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**When citizens choose not to participate in volunteering geographic information to e-governance: a case study from Mexico**

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1 ***When citizens choose not to participate in volunteering geographic information to e-governance:***  
2 ***a case study from Mexico***

3

4 **Abstract**

5 Citizen participation is a crucial democratic practice in many western societies. In contemporary  
6 societies, different social agents utilise information and communication technology (ICT) using  
7 Internet-based systems, to establish two-way communication in order to promote citizen  
8 participation. One such approach is Volunteered Geographical Information (VGI). It is considered that  
9 VGI provides a new space for citizen engagement, as well as an arena for political contestation,  
10 however little attention has been paid to the reasons, drivers and limitations for voluntary citizen  
11 participation. Although there is an extensive literature on both VGI and citizen participation, this rarely  
12 considers how much citizen participation is necessary to run a VGI platform, what are the drivers for  
13 non-participation, and what happens within a democratic political space when citizens are apparently  
14 not interested to participate with a VGI deployment. These topics are explored in this paper, through  
15 the lens of a particular case study of a University deployment for VGI developed in Mexico and a wider  
16 analysis of other VGI deployments taken from the literature. By critically assessing the extent to which  
17 the VGI deployments have enabled citizen participation, and the degree and quality of this  
18 participation, we draw conclusions as to how far and under what circumstances VGI can support  
19 government agencies to engage citizens in a meaningful dialogue as part of democratic governance  
20 initiatives. This leads us to identify key areas for further research by geographers and related social  
21 scientists exploring these socio-technical systems and their effects on democratic societies.

22 **Introduction**

23 This paper discusses the drivers and the constraints upon Citizen participation using web based  
24 volunteered geographic information (VGI). At a time of rapid technological change,  
25 with continuous and sometimes overwhelming communication through social media enabling

26 potentially massive amounts of geographic data (big data) to be contributed by people  
27 (crowdsourcing), we analyse the consequences for the credibility of democratic governance, when  
28 citizens choose not to, or are unable to contribute as equally as others to volunteering geographic  
29 information to such platforms.

30 In this paper we explore some of the theoretical gaps in relation to Citizen participation and VGI in the  
31 context of (so called) democratic western societies. Critically, we analyse the implications for  
32 democracy when citizens choose not to participate in the Polis, even when it is presented to them in  
33 today's most common and accessible form of it: pushing the icon of an app on their mobiles.

34 VGI platforms need to obtain sufficient volumes and densities of data to make credible maps of spatial  
35 processes over time – they also need sufficient volumes of responses (response rates) to demonstrate  
36 credibility of public engagement, if they are to claim they are empowering more democratic decision  
37 making.

38 This paper is organized as follows. The first section reviews the concept of volunteered geographical  
39 information and its links to citizen participation. The second part examines how citizen participation  
40 is changing with the influence of mobile technologies. In the third part we present our experience with  
41 the use of a University VGI platform designed to allow citizens to report instances of urban flooding in  
42 Mexico. We analyse the degree of Citizen participation with this system and explain this mainly  
43 according to the different social agents involved in the design, use and interaction of it. This paper  
44 therefore contributes to shaping the emerging research frontier of Citizen eParticipation and VGI

#### 45 **Volunteered Geographical Information for facilitating public participation**

46 One significant question Mike Goodchild (2007) raised in a seminal paper he wrote on VGI, but did not  
47 reflect on, were the reasons for voluntary citizen participation. "I discussed why people might be  
48 motivated to create VGI, but not why they might want to use it" (Goodchild, 2007, p. 220). In this  
49 paper we critically reflect on this question. Democracy depends on citizen participation. Currently the

50 latest computing architectures for VGI, combining location based services, spatial databases and web  
51 mapping technologies, supported by information and communication technology (ICT) have the  
52 capacity to enable big data volumes to be contributed by citizens and for this data to be stored,  
53 analysed and reported (Sui et al. 2012). Arguably, the technologies are now mature enough to allow  
54 citizens to contribute frequently to democratic governance, policy design and decision making. Yet  
55 compared to social media usage, the amount of electronic participation (e-participation) in these  
56 democratic processes remains far short of this potential. In this paper, we seek to begin the process  
57 of understanding why we are yet to see widespread public participation in governance using VGI and  
58 what factors may be slowing or constraining citizen participation.

