Spire. Since many individuals were included in the production process, including the Spire production network, university staff, and applicants, two electronic networks had to be established. The first network was the spire@maine.edu email address while the second was the Umaine.edu/spire webpage. Because so many individuals on the project would communicate through or use these networks, the question of how to maintain a high quality of content was brought up. To mediate this a system of hierarchical ownership was set up, where some individuals on the team had higher access to privileges than others. This allowed for a high level of content standardization and quality, but limited democratic control of these systems within the group.

<u>Email: Promotion and Communication</u> – The Spire email was used for both promotional and communicative purposes. Initially the official Spire email address was used to field questions and submissions from applicants, send mass emails to the Spire Editorial Team, and for professional networking. The official Spire email was used for all of these purposes for organization: since the team was receiving a lot of professional communication, it was best to keep it all organized under one address. More casual communication between the Spire Editorial Team took place on student email addresses. Since emails received and sent by the official Spire email were considered high stake they could not contain any errors associated with unprofessional writing form and needed to be highly professional. This level of professionality

was further needed because the official email address served as the first line of communication with applicants and thus needed to portray the credibility associated with a scientific journal.

To ensure this only two high ranking Spire Editorial Team members, the Editor-and-chief and the advisor, had the login information to access this email. Both members had a high level of experience in professional writing and communication. They were also the highest ranking members and had the knowledge and authority to answer questions. The decision to have two members with access to the email further limited any confusion related to who was to respond to emails.

Democratic ownership of the email was clearly limited as only two members had access, and although there were advantages associated with this, it also caused issues with transparency and efficiency. Team members who did not have access to the email often would still need to know information that was sent through this email. Sometimes specific questions, such as questions about digital specifications for artwork had to be handed over to team members with more expertise. This either lead to the conversation with the applicant to be hosted on a student email address, or for the email administrators to act as intermediaries. Therefore, either the communication would be faster but less centralized with the personal emails, or slower and more indirect through the official Spire email. In order ease the lack of transparency the administrators would field any questions about communication that occurred over the email address, and de-brief Editorial Team members further about the type of communication they had received.

During the month of November the Editorial Team started to actively promote the journal through email. In order to send a message to the entire student body a proposed message had to be approved by a communications office at UMaine. This process took almost two weeks, and when our promotional email was approved it was at first sent incorrectly and then sent again with

unprofessional looking formatting. Upon further inspection the team also discovered the promotional email did not even make it out to the entire student body.

The communications department that sent our email oversees communication that goes out to over 10,000 students, and thus all emails follow a strict and non-transparent vetting process to ensure security and student email lists are not publically available. This system also sends much higher priority emails such as safety announcements. Our promotional email was clearly not a high priority message, and thus the process for getting it sent was lengthy, and correcting its unprofessional formatting was not a high priority for the communications department.

The Editorial Team realized that this method was ineffective considering we had planned to send a series of promotional emails on a more rapid basis. The unprofessional formatting was also completely out of our control and yet was the first representation of Spire to many members of the student body, thus likely impacting our perceived credibility. In order to mediate this the Spire Editorial Team decided to own its promotion by using the Spire email address. However, this was initially problematic as there was no way to obtain the list of student email address. To approach this problem, the Spire Editorial Team compiled its own list of email addresses by searching department webpages for influential individuals including departments heads, administrative assistants, and other influential professors. The idea was that these influential individuals could further spread the message as they would have lists of the students within their departments. The Editorial Team could further use this method to send out promotional materials more rapidly, respond to questions directly, and target certain academic circles and demographics.

The Website and WordPress – At the beginning of the production process the key members of the Spire Editorial Team decided to host the online journal under the UMaine.edu domain. This allowed the team to avoid dealing with the process of buying a domain name and a hosting service, developing the theme and plugins of the journal, and dealing with security related issues. This further afforded the Editorial Team a robust and extremely helpful system of tech support, design and technical expertise. The team associated with maintaining the website also helped the Spire Editorial Team design a set of logos. The Umaine.edu domain also holds a degree of institutional credibility, and Spire was able to inherit this credibility by hosting under this domain.

The UMaine.edu domain is run on the open source software WordPress. Because WordPress is open source and was developed as blogging software it is extremely user friendly and informational and training materials are available online. WordPress allows for the use of themes and plugins, and the UMaine.edu domain runs on a customized branded theme and associated plugins. Because of the already established theme and plugins, the Spire Editorial Team needed no programming or website hosting knowledge, and rather depended on two team members with advanced experience in WordPress. Thus in giving up the ownership of the Spire website to the University of Maine, the team saved money and time, and the website was up and running within two weeks.

