

Into the digital wild: Utilizing Twitter, Instagram, You Tube and Facebook for effective science and environmental communication.

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9 **Abstract**

10 Recent years have seen an upsurge in the digital environment and the reliance placed upon it by
11 society. This case study reports on a project which sought to examine how the digital environment
12 can be utilized for science communication, exploring the role of social media and particularly short
13 online videos, as an effective means through which to engage the public with science, environment
14 and conservation messages.

15 Using as its focus a 300-mile trek around the coast of Cornwall (Sophie's Wild Cornwall) we
16 examine how science was communicated real-time using online videos and social media over a five-
17 week period, as well as data from an online public opinion survey (n=129). The observations gleaned
18 identify a number of key themes for others wishing to adopt digital approaches within their science
19 communication activities, including the role of web-based presenter-led narratives, the value of
20 accessibility and interaction on social media platforms, and online videos potential for stimulating
21 proactive, participatory engagement and interest in an environmental context.

22 Effective online video use requires a balance between crafting an informative yet entertaining
23 narrative without compromising scientific accuracy; yet ultimately, social media platforms may
24 represent a potential 'stepping-stone' for practitioners to consider implementing in a journey towards
25 'upstream engagement'.

26 **1 Introduction**

27 At a time when environmental health and biodiversity feature on many public agendas, encouraging
28 public uptake and action for pro-environmental behaviors requires both an awareness of conservation
29 issues, alongside opportunities for productive collaboration between science and society. Online
30 videos, shared via social media offer the potential to create such a relationship (Hacker and Harris,
31 1992; Ballard et al., 2017). It is estimated that over 1.4 billion people use Facebook daily (Facebook,
32 2018). Whilst 800 million people use Instagram (Statista, 2018a) and 330 million people use Twitter
33 on a monthly basis (Statista, 2018b). The explosion of digital landscapes has promoted a marked
34 increase in the time allocated to online activity (Andreassen and Pallesen, 2017; Marketing Magazin,
35 2017; Brossard, 2013), and using online sources, including videos, for science information has also

36 increased, particularly amongst 18-25 years olds (IPSOS Mori, 2014; Huber, Barndige and Gil de
37 Zúñiga, 2019; Mangold and Faulds, 2009; Bernhardt et al., 2011; Koohy and Koohy, 2014; Brossard,
38 2013; Peters et al., 2014; Liang et al., 2014; Hargittai, Füchslin and Schäfer, 2018; León and Bourk,
39 2018). Whilst some may argue this creates a potential disconnect with the natural world it may in fact
40 offer pertinent opportunities to “mobilize biodiversity conservation and environmentalism” (Fletcher,
41 2017, p. 226).

42 Extensive research into this “new realm” (Wilkinson and Weitkamp, 2016 p. 123) remains emerging
43 (Hargittai, Füchslin and Schäfer, 2018; Davies and Hara, 2017; Brossard, 2013), with researchers
44 who might use social media for communication activities, admitting a continued ‘limited
45 understanding’ about what it really is (Kaplan and Haenlein, 2010). Online videos have an
46 increasingly important influence on science and environmental communication, particularly amongst
47 young people, but research on such sources, and the potential of their role, is also still emerging
48 (Allgaier, 2019; León and Bourk, 2018).

49 Social media has facilitated large scale science-focused initiatives, notably health campaigns (Koohy
50 and Koohy, 2014) and some environmental projects (Aldred, 2016; Ballard et al., 2017; Aldred,
51 2016; Plastic Patrol, 2017) highlighting the far-reaching influence social media can have on actions,
52 attitudes and behaviors (Centola, 2010, Korda and Itani, 2013). Despite such potential, and many
53 corporate businesses regarding social media presence as, “top of the agenda” (Kaplan and Haenlein,
54 2010, p.59), academic institutions are said to fall behind in their online activity (Peters et al., 2008;
55 Koivumäki and Wilkinson, 2020; Howell et al., 2019; Jarreau and Yammine, 2017; Liang et al.,
56 2014), despite the value it can bring for public engagement (Wilkinson and Weitkamp, 2016;
57 Bernhardt et al., 2011). Engagement is often considered effective if it results in behavioral or
58 attitudinal change, particularly around issues such as climate change, health and the environment
59 (Lorenzoni et al., 2007; Corner and Randall, 2011) and sites such as Twitter are known to facilitate
60 such interaction outcomes (Simis-Wilkinson et al., 2018).