59 In 2007, Goodchild described the opportunities for information access and geographical design that  
60 these new technological devices were creating for the earth sciences and for information creation and  
61 access for citizens. He considered that technological platforms on the Internet such as Wikimapia,  
62 Google Earth or Open Street map represented the democratization of GIS. His main assumption was  
63 that massive participation would have a profound impact on geography as a discipline, and  
64 furthermore on the way democratic societies operate. A decade later, although there is a significant  
65 literature on the technological underpinnings of VGI, relatively few articles explore the motivations  
66 and concerns for citizens to participate in using VGI platforms.

67 For VGI, citizen contributions including the capacity for geolocalization (reporting of features, events  
68 or processes at a finer, local scale) are very important. Although geographical information can be  
69 expressed by citizens through other media, such as through sketch maps or scale models that are still  
70 widely used in participatory settings to collect and disseminate geographic information, (Rimbaldi et  
71 al. 2006), increasingly VGI implies digital information, with citizens recording and contributing their  
72 own information about places or features of interest according to their present location, which they  
73 can now give precisely using a Global Navigation Satellite System GNSS enabled mobile device, such  
74 as any smartphone.

75 Although Goodchild (2007) acknowledged some limitations of VGI, he was on balance positive about  
76 the potential benefits of it, seeing it as creating greater opportunities for citizen engagement, for  
77 including place-based knowledge into decision making and facilitating cost-effective data collection.  
78 Konecny (2011) considers more generally that increasing the availability of spatial information is likely  
79 to contribute to better governance and decision making, as it is more likely to incorporate citizen's  
80 views. From the position of many geo-spatial scholars, VGI is primarily an enabling technology that  
81 contributes to greater availability of spatial information, particularly more current information at local  
82 scales e.g. Williamson et al. (2006).

83 VGI as a technology can be used to support both neogeography and citizen science (Connors et al.  
84 2012). Whilst citizen science arguably views citizens as more passive sensors contributing information,  
85 neogeography implies a more active and purposeful sourcing and framing of the information, with  
86 citizens collaboratively creating new forms of maps enabled by new technologies including web  
87 mapping and crowdsourcing (Gartner 2011). Whilst citizen science engenders a scientific view that  
88 problems can be better understood through an increased volume for data collection, neogeography  
89 perhaps uses VGI to explore and articulate a wider range of viewpoints, opening up the use of VGI as  
90 a disruptive technology for making political statements that can mobilize different social agents to  
91 facilitate access to social benefits (Azocar Fernandez et al. 2013).

92 There are many expectations about how VGI might facilitate greater civic engagement. It is commonly  
93 assumed, for example, that citizens delivering information may help to challenge existing power  
94 distributions between the state and the citizen, contribute to more socially inclusive policy design and  
95 decision making, enable more marginalized individuals and communities to have a voice and enable  
96 them to access greater social benefits (Jones 2015; Kleinhans et al. 2015; Miller et al. 2015). Elwood  
97 (2008) discussed how spatial and technological improvements can contribute to enabling data  
98 collection, information access and production by grassroots organizations, enabling them to construct

99 alternative visions and develop social agendas that include more of the local political and cultural  
100 contexts.

101 It is true that VGI enables situated information from the local context, to be incorporated alongside  
102 more authoritative base mapping in ways that facilitate empowerment of local groups. For example,  
103 by allowing them to express their visions for an area to a similar mapping standard, to that used by  
104 more powerful agencies. Whilst this more egalitarian access to cartography certainly empowers some  
105 local groups, allowing them to, articulate counter-mapping against, planning proposals by state  
106 authorities (Peluso 1995, Wood 2010) one must also consider that not all groups are equally able to  
107 access and utilize VGI, and not all groups have a platform through which they can present their  
108 counter-proposals, or contribute local views to public consultations.