Yet the lack of ownership of the website leads to limitations in design freedom. The content plugins and theme included a system for making slideshows, as well a visual block design system for page content. We were not able to obtain permission to use a more robust block system plugin or a different theme. When working with the visual design block system, we found that it was clearly not built for extensive editorial content and was rather built for

navigational and informational purposes. This made sense, as UMaine.edu was not an editorial website, but rather is an informational resource for current and prospective students. Yet despite these limitations sacrificing design freedom for security, saved money, and a support system was an incredibly beneficial trade-off.

<p align="center">Team Management</p>

Meeting Times and Purpose – During the fall semester of 2016 the Spire Editorial Team was only composed of 4 members. Also during this time there were only semi-regular meetings each week that were not held at a regular time. Conversations during these meetings were mostly hypothetical, and most of the conversations were spent discussing ideas for the future of Spire. For example, a meeting on November 4th was spent discussing the potential for a series of interviews of prominent applicants, and if Spire was going to follow a traditional journal format or look more like a blog. These discussions rarely resulted in action, as with no submissions to review and only a rudimentary introduction website online, there was almost no work that needed to be done. Yet these meetings were important as they allowed the leading members of the team to align their viewpoints on the internal ideology and framework of Spire. For example, meetings during this time were often not structured and did not have an agenda. Rather they were used to discuss topics such as possible designs for Spire, how to properly network with organizations outside of UMaine, and even how users should interact with the journal. These topics would rarely come to a conclusion and instead served to help align various members vision of Spire.

However, near the end of the fall semester meeting times needed to become more regular as more technical work arose. Before winter break started a survey was sent out to potential team members asking what their availability was for the next semester. A common meeting time

became absolutely necessary to retain a consistent Editorial Team, especially when that Editorial Team was composed of graduate students with highly variable and saturated schedules. The Editorial Team started meeting once a week for an hour in a consistent meeting place after this survey.

Since meetings were only an hour in length most work was completed outside of the meetings. Thus meetings followed a structure where issues were discussed and then deadlines and work related goals were put in place for the next meeting. For example, when vetting submissions Editorial Team members were assigned certain submissions to read and comment on for the next meeting.

There were often private work sessions or meetings between two or three team members to discuss much more specific issues. The Editor-and-chief and Web-designer would have a second half an hour meeting each week to discuss promotional activities, current issues, and the editorial logic behind the design of the website. The faculty advisor would meet with either just the editor and chief or sometimes with the web designer to discuss larger picture items such as future leadership roles. Towards the end of the spring semester, the two web designers would meet weekly in order to establish a standardized method of web-design.

Democratic Structure and Fluid Roles – Spire itself aims to include work that enriches the dialogue around conservation and sustainability by including a variety work, such as artwork, anthropology, and traditional scientific articles. Because of this the Editorial Team also had to be interdisciplinary and followed a slightly fluid democratic structure. Certain members held clear positions such as Editor-and-chief and Web-designer, while others had more fluid positions based off of their expertise, such as a student who commonly advised on student government and editorial issues. Other students held expertise in Communication, Economics, and the Natural

Sciences, and thus informed the entire group on aspects of an issue related to their area of expertise.

Since the interdisciplinary nature of the journal required a range of expertise that no member could master alone, the meetings automatically followed a democratic structure. Matters would commonly be settled through debate and conversation, where members would bring up competing interests and find a common ground that satisfied the concerns of the entire group. For example, a series of editorial standard rules were arrived at through a debate at one meeting.

However, there were instances where technical decisions were reached through non-democratic means. Technical decisions that involved a large amount of expertise were given exclusively to the team member with the most knowledge on the subject. For example, two members were solely responsible for building the UMaine.edu/spire website. Despite this, non-expert members could give generalized feedback on technical matters. For example, though two team members designed the website the layout of the journal was debated.

Volunteerism: Retention and Recruitment – Volunteers provided most of the work for Spire because Spire was a graduate student run organization. Though the Spire Editorial Team did receive assistance from university employees on topics such as advising and website technical problems, volunteers still provided most of the labor. Volunteers were crucial to the success of Spire because the Editorial Team did not have the access to funding to pay for labor costs. A few volunteers had slight incentive to work within Spire, for example conducting research on Spire or taking a class to gain credit for working on Spire. Thus volunteers saved Spire money that could be spent on more crucial aspects of the journal, such as printing and launch event costs.

However, volunteerism can be problematic for production teams because of volunteer turnover and lack of incentive. Since Spire is a student run project the workforce was entirely

composed of volunteers who were not being financially compensated for any work related to Spire. Most of the students working on the project were second year graduate students, and thus were graduating from the university shortly after Spire was to be published.

The volunteer turnover is problematic for Spire because the development and publishing of the journal involves two types of knowledge: technical expertise, and established standards and protocols. For example, the design of the website required technical expertise in WordPress and graphic design knowledge, while routine standards for vetting submissions needed to be established and learned.