61 Social media addresses a ‘ready-made’ audience, an integral feature of science communication
62 practice (Peters et al., 2014; Holliman et al., 2009; Wilkinson and Weitkamp, 2013). Given the
63 challenges often associated with reaching a target audience (Groffman et al., 2010; Ballard et al.,
64 2017), communicators can “take advantage of where people already habitually and routinely gather,
65 share and communicate” online (Metzger and Flanagin 2011, p.55). This can also allow users to see
66 science ‘in the making’ (Lessard et al., 2017), spurring positive change and uptake of science in
67 society, as science happens, in real time (Simis-Wilkinson et al., 2018; León and Bourk, 2018; Peters
68 et al., 2014).

69 However, identifying and evaluating the impacts of online engagement is a common obstacle for
70 conservation organizations (Miller et al., 2004), leaving a “serious communication gap” (Spooner et
71 al., 2015, p.2) between conservation research and practice. This neglects to understand the
72 motivations to participate in online endeavors (Kuss and Griffiths, 2011; Schou Andreassen and
73 Pallesen, 2014; Collins et al., 2010; Andreassen et al., 2017) and maintains a recurring narrative in
74 environmental science disciplines of the prevalence of one-way mass communication (Collins et al.,
75 2010), missing opportunities to ‘restart’ of the conversation between ecology and society (Groffman,
76 2010).

77 With this in mind, this case study explored how, “high-quality meaningful engagement” (Collins et
78 al., 2010, p. 1181) can be obtained digitally. At its heart was a 300-mile science-focused trek around
79 the coastline of Cornwall in the UK, entitled ‘Sophie’s Wild Cornwall’, which allowed us to directly

80 observe how an audience engages with online videos on social media, including a 22-part online
81 YouTube series.

82 **2 A Case Study: Sophie's Wild Cornwall**

83 Cornwall is one of the most environmentally significant counties in Great Britain, hosting over 60
84 nature reserves, 160 Sites of Special Scientific Interest and giving rise to unique habitats and wildlife
85 (Cornwall Wildlife Trust, 2017). Cornwall's geographical isolation can restrict its involvement with
86 science communication (Smallcombe, 2017), meaning the content was also well suited for online
87 videos shared via social and digital media, engaging with audiences who are otherwise 'underserved'
88 (Wilkinson and Weitkamp, 2016).

89 Over the 22-day trek, clips were filmed and edited daily on an iPhone 7-Plus into a 5-7-minute video
90 blog (vlog), using iPhone's pre-installed iMovie software. Short vlogs have been shown to provide
91 influential digital interaction, contributing to cultural citizenship (Ruedlinger, 2012; Papadima-
92 Sophocleous et al., 2016). Vlogs were a mixture of landscape and wildlife 'cutaway' shots, presenter-
93 led sections and spontaneous wildlife encounters. These were uploaded the same day onto YouTube
94 and shared via dedicated social media accounts to be followed online in near real-time, enabling
95 rapid engagement (Lessard et al., 2017).

96 Two months prior to Sophie's Wild Cornwall, information on the trek was disseminated via frequent
97 online posts. The Cornwall Wildlife Trust, Surfers Against Sewage, The Wildlife Trusts, Ordnance
98 Survey, BBC Countryfile Magazine and the university at which the work was based, also shared the
99 trek via their social media accounts, before, during and after the event.

100 Engagement trends were measured one week before, during the three weeks of the trek and one week
101 after using analytical tools available on the social media platforms, offering insights into the online
102 landscape of public engagement (Fan and Gordon, 2014), including audience demographics, length
103 of engagement and the types of content eliciting the most response.

104 An online survey consisted of questions determining user demographic data, including education
105 level and whether the respondent had a science background, as well as motivations for following and
106 engagement outcomes. The survey was shared one week after completion of the trek across the same
107 social media channels, as well as distribution across mailing lists consisting of science
108 communication professionals, academics and members of scientific organizations. All participants
109 remained anonymous and under 18s were excluded. The survey followed the ethical procedures for
110 Postgraduate Taught Masters projects at UWE, Bristol, including written consent to participate.