109 Geo-positioning is a significant characteristic of VGI, considered to enrich place-based knowledge,  
110 especially at the local level, through a process of geolocalization. At local levels, information is  
111 produced more often by laypeople whose main interest is to articulate their interests in a way that  
112 can be heard, understood and accepted by those in positions of authority (Sui & Goodchild 2011).  
113 Elwood et al. (2013) acknowledges the importance of incorporating information about the priorities,  
114 identity and experience of the everyday citizens, which is present in VGI data, together with place-  
115 based information that is now produced by thousands or millions of citizens who contribute to Open  
116 Street Map (Budhathoki & Haythornthwaite 2013) request changes to Google Street View or through  
117 other more specialized forms of VGI platforms.

118 Given this massive expansion in opportunity for citizens to contribute their own data, it is perhaps  
119 surprising there is relatively little work to date, exploring reasons for participation (and non-  
120 participation) with VGI systems. Along similar lines to Budhathoki & Haythornthwaite (2013) and  
121 Marien et al. (2010), we argue that part of the reasons for high levels of evidenced participation in  
122 projects such as Missing Maps (URL) and Humanitarian Open Street Map (URL) are that in these  
123 initiatives many users believe they are contributing to an emergency crisis (for example a more

124 accurate and current mapping for humanitarian relief purposes) nevertheless based on interviews  
125 with NGO's, after the crisis or particular moment, participation rates fall. High levels of participation  
126 through participatory platforms tend to occur when contributors believe the information created is  
127 open and shared. Whilst some moderation of the contributions takes place by trusted individuals,  
128 nevertheless the processes of how people contribute should be transparent and accountable (McCall  
129 et al. 2015; Basiouka. & Potsiou 2012).

130 Miller and Goodchild (2014) addressed specifically the social challenges for Citizen participation using  
131 VGI technologies. From their perspective, one further important constraint on representativity is that  
132 people self-select if and how they will engage and participate on social media. Brovelli et al. (2016)  
133 also reported that a high proportion of respondents in their 'citizen sensor' projects were under the  
134 age of 30 and had completed high school education, suggesting a possible digital divide in terms of  
135 participants according to both age and educational attainment. Like many e-participation projects,  
136 they reported difficulties in motivating large numbers of the population to participate. Interestingly,  
137 their results in terms of the numbers of participants as a proportion of the whole population closely  
138 followed Nielsen's (2006) often-cited filtering ratios for participation inequality. These findings remind  
139 us that publically contributed data is already influenced and highly segmented and have implications  
140 for how representative of all society the data collected by VGI platforms can be claimed to be.

141 The above discussion of the potential of VGI suggests it can be an effective technological approach to  
142 enabling Citizen participation, allowing both capture of local features to improve information for  
143 authorities and at the same time providing a platform for previously unheard voices. Citizen  
144 participation itself however is a contested concept and some discussion is necessary of who benefits  
145 from the use of VGI for Citizen participation, and whether participation supported by VGI platform is  
146 able to effect social or political change in a democratic manner.

147 In this work we reflect on citizen participation from an ethical and sociological perspective, arguing  
148 that participation is part of the duties of a community, and from this perspective we argue that any

149 government seeking to be a fundamental agent contributing to the citizens' wellbeing (Roberts 2004;  
150 Dimock 1990; Dewey 1966) should be exploring the potential of new technology for actively fostering  
151 more democratic participation in its decision making.

## 152 **Citizen participation and the era of mobile technologies**

153 Citizen participation, in western democratic contexts, is defined as multiple activities related with the  
154 Polis, from deliberating on the distribution of activities, access to benefits and political power. The  
155 internet era accompanied with technological change has transformed the nature of citizen  
156 participation, adding the prefix e to particular way for people to interact with each other and with the  
157 state to express their social issues and political interests. In this section we will also explore the  
158 concept of Citizen participation and the role of ICT, particularly mobile devices and software for mobile  
159 applications.

160 Dahl (1989) describes citizen participation as the ability of citizens to exercise control over the  
161 decisions of the Polis, as opposed to the capacity of the political system) to reasonably respond to the  
162 collective preferences of its citizens. From Dahl's (1989) perspective, direct Citizen participation is not  
163 a realistic or feasible expectation, given the size and complexity of modern nation states. However,  
164 recent technological development allows us to explore the idea of citizens both contributing their  
165 preferences more regularly and through this having greater influence on decisions of the Polis, as we  
166 discuss later.