The structure of Spire required expertise in student government, and the professional emails required a high level of expertise in writing. Thus technical expertise was not something that could be taught during the process of developing Spire, and required students who were already experts in these area. In order to obtain such individuals, the Editor-and-chief and advisor relied upon emailing professors that taught within this skill set who could identify expert students. The Editor-and-chief and advisor also used a lot of personal networking, recruiting other grad students they thought would be good for the position, and recruiting through any classes they taught.

Beyond inherent technical skill, standards and protocols could be established to help new and current members align themselves to a common set of practices. For example, an Editorial Team member wrote a series of very specifically worded guidelines for how to vet submissions. The importance of writing such guidelines cannot be stressed enough in maintaining smooth transitions of power between volunteers as they leave the university and the group. Thus design standards for the website will also be established as materials for the next generation of Spire editorial members to inherit. Beyond writing down a specific process, writing down key

statements of purpose and mission can help align new volunteers to an ideological structure more easily.

Another way to help new members learn the common practices was to build Spire within an open source system. WordPress is easy to learn and widely used, and by hosting under the UMaine domain we had access to a huge network of support. This kind of system will be incredibly valuable to the future of Spire as new volunteers will need to be able to quickly learn these systems.

In order to keep volunteers two factors were identified as helping to incentivize the process. First, Spire could help a student's career through resume or experience building. Second, the feeling of being needed within the group or being personally interested in the topic also helped retain volunteers. Some students on the Editorial Team were also taking a class associated with Spire, such as a thesis or independent study. But beyond this volunteers tended to stay on the team if they felt they were needed and were genuinely interested in the project. We found that the attendance to meetings greatly increased when there was a clear agenda and work to be done. Further members whom had a specific and rare expertise naturally started offering that skill to the group and took on more responsibility. But beyond this, individuals with the most personal interest tended to take on the most responsibility. This emphasizes the importance in trying to recruit those with interest, not just those with skill.

<u>Technical Design and Standards</u>

The use of standards and website design was briefly mentioned in the previous section. Though volunteerism was used as a rationale for having standards in place, the standards were never mentioned or analyzed in depth. Such standards and web design practices are an incredibly important Spire, and thus it is important to go into depth about the systems that were used.

Technical designs and standards that were used include a common strategy for displaying content and sets of submission standards.

Technical Website Design – The design of the Spire website came in two stages that served two different purposes. While the Editorial Team was advertising and receiving submissions the website was purely informational. This website contained a homepage, an advisory board page, a submission page, and a cover design contest page. The goal behind this setup was that users would see our promotional emails and go directly to the website where they could learn more. The cover design contest was also a method of attracting attention to Spire, and we offered a prize of 100 dollars for the chosen submission. Another page, called "our partners", was initially going to be used to show the depth of our community, however organizations did not have enough initial interest in the prospect of being a partner to set up this page.

The website had a common set of branding trends associated with UMaine. Since we were hosted under the UMaine domain, we did inherit font styles, colors, and other design standards such as a custom logo. Though Spire may eventually seek its own unique design, the UMaine design standards were helpful in automatically making the Spire website cohesive looking. The importance of design cohesiveness should not be underestimated, as it serves as a visual representation of the quality of the content.

The design of Spire aims to visually pair diverse forms of expression such as paintings and scientific articles. This visually would then reinforce the broadened dialogue around sustainability and conservation. However, this offered a unique design challenge as the pieces were fundamentally different, and thus needed different design methodologies to incorporate them into the website. For example, a photograph cannot be treated the same as text within web design. In order to mediate this, a design standard was set in place that used shortened versions

of all of the pieces on a scroll down "main content page", with clickable links to read more about each piece. When clicking this button, the reader would then be taken to a separate page with the content of one submission. Next to this submission would be a navigational sidebar with the option to go back to the main issue or to see other articles.

<u>Editorial Standards</u> – The Spire Editorial Team followed a strict set of standards when vetting submissions to maintain editorial integrity. When a piece was received it would go through an initial review process, which would either pass or reject the piece based on the follow two requirements.

1. The submission's purpose is compatible with our vision statement; it helps to further dialogue around/considerations of conservation and sustainability. Its primary purpose is not to advertise anything, but rather to inform or prompt new thinking in an audience. Submissions should not self-promote or advertise any group or entity, including financial gain. (Spire Editorial Standards)
2. There are no visible and overarching quality issues that render the piece unpublishable. That is, an entire rework of the piece would not be necessary for it to be published in Spire. Issues include (but are not limited to): Excessive typographical or language issues, file quality issues (pixel density, bitrate...etc.) (Spire Editorial Standards)

If these two stipulations were met, the piece would then be sent on to an academic review process. Two members of the editorial board with experience relevant to the content would then read the submission and suggest edits if desired. The two reviewers would then present their comments to the entire team, and the submission would then either be accepted, conditionally accepted (in the case of edits), or rejected.