111 **3 Results**

112 **3.1 Sophie's Wild Cornwall Analytics**

113 Over the five-week period, total engagement increased across all platforms. Total followers increased
114 by 75% on Facebook to approximately 400 individuals, while Twitter saw an approximate 300% rise,
115 and YouTube subscriptions rose by >1000%. Instagram experienced the greatest overall following,
116 growing three-fold to 1,000 individuals over the duration of the project. Most users were 18-24 years
117 old, with YouTube attracting a slightly older audience (Table 1). Each platform hosted near-equal
118 male: female participation, however Facebook entertained a noticeable female majority.

119 < Insert Table 1 >

120 Nearly all participants were from the south of the UK, suggesting an element of relatability as the
 121 area was familiar or nearby. Despite a strong ‘local’ reach, posts also experienced interaction from
 122 followers in Russia, the USA, Australia and Europe.

123 A closer examination of user interaction with the posts determined overall ‘reach’ and active
 124 ‘engagement’ across each platform (Figure 1). ‘Reach’, quantifies the number of individual accounts
 125 that ‘see’ a post and ‘engagement’ measures, ‘social involvement’, the number of times a post was
 126 liked, saved or commented on. Twitter only offers data on social media ‘impressions’ versus ‘reach’,
 127 quantifying the times people saw a particular ‘tweet’, instead of how many individual accounts saw
 128 it.

129 < Insert Figure 1 >

130 Figure 1 illustrates increased reach over time across each platform. Each post reached an average of
 131 1,000 individuals per day. Facebook experienced the greatest growth, similarly, Instagram grew by
 132 89%, yet maintained a more stable reach. Despite being unable to quantify ‘reach’ on Twitter, the
 133 overall trend quantifying Twitter ‘impressions’ matches that of the other platforms. YouTube had the
 134 lowest overall activity, experiencing a small decrease in reach across the five weeks, despite a 63%
 135 relative growth in audience engagement between week one and four.

136 Fluctuations with engagement and reach appeared to coincide with key events. For example, the
 137 prelude to Sophie’s Wild Cornwall involved external support and ‘sharing’ with an average
 138 approximate 74% increase in reach between Facebook and Instagram during week one. Two relevant
 139 online videos at the outset, explaining the purpose of the initiative, may explain the estimated 88%
 140 relative growth in YouTube engagement given the suitability of such content for that platform.

141 Reaching the ‘halfway’ point of the trek promoted an increase in reach and engagement across all
 142 platforms. The most popular posts and online videos were those that presented breadth of content,
 143 such as multiple encounters with wildlife, depth of scientific information or striking landscapes. All
 144 platforms bar YouTube, exhibited a growth in reach and engagement during such moments,
 145 especially Facebook and Instagram. Similarly, moments captured in online videos such as physical
 146 injury or emotive scenes, contributed to increased follower interaction. This was especially noticed
 147 towards the end of the initiative and the trek’s successful completion, where all channels except
 148 YouTube, experienced a peak in both audience reach and engagement.

149 **3.2 Public opinion survey**

150 Table 1 illustrates that there were a higher proportion of female: male respondents among a largely
 151 young audience. Academic qualifications offered insight into potential incentives for following, 43%
 152 (n=55) selected a university undergraduate degree as their highest academic qualification, followed
 153 by a postgraduate degree (34%). Whilst half had studied a science or environmental area at university
 154 (50%), the remaining respondents had received no scientific/environmental degree training. 52% of
 155 people had not previously worked in a science or environmental area.

156 Respondents stated engaging in a similar use of Facebook (26%), Twitter (18%), Instagram (22%)
 157 and YouTube (19%) (n=27), supporting the decision to use a combination of these platforms to share
 158 the online videos. 83% (n=107) of participants cited a smartphone as the preferred device for access.
 159 When asked about engagement with STEM (science, technology, engineering and math) content
 160 online, ‘environment and nature’ had the highest level of daily engagement (43%, n=55) compared to
 161 ‘health and medicine’ (19%) and ‘technology and engineering’ (27%).

162 Nearly 90% (n=116) of respondents used Facebook, Instagram and YouTube to follow, leaving under
 163 10% of people using Twitter alone. A range of motives, were selected, in regard to why they
 164 followed. ‘Information’ and ‘entertainment’ comprised around 75% (n=97) of responses. Other
 165 motivations included social engagement, interest in Cornwall and the overall project. To determine
 166 success as a science communication initiative, respondents were asked what they ‘gained’ from
 167 following. ‘New information’, ‘entertainment’, ‘on the go’ science communication and ‘an
 168 appreciation of local nature’ comprised 94% (n=121) of responses. Vlogs, online videos produced
 169 during Sophie’s Wild Cornwall were the most popular medium with which users could engage; 86%
 170 (n=111) of respondents liked them ‘a lot’. Photographs with an informative caption also proved
 171 popular (72%, n=93 liking them ‘a lot’).