167 In this context, a fundamental contribution in the field of citizen participation is Verba's et al. (1972)  
168 suggestion that citizen participation is not limited to voting or elections (Dahl 1994). Rather, Verba et  
169 al. (1972) argue that citizen participation should be much more multi-dimensional and extra-  
170 institutional, extending to and being expressed in activities such as strikes and demonstrations. In  
171 addition, Gibson and Cantijoch (2013) consider that these practical, direct and offline types of political  
172 engagement remerge online, because individuals use tools that are available to facilitate and co-  
173 ordinate action. From this perspective, citizen participation is related with civic responsibility at



174 different levels, and commitments with the Polis and the welfare of human and non-human (Nature)  
175 communities. In these ways citizen participation theory is developing to explain the role of the citizens  
176 and the role of administrative institutions facilitating Citizen participation in the internet era.

177 Understanding different levels of citizen participation is important to this study. Bobbio and Mateucci  
178 (1991) influential political theorists working on democracy in the 1980s and 1990s defined various  
179 attributes of participation, operating on three different levels:

180 *Exposure*, the most basic form of participation, involves joining events or accepting exposure to  
181 political messages

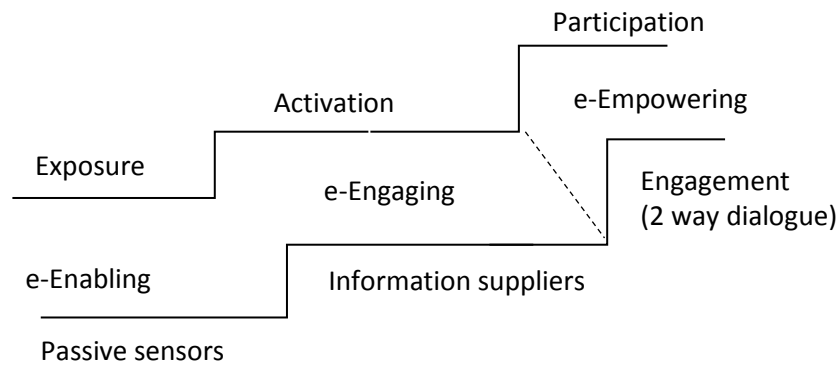
182 *Activation*, related with citizens participating in organizations of different nature.

183 *Participation*, citizens directly or indirectly engaging in political activities.

184 Steinberg (2015) suggests that citizens usually participate on the most basic level of Bobbio and  
185 Mateucci (1991) three levels - that of Exposure. Steinberg's (2015) results suggest that at the moment  
186 is not clear how and for what purposes citizens are using the internet and software applications as a  
187 deliberative political forum, neither is it clear what is presently the impact of the web in political  
188 knowledge and participation.

189 Recently, the popularization of smart phones has had a significant impact on the possibilities for e-  
190 participation. Smartphones with wi-fi and 3G/4G data connections enable relatively continuous  
191 access to VGI platforms. This portable technological infrastructure enables 'participation on the go  
192 (Kleinmans et al. 2013). This participation allows various processes: establishing connection,  
193 generating information, sharing, commenting and voting (Hoffken & Streich, 2013).

194 Macintosh (2004) suggest a model of citizen e-participation, which might characterize e-democracy  
 195 initiatives, which we argue is particularly applicable to the web and social media.



196  
 197 Fig. 1 Comparison of Citizen participation ladder, based on (from top to bottom) Bobbio et al. (1991), Macintosh (2004) and  
 198 Johnson (2013)

199 e-Enabling seeks to enable citizen participation from those who normally do not make use of  
 200 the Internet on any device. Macintosh (2004) suggests it involves a basic level of technological  
 201 familiarisation on the part of the user, assisted by software developments that make  
 202 technologies and especially mobile platforms more user-friendly.

203 e-Engaging is sometimes expressed as a top-down consultation by state or municipal  
 204 administrative organizations that seek to engage a wider population, encourage diverse  
 205 contributions and foster a deliberative debate on policy issues.

206 e-Empowering supports greater bottom-up citizen participation and access to policy design,  
 207 changing the role of citizens from providers of basic data and consumers of information, to  
 208 producers of their own information for their own purposes.