RESULTS AND ANALYSIS: THE EXPLANATORY CASE

Research Question: How do websites of popular online scientific communities implement design strategies to address Dialogic Design, Interactivity, and Strategic Messaging, all categories recognized as important to fostering scientific discourse within a patron community?

Introduction

Once the communication dynamics and trade-offs within a production team have been addressed and understood a team can then move on to implement design strategies within the website. In the case of Spire, the communication dynamics and trade-offs had to be dealt with before the actual construction of the website to ensure that the team was functional. In fact, the production of the Spire journal design only occurred in the last two months of the yearlong project.

Because much of the time of the Spire project was spent dealing with communication dynamics and trade-offs the explanatory case was used as a method of isolating the identified design strategies in already effective and popular websites. The idea behind using successful websites is that since they exhibited already established communities and likely had more design autonomy than Spire these websites would exhibit more examples of the design strategies of Dialogic Looping, Strategic Messaging, and Interactivity. Thus methodology identified on these websites as contributing to the three strategies should be seen as future goals for Spire rather than being currently used on the Spire website.

WWF.org

The World Wildlife Fund (WWF), is an international charity foundation that provides funding for projects related to forests, oceans, freshwater, wildlife, food and climate. According to WWF.org, WWF is the "The world's leading conservation organization, WWF works in 100

countries and is supported by more than one million members in the United States and close to five million globally," (WWF.org, n.d.).

1. Strategic Messaging for Homophily

Examples Present - Home Page: 7, About/contact: 5, Article 1: 2, Article 2: 1

Because WWF.org depends on donations the website was designed with messaging that reinforced group similarity through a common purpose and group power. Thus much of the material on their homepage was rhetorically aimed at establishing the visual presence of a large community. One featured tweet on the front page that accomplished this stated that "buildings and landmarks across the globe are joining the #EarthHour movement, you can too" (WWF.org, n.d.). The WWF about page contained messages that further reinforced the size, common purpose, and accessibility of the community by stating "it's a big job, and no one person can do it alone" (WWF.org, n.d.). The website also used visual examples of community by including pictures of groups of protesters with the caption "on lobby day, WWF activists head to capitol hill to engage leaders on conservation issues" (WWF.org, n.d.). Further messaging included asserting the high value of some of the members within the community with one photo showing actress Kristen Bell claiming that "Kristen Bell commits to sustainable laundry practices, will you? Take the pledge" (WWF.org, n.d.).

2. Interactivity and Networking

Examples Present - Home Page: 2, About/contact:1, Article 1: 3, Article 2: 0

Despite the massive amount of strategic messaging, there was very little evidence of connection within the community in terms of interactivity and networking. Though WWF does use social networks such as Facebook and Twitter, these networks were only linked on the homepage through a series of icons. Upon analyzing Twitter, the social network seemed to contain very

little patron interaction, and rather served as some sort of blog to post both articles about WWF funded activities and more strategic messaging. Throughout the homepage there were often call to action buttons that implied some sort of interaction, for example "let us know if you are participating [Earth Hour]" (WWF.org, n.d.). Upon further inspection, call to actions such as these seemed to be more about data collection. This data would then be used to reinforce strategic messaging by stating the size of the community and their collective purpose. The most prominent interactive feature included creating a WWF account. However, this account, referred to as the support center, was really just a tool for WWF to gather email addresses for promotional purposes and to gather donations and therefore including little to no interpersonal interaction.

3. Dialogic Loops

Examples Present: Dialogic Design appeared universally on all pages

Since WWF depends so greatly on stakeholder support it contained a robust system of dialogic loops. This system was so robust that it was not mainly contained on a certain page, but appeared as part of the header and footer of all pages. For example, users could set up a WWF account where they could contact site administrators with questions or look up common answers. After interacting with WWF.org for a couple minutes, a popup survey appeared asking about my experience with WWF.

<div align="center">350.org</div>

350.org is an environmental activist network that aims to promote three specific agenda points: keep carbon in the ground, help build a new more equitable low-carbon economy, and pressure governments into limiting emissions, (350.org, n.d.). 350 refers to 350 ppm, the level of carbon in the atmosphere that needs to be reached to reverse or stop climate change. The organization

does accept donations, but the main purpose of the group is to organize group climate action through the use of in person meetings. Thus the about page claims that "We're Stronger When We Collaborate", and "Mass Mobilizations Make Change", (350.org, n.d.).