172 Open comments provided a number of additional motivations for following online, including that it’s
 173 “easier to access the content you want (User E), to follow/unfollow your interests, the accessible
 174 nature, checking throughout the day, as part of daily routines, “anytime, anywhere” (User H). The
 175 ability to follow events in near real-time also seems to make content, “more relevant” (User J). The
 176 use of presenter-led vlogs was very popular, with users developing “a kind of relationship with the
 177 presenter” (User O), learning along with them, and liking the ability to interact. Users could, “speak
 178 directly to the presenter” and appreciated this both in making the content “feel more personal and
 179 approachable” (User T).

180 **4 Discussion**

181 There are inherent elements of subjectivity in the interpretation of this case study, however it presents
 182 insight into how an audience engaged with one science communication endeavor using online videos
 183 via digital platforms. However, the role of the authors in the intervention must be acknowledged and
 184 this may have influenced the interpretation of some findings. In examining the results, the 'AEIOU'
 185 criteria (Burns et al., 2003) were used as a means of considering whether online video use via social
 186 media, can be used for public engagement.

187 Online videos, shared via social media, can be used as a modern, “gateway” raising awareness of a
 188 scientific topic to motivate a users’ curiosity and potential behavioral change (Allgaier, 2019; Burns
 189 et al., 2003; Lorenzoni et al., 2007; Corner and Randall, 2011; Liang et al., 2014). *Awareness* is
 190 difficult to quantify especially on social media (Hanna et al., 2011), however the physical growth in
 191 both ‘reach’ and active ‘engagement’ across each platform indicated a likely growing consciousness
 192 of the expedition and environmental content. External support from organizations and media groups,
 193 raised awareness of the project, amplifying Sophie’s Wild Cornwall organically.

194 The integration of online ‘sharing’ tools to promote the online videos, introduced the initiative to a
 195 broader audience. Facebook, Twitter and Instagram epitomize ‘interactive media’ through which
 196 users can comment, share, tag friends or ‘like’ a post (Hanna et al., 2011). In contrast, YouTube is
 197 limited to video content (Zuckerberg et al., 2012), meaning subscribers to Sophie’s Wild Cornwall
 198 only received one notification per day. This minimized the opportunity for non-subscribers to
 199 become aware of the initiative, supporting research detailing YouTube’s low ‘posting’ rates (Moran
 200 et al., 2011) and inadequacy as a tool to spread ‘awareness’ (Steinberg et al., 2010). It also supports
 201 the growing popularity of Instagram especially among young people (Groffman et al., 2010). Young
 202 adults are adept at navigating digital spaces (Lee, 2012; Ofcom, 2015) and therefore using social
 203 media in crafting impactful content, appears a beneficial way, to mobilize this cohort to participate in
 204 science (DeBoer, 2010; Hargittai, Fuchslin and Schäfer, 2018).

205 Active *engagement* during Sophie’s Wild Cornwall also indicated user enjoyment, as followers felt
206 sufficiently engaged to maintain involvement. To be ‘entertained’ by social media content was
207 expected by a quarter of survey respondents, and users appeared particularly eager to connect directly
208 with the presenter, supporting the value of ‘presenter-led’ real-time engagement (Young et al., 2017).
209 The physically demanding nature of the trek produced ‘emotion’ and ‘drama’, as users admitted that
210 the, “informal but informative” mode of delivery contributed to a participatory experience, building
211 upon previous research suggesting establishing an emotional connection with an audience improves
212 relatability and directly affects the duration of engagement (Durkin et al., 2012; Lessard et al., 2017;
213 Jarreau and Yammine, 2017).