209 Johnsons & Sieber (2013) analyse the various forms of citizen participation that have occurred using  
 210 VGI platforms; from their perspective participation through VGI can adopt different forms:

211 *Citizens as Passive sensors.* Citizens provide data up to decision making authorities, uni-  
 212 directionally. VGI allows data to be collected from many sensors.

213 *Citizens as Information Suppliers.* Citizens participate in monitoring a problem relevant for  
214 them. Again the information flows mostly upwards, although a summary or final decision may  
215 be communicated downward or outward. This has several parallels with the Citizen Science  
216 paradigm discussed earlier.

217 *Engaged Citizens.* Citizens contribute information, while government institutions facilitate  
218 public participation by allowing access to government data. VGI is used for collating the user-  
219 contributed and authority information together into actionable policy, or at its more  
220 collaborative, allowing contributory debate or mapping where citizens contribute by  
221 describing or mapping their issues, objections, proposals. In this case there is a two way flow  
222 of information

223 Figure 1, presented above, compares and aligns these three perspectives on citizen participation. The  
224 first is a classical model of citizen participation. Bobbio and Matteucci (1991) suggest that involvement  
225 in political activities means that citizens are informed about political issues, and are able to reflect  
226 about different political offers. For these authors, political mobilization, for example in the form of  
227 demonstrations, not necessarily implies participation, but activation. In general these political  
228 movements do not contribute in the creation of organizations, therefore these movements do not  
229 lead to the institutionalization of citizen participation.

230 Macintosh (2004) integrates ICT, Social Media and new electronic devices with the concept of citizen  
231 participation, recognising three successive stages in the ladder to citizen e-participation. Macintosh  
232 (2004) places empowerment at the top of the ladder, aiming at integrating citizens in decision making  
233 through social media and technology for policy design. She does not talk explicitly in her paper about  
234 governance but the idea is suggested in it.

235 Johnson & Sieber's (2013) last stage is closely related to Macintosh's proposal. For these authors, the  
236 last step in the ladder summarizes empowerment (Macintosh 2004) and engagement (Johnson &  
237 Sieber 2013) and both are foundations for direct democracy. Technology today enables us to handle

238 large data volumes provided by individual users (big data) through their electronic devices; the  
239 software can organize these data for analysis, and administrative organizations have appropriate  
240 databases that can cross check and validate the citizen as an entitled supplier of the data if this is  
241 desired.

242 Johnson and Sieber's (2013) proposal for public engagement is closely related to the idea of  
243 governance. In this case E-governance, which implies the idea of linking citizens, administrative  
244 organisations, NGO's, business, and universities among other social agents using ICT, web-based  
245 platforms and technology for better policy design. E-governance seeks to narrow the distance  
246 between politicians and the public, and to allow efficient individual participation through the use of  
247 technology (Chun et al. 2010).

248 A complementary perspective on citizen participation is suggested by Roberts (2004); she examines  
249 power thresholds and the role of public officials exerting it. From her perspective citizen participation  
250 is defined as a process in which citizens share power with administrative bodies for policy design.  
251 However, she observes that very frequently the administration turns into a battlefield of knowledge  
252 the public involvement (Long 2003), because of the lack of specialized jargon from citizens. The results  
253 from Roberts (2004) study and the wider literature reviewed concerning the governments'  
254 perspective on citizens, shows how administrative bodies often prefer to consider citizens simply as  
255 service-consumers, rather than as effective and trustable contributors to public decision-making, and  
256 this may consequentially be a factor restraining greater citizen participation. Referring this to fig. 1,  
257 governments are often mostly interested on designing platforms for e-participation which address  
258 principally the basic levels of the exposure and activation of citizens as service-consumers. Influences  
259 from the Institutional Change approach (Lin 2013), advocating for governments and other agencies to  
260 provide spaces for representation and voice, are also promoting bottom-up citizen participation, as  
261 part of more decentralized local governance. In this regard, VGI appears an opportunity for change.