1. Strategic Messaging for Homophily

Examples Present - Home Page: 2, About/contact: 2, Article 1: 1, Article 2: 2

When first landing on the home page, the first visual element shown is a strategic message that asserts "We are building a global climate movement" (350.org, n.d.). Within this message, the words "we", and "global" assert the size of the community, while "climate movement" asserts the purpose. Within the about page there are many assertions of homophily, including entire sections dedicated to purpose overview and goals. These sections assert a common purpose by claiming "we believe in a safe climate and a better future," and "we are stronger when we collaborate" (350.org, n.d.). The articles themselves often contain statements of group strength and a common shared goal, further reinforcing the common purpose. Strong visual messages also supported the idea of a group with a common purpose, with a map showing the geographic locations of different 350.org communities and photos of mass protests.

2. Interactivity and Networking

Examples Present - Home Page: 5, About/contact:1, Article 1: 3, Article 2: 1

There was a lot of overlap between strategic messaging and interactivity. Strategic messaging was used to assert the size and purpose of the group, and was usually accompanied with a button that allows you how to interact in a very personal way with this community. For example, one graphic showed an icon of a map with the text "find a 350 local group" (350.org, n.d.). When clicking this icon, you are directed to a map that allows you to find the contact information for your local 350 group, where you can meet participants face to face. There was even an option for

you to create your own 350 group, and all groups were provided with free advertising and branding materials. Even a window that asked for email addresses framed the email list as a way to "get involved," and "get emails updates at moments when you can make a difference" (350.org, n.d.). In one article, a live strategy session was advertised, where members could chat directly with each other and watch the strategy session. The social networks were incredibly prominent on all pages, and upon inspection Facebook included invitations to in person events and clear user interaction through comments.

3. Dialogic Loops

Examples Present - Home Page: 2, About/contact:1, Article 1: 1, Article 2: 0

Though user interaction and networking took place on the website, the goal of the website was to foster personal interaction in public meetings and events. Dialogic loops could then theoretically occur within these face to face meetings and not necessarily on the website. Thus the website itself did not contain many examples of Dialogic Design, as user feedback could take place within the personal meetings. On the homepage there was the ability to contact site administrators and sign up for an email program, but these options were small and were contained within the page footer. The about/contact page also contained a section for users to submit feedback via email that was slightly more prominent.

<div align="center">Sciencemag.org</div>

Science magazine is a journal conglomerate that contains the journals *Science Advances*, *Science Immunology*, *Science Robotics*, *Science Signaling*, and *Science Traditional Medicine*. Sciencemag.org is a representative page for all of these journals, and the organization is sponsored by the American Association for the Advancement of Science. The conglomerate website was chosen because of its vast amount of influence within academic spheres according

to its top 50 scientific journal rank on http://www.scimagojr.com/. Sciencemag.org seeks to "advance science, engineering, and innovation throughout the world for the benefit of all people," (sciencemag.org).

1. Strategic Messaging for Homophily

Examples Present - Home Page: 2, About/contact: 0, Article 1: 0, Article 2: 0

Within more established scientific journals or journal conglomerates, strategic messaging for homophily becomes more abstract. There were few direct statements of purpose or language referencing the size of the community. Rather sciencemag.org depended upon visual representations of the size and and purpose of the community. The home page would often contain long lists of the names of journals produced by the community, and highly visual picto-navigational links to various journals and featured articles. This insinuates that the community is large enough to produce large volumes of high quality work and the purpose of the community is to contribute to scientific topics.

2. Interactivity and Networking

Examples Present - Home Page: 3, About/contact:0, Article 1: 2, Article 2: 2

Within a proper journal there is another mode of interaction, which involves publishing. Website visitors have the opportunity to try and publish through their academic institutions to one of the journals put together by Sciencemag.com. This allows for an intellectual interaction with the greater scientific community by adding to the meta-discourse around science. Because of the high academic standard of the journal, there was very little access to publishing tools, other than a small section at the top of the page for authors, members, and librarians. Upon clicking on the authors option a user could then figure out how to submit.

In terms of direct interpersonal interaction and networking, social networks held a high

presence on many of the web pages. Social media icons could be easily found on the home page,

and Sciencemag.org uses Facebook, Twitter, YouTube, and Google Plus. More interpersonal

interactions occurred within these sources as they served as a method for authors to network with

each other. This networking was further reinforced by the opportunity to directly interact with

authors by clicking next to an author's name, where you can email or tweet them directly.

3. Dialogic Loops

Examples Present - Home Page: 2, About/contact:0, Article 1: 0, Article 2: 1

Sciencemag.org contained very few methods of reaching out to the production team for contact

via dialogic loops. Within the homepage there was a clickable link to a contact section at the

bottom of page, and within the contact page there was a list of methods to reach out with

questions. However, there was very little evidence of further dialogic loops on the webpage.