214 The increasing acceptance of social media as a source of *information* (Fletcher, 2017; Liang et al.,
215 2014; Brossard, 2013) provides opportunities to integrate science communication, including in the
216 form of online videos (Davies, León and Davies, 2020), in daily lives. Seeking ‘new information’
217 was a primary motivator and engagement outcome from following Sophie’s Wild Cornwall and
218 social media offered opportunities to reach more diverse audiences, with only 50% of respondents
219 holding an environmental or science-related degree. Embedded algorithms tailor content to reflect
220 users’ interests (Zuckerberg et al., 2012) a barrier to reaching new audiences. This re-iterates the
221 immense power of ‘social sharing’, offering the potential to spread content beyond a user’s network
222 (Hanna et al., 2011; Huber, Barndige and Gil de Zúñiga, 2019). As half of respondents had no
223 previous involvement in a science or environmental area, social media can succeed in stimulating
224 interest in topics that a user, “might not usually think about” (User N). Engagement with the trek also
225 contrasted some previous studies which found that online science users tend to be tend to be “more
226 knowledgeable about science, more educated, and primarily male” (Brossard, 2013 p.14097).

227 *Opinions* are complex, subjective and difficult to measure. A person’s current knowledge, beliefs and
228 personality can influence opinions (Burns et al., 2003) and even predict future behavior (Kelman,
229 1961). Successful science communication can occur when a participant reflects upon new ideas, to
230 inform or review previously held opinions (Burns et al., 2003; Lorenzoni et al., 2007; Corner and
231 Randall, 2011). Social networks can therefore ‘guide opinion’ (Susarla et al., 2012) and followers of
232 Sophie’s Wild Cornwall and survey respondents commented on the rich learning experience provided
233 by being able to view responses from the presenter and collaborate with other users.

234 Achieving *understanding* following a science communication endeavor arguably remains the ‘end-
235 goal’ for many and a, “prerequisite for higher levels of scientific literacy” (Burns et al., 2003, p. 198).
236 The transferability of the vlogs into classrooms, which was reported in some comments and survey
237 responses, demonstrates their suitability for learning in a similar way to sites such as You Tube as
238 teaching aides (Tess, 2013). Online videos, shared via social media may offer a modern solution to
239 upstream engagement, by presenting science content in an appealing, digestible format that users can
240 ‘understand’ (Lovejoy et al., 2012; Duggan, 2015; Garcia-Aviles and de Lara, 2018) while it is in
241 process.

242 Via a 300-mile trek around Cornwall, this case study has highlighted implications for the use of
243 social media, and online videos, in science communication and engagement, including on social
244 media platforms beyond YouTube. The global audience, but also local audience, were motivated by
245 the visual, concise and interactive features of social media. Nearly all survey respondents indicated
246 that they would like to engage with science in this way again and the vlogs were particularly effective
247 at sharing the adventure with a young audience. Effective social media and online video use then
248 requires a balance between crafting an informative yet entertaining narrative without compromising

249 scientific accuracy; yet ultimately, these platforms may represent a pertinent and exciting ‘stepping-
250 stone’ for practitioners to consider implementing in a journey towards ‘upstream engagement’.

251 Word Count: 2,961.

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257 The authors declare that the research was conducted in the absence of any commercial or financial
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259 **6 Author Contributions**

260 With regard to authorship, the following criteria were satisfied by both authors: substantial
261 contributions to the conception or design of the work; or the (SP, CW) acquisition, analysis, or
262 interpretation of data for the work; and drafting the work or revising it critically for important
263 intellectual content; (SP, CW), and final approval of the version to be published; (SP, CW), and
264 agreement to be accountable for all aspects of the work in ensuring that (SP, CW), questions related
265 to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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449 Table 1: Key user insight data generated from imbedded social media analytic tools and online
 450 survey respondents

Facebook, Instagram and You Tube User insight data. <i>Twitter does not provide such data unless the account is eligible for advertising.</i>			
	Top Age Range	Gender (M:F)	Top Geographic Region
Facebook	18-24	31:69	Southwest, UK
Instagram	18-24	41:59	Southwest, UK
You Tube	25-34	50:50	UK
Twitter	n/a	n/a	n/a
Demographic data on the online survey respondents (n=129)			
Age/Gender	Responses (% n=129)		
Males	36%		
Females	63%		
18-24	36%		
25-34	30%		

35-44	8%
45-54	10%
55-64	11%
65+	5%

451 Figure 1. The mean number of individuals ‘reached’ and ‘engaged’ across each social media platform
452 used during Sophie’s Wild Cornwall throughout the five-week measurement period. Labels indicate
453 key chronological events during the walk that likely influenced noticeable changes in audience reach
454 and overall engagement trend.