262 Also of relevance to these ideas are scholars who have focused on deviated forms of participation.  
263 Selznick (1948) differentiates participation from co-operation, whilst Arnstein (1972, 1969) usefully  
264 distinguishes 'true' participation from other deviated forms such as manipulation and tokenism. These  
265 forms of participation are not exclusive from each other, and it is possible to find elements of them  
266 combined, for example in public consultation exercises. One of the main challenges in obtaining an  
267 inclusive form of citizen participation is often the struggle to represent the views and opinions of  
268 experts (scientists, officials) with those of laypeople, poor people, women, minorities, communities  
269 without power, and it is necessary to acknowledge how different groups with power may sometimes  
270 use these deviated forms of participation to suggest engagement with citizens whilst disguising their  
271 control (Güiza et al. 2016).

272 Following Goodchild's (2007) paper on VGI, several researchers have explored different people's  
273 experiences with technology, rapid technological change and massive technological information  
274 access. Miller and Goodchild (2015) reflected that even considering the huge number of people using  
275 social media, it does not necessarily mean a change in their lives.

276 Brandeis et al. (2016) consider that administrative organizations are reluctant to accept VGI as reliable  
277 information for policy design. Brandeis et al. (2016) consider that there is a reciprocal influence  
278 between citizens and organizations, and this perspective links with the top-down idea of citizens as  
279 service-consumer, rather than as contributors and active participants with the Polis. Also Kleinhans et  
280 al. (2015) consider that many VGI developments are technology-led, especially in the recent  
281 popularisation of the smart cities idea (Cardone et al. 2013). Another common observation in the  
282 literature is distrust from governmental organizations, some scholars and practitioners of the  
283 information that is contributed by lay people. This may be partly but not wholly explained by  
284 authorities with concerns that the information contributed by the public can be of a poor quality or  
285 even erroneous (Foody et al. 2013). There is substantial evidence that even if they are described as  
286 tools for public engagement, many state agencies still design web mapping deployments primarily for

287 a one-way, top-down, communication to the consumer, with limited scope for dialogue with the public  
288 beyond providing an opportunity for response.

289 Developing this argument, Effing et al. (2011) make the interesting claim that contrary to popular  
290 expectations, citizen participation is not increasing in the age of mass communication technology, by  
291 internet and social media. They suggest that many government e-platforms are oriented to  
292 consumption and provision of information, but not to the (collaborative) production of it. They suggest  
293 this is related to a low trust threshold on both sides, discouraging citizen participation. This leads us  
294 to argue that in the middle 21st century e-empowerment, to use Macintosh's (2004) term, or pure  
295 participation as suggested by Bobbio and Mateucci (1991) it has not yet been reached. According to  
296 the frameworks of Macintosh (2004) and Bobbio (1991) citizen participation should develop over time  
297 from exposure/e-engaging, to activation/e-enabling, but in just a very few examples do we find  
298 examples of citizen e-Empowering.

299 Communication technology allows massive individual participation. Some of these technologies  
300 assemble participation through digital platforms (Change.org) or physically through social movements  
301 (Occupy), but in general, massive citizen participation is unstructured and often relates to personal  
302 interest or entertainment. Very recently platforms such as Facebook and Twitter have oriented part  
303 of their activities to the area of disasters or emergency response to social movements' outburst,  
304 nevertheless participation is highly individualized, the citizen's role is as information provider and the  
305 participation does not lead to a political organization (Kleinhans et al. 2105; Loader et al. 2014; Effing  
306 et al. 2011).

307 Agostino & Arnaboldi (2016) reviewed the effectiveness of Facebook pages of several Italian city  
308 administrations, which were intended to foster public engagement about city plans for local issues.  
309 They found a considerable difference between the utility of Facebook as a popular means for  
310 disseminating information, compared to its utility for stimulating a deeper engagement or  
311 participatory dialogue between users and authorities, which they found was often much more limited.

312 Their findings underline the scant evidence to date as to whether social media can actually be used to  
313 establish meaningful engagement between local government and the public. In this regard, Miller's et  
314 al. (2015) affirmation is significant on the influence of social media to promote Citizen participation  
315 and in the end prompt change at the institutional level (Lin 2013): Social media such as Facebook may  
316 have high penetration rates with respect to population, but do not necessarily have high penetration  
317 rates into peoples' lives.