<div align="center">Plos.org</div>

The Public Library of Science (PLOS), is a conglomerate system of journals that provides

scientific articles in an open source format. According to Plos.org, "PLOS was founded in 2001

as a nonprofit open access publisher, innovator and advocacy organization with a mission to

accelerate progress in science and medicine by leading a transformation in research

communication" (Plos.org, n.d.). PLOS publishes a number of open journals including *Biology*,

Computational Biology, *Neglected Tropical Diseases*, *Medicine*, *Genetics*, and *Pathogen*. All of

the articles published in these journals are accessible to the public at no charge.

1. Strategic Messaging for Homophily

Examples Present - Home Page: 6, About/contact: 2, Article 1: 3, Article 2: 1

Plos.org seeks to convince visitors of the value of their mission by including messaging that hints at the size and purpose of the open source publishing community. On the home page, a prominent header image claims "Plos is a nonprofit publisher, innovator and advocacy organization" (Plos.org, n.d.). Further messaging includes an image that states "Ten years of advancing science as One: come celebrate with us" (Plos.org, n.d.). The about page includes further strategic messaging that asserts the goal of the organization by stating "our job is not done," and that "openness ensures innovation" (Plos.org, n.d.). Further strategic messaging included picto-navigational bars that show the breadth of the publishing community and lists of the journals offered.

2. Interactivity and Networking

Examples Present - Home Page: 5, About/contact: 3, Article 1: 0, Article 2: 2

Similarly to Sciencemag.org, Plos.org is a conglomerate journal organization, and thus a method of interaction includes publishing. Within Plos.org however the methods of publishing were clear and easily accessible. Plos.org contained a large button that said "Submit your manuscript," in the upper right corner (Plos.org, n.d.). Plos.org also runs a series of blogs including medicine and technology commentary that allow patrons to interact further.

Plos.org allows for more direct networking and interaction by advertising a personal "Meet the editors" session during an AACR conference (Plos.org, n.d.). Further Plos.org allows for interaction via social networks. Facebook and Twitter were used as systems for posting articles, members of the Plos.org community clearly interacted on these networks, either through Facebook comment sections, or from tweeting to each other directly. Within articles themselves hosted on Plos.org users could even contact authors directly.

3. Dialogic Loops

Examples Present - Home Page: 1, About/contact: 2, Article 1: 1, Article 2: 0

Plos.org had very few examples of dialogic design within their website. On the Plos blogs there was a contact form where you could specifically send comments and feedback, and at the bottom of every page there was a contact section. There was also a box where you could enter an email address to receive promotional emails from Plos, but there was no evidence this was used for feedback.

<div align="center">Key Design Strategy Themes</div>

Dialogic Infrastructure and Popups – Dialogic loops showed up on all pages in varying levels. These examples of dialogic loops would commonly be formatted in two ways. First, dialogic loops were built into the header and footer of the page as a dialogic infrastructure. This infrastructure could be found on all pages under a domain and was often difficult to notice and not-intrusive because of its small font. This format of dialogic looping is beneficial because visually it does not interfere with the main content of the page, but can still easily be accessed by scrolling to the top or bottom of the page. Second, pop-up surveys were another method of prompting a dialogic loop. One WWF.org survey in a pop-up window was given once a couple of pages had been analyzed. This allows for a user to have time to interact with the website before a survey comes up asking them about their experience.

Implied and Direct Strategic Messaging – Strategic messaging was used in all websites to create feelings of homophily. Examples of this include the usage of direct messaging and implied messaging. Direct messaging involves stating a common goal or purpose, such as 350.org stating "We are building a global climate movement" (350.org, n.d.). Direct messaging was typically found at the very top of the home page floating on top of a banner image, or on the about/contact

page. Implied messaging includes non-direct messages of homophily, such as an image on WWF.org that shows a group of WWF volunteers walking into a government building to protest for an environmental cause. Other implied messaging includes the use of picto-navigational lists of articles. Though this serves to help a user navigate throughout the website, it also reinforces the existence of a community needed to produce such articles, and the purpose of that community which is to produce scientific articles.

Combined Interactive and Strategic Messaging Elements – Calls to action were sometimes combined with strategic messaging on the websites to encourage interactivity. A call to action is a web element used to convince a user to perform a certain action, such as clicking to buy a product. On the websites studied a strategic message would first assert homophily, then include a call to action that would encourage the user to join the community. An example of this is on Plos.org, where a written message says "Ten years of advancing science as One: come celebrate with us" (Plos.org, n.d.). This message was then followed by a linked button where users could sign up for the celebration event. On 350.org, combined interactive and strategic messaging elements were used to connects patrons in face to face meetings. For example, one webpage element stated that "you have the power to organize your friends, colleagues, and neighbors to take action together" (350.org, n.d.). This statement was followed by a button that helps you find local groups by showing you a map of local 350 groups and their contact information.

Relevant Research Question: Based on the communication factors that shaped Spire and on the website review, what recommendations can be made to foster scientific discourse through academic journal production contexts?

<u>Introduction</u>

The inaugural edition of Spire will be published on May 4, 2017 following a celebration launch event at the UMaine Hudson Museum. Spire as a project has provost level support and aims in future years to become further established at UMaine as an important avenue for community level discourse and in name recognition on campus. With this in mind this research project might be used to inform the future direction of Spire and help the ultimate success of Spire as a journal and as a community. Thus this section is dedicated to recommended future practices for Spire based on the communication dynamics, factors, and design strategies analyzed.

<u>Recommended Website and Design Practices</u> – The Spire website is hosted under the UMaine.edu domain. Because of this Spire inherits the brand standards and navigational tools used by UMaine. Spire also has a limit on the amount of storage space given by UMaine, and extremely limited customization options. This system was free to operate for Spire, which was advantageous as website hosting services cost additional funds. Hosting under the UMaine domain was further advantageous because it came with technical support from UMaine and was an open source system.

However, Spire in the future should be hosted under a private domain in order to gain more autonomy with design choices. Once Spire becomes more established as a successful journal more resources such as a larger Editorial Team and additional funding may become

available. Thus Spire can expand its volunteer network to contain more individuals with website building expertise, or have enough funding to outsource the production.

Since Spire currently has limits in design autonomy it was difficult to implement dialogic loops, strategic messaging, and interactivity. Further, because Spire was in development stages, much time was spent on communication dynamics within the production team. By developing Spire under a new domain the Editorial Team can work to better implement these design strategies. The Spire website should then work to include dialogic infrastructure to cater to the questions and problems of a larger user base and audience. Spire should also work to include more social networking and sharing options. Spire does have an underutilized Twitter account but in the future this account could be used to help communicate with the Spire community. These social networks could even be dynamically linked on the Spire website once more design autonomy is gained. This would allow for more direct interaction within the Spire community through commentary and messaging.

Communication Dynamics Recommendations – The fluid democratic structure worked well for Spire as it was going through development. The Spire Editorial Team had very little experience producing a journal and thus issues that came up had to be solved on the spot with little prior knowledge or reference materials. Some team members had specific roles, such as Web Designer, Editor-in-chief, and Advisor. However, beyond this team members served a number of roles to be able to adjust rapidly to sudden problems or issues. However, as Spire continues to grow and gain prominence it would be best to add more concrete positions to the group. The fluid democratic structure was important for Spire while developing but as less protocols and standards need to be developed in the future more concrete roles that specialize in these protocols and standards will be needed. An example would be the addition of a treasurer. The

management of Spire funds was done by higher level members because the team needed very little money to operate and were still developing avenues to spend these funds. But as more money is needed to operate Spire in the future a designated treasurer will be needed to maintain organization.

Further as the Editorial Team continues to grow in members and more concrete positions are added meetings should also become specialized and not include all members. For example, there might be a meeting just for editors and another separate meeting for designers with a general Spire meeting twice a month. With this model, meetings can become more focused and efficient by requiring only members who are expert in the meeting topic.

Incentivizing and recruitment – The production of Spire involved the work of both graduate and undergraduate students. These students were not financially compensated for their work on Spire, and often did Spire related work during Editorial Team meetings and in their free time. Thus as Spire continues to grow and requires more work to maintain and publish it, more advanced methods of recruitment and incentive will be required. One method of incentive that was already seen within the Spire Editorial Team was personal ownership of the Inaugural Edition of Spire as a thesis. Two members of the Spire Editorial team were incentivized within the project because they worked on Spire for their senior thesis. However, most members worked on the Spire Editorial Team out of interest. Therefore, it might be advantageous to give students opportunities to obtain credit for working on Spire, such as a service learning projects for classes, or even low credit elective classes. This could be achieved by taking advantage of the massive network of university stakeholders involved in the Spire project who may have influence over class and academic curriculums.

REFERENCES

Dickinson, J. L., & Bonney, R. (2012). *Citizen science: public participation in environmental research*. Ithaca: Comstock Pub. Associates.

Ackland, R., & O'Neil, M. (2011). Online collective identity: The case of the environmental movement. *Social Networks, 33*(3), 177-190. doi:10.1016/j.socnet.2011.03.001

Brazelton, J., & Gorry, G. A. (2003). Creating a knowledge-sharing community: If you build it will they come. *Communications of the ACM, 46*(2), 23. doi:10.1145/606272.606290

Burke, B. J., Welch-Devine, M., Gustafson, S., Heynen, N., Rice, J. L., Gragson, T. L., . . . Nelson, D. R. (2015). Can science writing collectives overcome barriers to more democratic communication and collaboration? Lessons from environmental communication praxis in Southern Appalachia. *Environmental Communication,10*(2), 169-186. doi:10.1080/17524032.2014.999695

Cavalcanti, D. P., & Cavalcanti, C. C. (2009). New languages for the spreading of scientific knowledge: broadening the dialog between science and society. *JCOM: Journal of Science Communication*.