318 Despite the potential of VGI to empower alternative viewpoints, it is also important to acknowledge  
319 that sometimes citizens can become more vulnerable as a result of contributing information in  
320 situations where anonymity is not assured. As Elwood (2009, 2010) observes, with new technologies  
321 some practices are putting at risk citizen participation because of its growing intrusive capacity with  
322 activities such as surveillance, privacy invasion as well as the issue of excluding those who cannot have  
323 access to technological appliances. Fundamentally, users need to have trust and feel secure in  
324 knowing how and for what purposes the data they contribute will be used for ad that their claims  
325 would be solved.

#### 326 **The use of VGI Platform *Proube* in Mexico**

327 Collective decision making and ultimately democratic governance relies on informed debate about  
328 public issues, which relies in turn on effective communication between agencies of the state and the  
329 general public. These conditions are part of citizen participation, a fundamental concept of democracy  
330 and its related political processes (Van Dijk, 2012).The VGI framework provides with an  
331 epistemological and theoretical basis through which citizen participation could be facilitated using  
332 new technologies. In the context of this project, focusing on citizen e-participation using the ideas  
333 developed in the previous sections, some of the questions which the researchers were exploring were:

334 *To what extent is citizen participation promoted or facilitated by VGI platforms?*

335 *What are the drivers and constraints to citizen e-participation?*

336 *What are the consequences on democracy when citizen participation is absent?*

337 The focus of this section are the drivers and limitations for citizen e-participation and the  
338 consequences for democracy. This is related to the experience of the last three years testing and  
339 improving the platform Proube, with involved social agents. The team designed the smartphone and  
340 web-based platforms for Proube taking as reference the related Ushahidi application  
341 (<https://www.ushahidi.com/>). After different deployments were reviewed and the team agreed that  
342 Ushahidi provided the multiplatform capability and support for geographically referenced data  
343 necessary for the project, as well as an open architecture to allow modification if required.

344 In this section we describe the sociopolitical processes and experiences the research team  
345 encountered in developing and testing Proube. The team combined social scientists, geographers and  
346 ICT staff with an aim to analyse the social impacts, practices and drivers for different agents to use or  
347 not to use Proube, a VGI deployment designed to allow citizens to contribute to monitoring floods in  
348 a medium sized city in Mexico, Morelia, suffering seasonal flooding. In order to generate a sufficient  
349 volume of information to enable analysis, and a diversity of users, the main goal of the VGI project  
350 was to engage affected citizens, NGO's, scholars and officials in charge of emergency relief in the  
351 testing of Proube.

352 Citizen Participation was considered a vital part of user testing for improving the Proube platform  
353 and its related mobile application. Different workshops, training sessions, presentations in different  
354 contexts provided us with rich information from these different user groups about their motivations  
355 for engaging and problems they encountered. Results from these different workshops and testing  
356 sessions with different social agents are presented below. We first present the experience of the  
357 citizens, followed by NGOs, scientists and finally the governmental officials involved from various  
358 different institutions.

359 **Citizen's e-Participation with *Proube***



360 The team approached a wide variety of citizens affected by floods, living adjacent to the city's two  
361 main rivers. Meetings were conducted with people of different socioeconomic contexts and from a  
362 variety of neighbourhoods ranging from middle class, enclosed developments, to slums. For each  
363 group we conducted workshops, training people on how to install the app on their mobile phones and  
364 if available, personal computers (PCs).The team explained to all participants the benefits, the  
365 constraints as well as monetary charges and possible risks of using *Proube*. In this section we present  
366 the issues reported by citizens, separated according to the social and technical drivers and limitations  
367 they reported for citizen e-participation.

#### 368 *Drivers (motivating factors)*

369 One important driver for the citizens to contribute information was the possibility of reporting their  
370 risky situation and their emergency condition directly to authorities. People, and particularly people  
371 from low income areas, consider that authorities do not want to provide them any help or access to  
372 resources, so they considered a report presenting their needs on line might put pressure on the city  
373 officials in charge.

374 Citizens in general want evidence that might allow them to negotiate with the authorities or insurance  
375 companies about their needs for infrastructure, financial support or reparation. VGI Platforms are  
376 understood as a way to present both complaints and supporting evidence at the same time, because  
377 of the facility that systems such as *Proube* allows for uploading of pictures, video, text georeferenced  
378 text tags.