Denison, T., & Williamson, K. (2012). Website management issues for community-based, non-profit organizations in rural and regional areas. *Information, Communication & Society,16*(7), 1072-1092. doi:10.1080/1369118x.2012.687005

Domegan, C., Davison, K., & McCauley, V. (2010). Realising the management challenges for science communication outreach: A social marketing perspective. *Irish Journal of Management*.

Evans, N. G. (2010). Speak no evil: Scientists, responsibility, and the public understanding of science. *NanoEthics, 4*(3), 215-220. doi:10.1007/s11569-010-0101-z

Farooq, U., Ganoe, C. H., Xiao, L., Merkel, C. B., Rosson, M. B., & Carroll, J. M. (2007). Supporting community-based learning: case study of a geographical community organization designing its website. *Behaviour & Information Technology, 26*(1), 5-21. doi:10.1080/01449290600811503

Few, R., Brown, K., & Tompkins, E. L. (2007). Public participation and climate change adaptation: avoiding the illusion of inclusion. *Climate Policy, 7*(1), 46-59. doi:10.3763/cpol.2007.0704

Kent, M. L., Taylor, M., & White, W. J. (2003). The relationship between web site design and organizational responsiveness to stakeholders. *Public Relations Review, 29*(1), 63-77. doi:10.1016/s0363-8111(02)00194-7

Kouper, I. (2010). Science blogs and public engagement with science: Practices, challenges, and opportunities. *JCOM: Journal of Science Communication*.

Kraut, R. E., Resnick, P., Kiesler, S., Burke, M., Chen, Y., Kittur, N., . . . Riedl, J. (2011). *Building successful online communities: evidence-based social design*. Cambridge, MA: The MIT Press.

Lassen, I., Horsbøl, A., Bonnen, K., & Pedersen, A. G. (2011). Climate change discourses and citizen participation: A case study of the discursive construction of citizenship in two public events. *Environmental Communication, 5*(4), 411-427. doi:10.1080/17524032.2011.610809

Massoli, L. (2007). Science on the net: An analysis of the websites of the European public research institutions. *JCOM: Journal of Science Communication*.

Newell, P. (2008). Civil society, corporate accountability and the politics of climate
     change. *Global Environmental Politics, 8*(3), 122-153. doi:10.1162/glep.2008.8.3.122

Newell, R., & Dale, A. (2015). Meeting the climate change challenge (MC3): The role of the
     internet in climate change research dissemination and knowledge
     mobilization. *Environmental Communication, 9*(2), 208-227.
     doi:10.1080/17524032.2014.993412

Public Library of Science. (n.d.). Retrieved March 26, 2017, from https://www.plos.org/

Science Magazine. (n.d.). Retrieved March 25, 2017, from http://www.sciencemag.org/

Smith, D. R. (2016). One scientists struggle to be a better writer, and a plea for undergraduate
     science-writing engagement. *Science Communication, 38*(5), 666-674.
     doi:10.1177/1075547016664737

Takahashi, B., Edwards, G., Roberts, J. T., & Duan, R. (2015). Exploring the use of online
     platforms for climate change policy and public engagement by NGOs in Latin
     America. *Environmental Communication, 9*(2), 228-247.
     doi:10.1080/17524032.2014.1001764

Treise, D., Walsh-Childers, K., Weigold, M. F., & Friedman, M. (2003). Cultivating the science
     internet audience: Impact of brand and domain on source credibility for science
     information. *Science Communication, 24*(3), 309-332. doi:10.1177/1075547002250298

Watermeyer, R. (2010). Social network science: pedagogy, dialogue, deliberation. *JCOM:
     Journal of Science Communication*.

Weber, R., Dinc, S., & Williams, M. (2016). American's support for NASA's James Webb space
     telescope: Effects of traditional texts compared to interactive media. *Science
     Communication, 38*(5), 601-625. doi:10.1177/1075547016663001

World Wild Life Fund. (n.d.). Retrieved March 25, 2017, from https://www.worldwildlife.org/

350. (n.d.). Retrieved March 14, 2017, from https://350.org/

ABOUT THE AUTHOR

James Robe was born in Waterville, Maine on January 25, 1995. He was raised in Waterville and graduated from Waterville High School in 2009. Majoring in Mass Communication, James double minored in Graphic Design and New Media.