379 It is been reported by researchers of different participatory approaches how geographical local  
380 knowledge provided by people can be relatively accurate about events in time and space, (Vergara-  
381 Asenjo, 2015). This knowledge could be geo-referenced and hence localised with VGI deployments.  
382 Particularly in the case of risks and floods, people can report very specific locations of flooding through  
383 a web based or mobile app and this detailed local information can be contrasted with the more  
384 general summary mapping or information about the flood extents in the governmental reports. One

385 important factor to consider is that knowledge provided by citizens is locally based, meaning that their  
386 interest to contribute is often focused on their immediate context. Provided that enough local  
387 contributions are available, there will be adequate coverage of data for the area. But areas where  
388 people do not live may have no contributions even though flooding has occurred. This is an example  
389 of the patchiness of contributions through VGI.

390

391 We found there was a strong link between people being motivated to continue using the app and the  
392 rewards they received for using it. We assumed from the beginning that the main driver for citizens  
393 to collaborate with the city would be the incentive to improve local conditions and to report risky  
394 events, but in fact citizens were often motivated more if they found the technology interesting and if  
395 the app provided them a reward or was fun to use, this was often a stronger driver for them to use it.  
396 The team had expected that some citizens might be interested in participating simply for their  
397 commitment with the city and their wellbeing – i.e. through a sense of civic duty. Some citizens,  
398 particularly in the middle class areas reported a willingness to participate for reasons of civic duty but  
399 for the majority, a much stronger motivator was to enable their voice to be heard.

#### 400 *Limitations*

401 Below we present the most commonly reported social and technical limitations we found during the  
402 user testing workshops, with the mobile app. The team found that in order to encourage users to  
403 contribute frequently and regularly use the app it needed to be continuously available online so when  
404 they connected they could immediately upload their reports. One of the main factors of success of  
405 platforms such as Facebook or Twitter, is the rapid response from friends, or comments from other  
406 social agents. This interaction or rapid response is often reported as a basic motivator for citizens to  
407 maintain their interest and participate further.

408 Particularly, regarding the reporting of actual flooding events, many citizens wanted to hear of  
409 solutions to their reported problems from the government. In this case, citizens who agreed to use

410 the app found it challenging that the authorities might not respond, and they suggested that reporting  
411 hazards without any answer from the authorities is not useful (Zook et al., 2010). One relevant finding  
412 is that many people did not consider that reporting social needs, risks or emergencies to governmental  
413 officials and to NGOs, as a political activity, but as a practical call for assistance.

414 After a few weeks of using the app, some citizens reported they were discontinuing due to a lack of  
415 time, or because of difficulties in reporting due to technical issues. Others just stopped  
416 communicating with the team. This rapid fall off in contributions has been reported in other studies  
417 with VGI platforms that often report low rates of public participation (Leao & Izadpahani, 2106;  
418 Goncalves et al. 2015; Cardone et al., 2013) During workshops, participants of different ages  
419 reported their preference for using popular social media as Facebook and Whatsapp (Loader, et al.,  
420 2014) to communicate and exchange news with friends (Effing et al., 2011) and relatives and the  
421 main factors they suggested for using these other apps more continuously were that these platforms  
422 were easier to access, more friendly<sup>1</sup> and intuitive. Regarding this issue Leitner et al. (2002)  
423 identified the need for Human Computer Interaction/human factors work to ensure that  
424 Participatory GIS Mapping platforms have easy to use interfaces as a way to encourage more  
425 sustained use.

426 Technically one limitation for citizens, and for the team was keeping updated with the rapid change in  
427 software and operating systems for the VGI platforms and the mobile devices. The most popular  
428 software platforms for mobiles are Android, followed by IOS and Windows. These are typically  
429 updated about every six months (Bennett 2008). Renewing content and maintaining technical  
430 compatibility requires a significant and continuous investment, as some features stop working or  
431 become unsupported on newer devices (Brovelli et al., 2016). In our case when the project ran out of

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<sup>1</sup>A common definition of user-friendly is related to software programs that ensure a good experience,  
by having interfaces that are simple, clean, intuitive and reliable.

432 money the ICT developers ceased making necessary software updates and levels of participation fell  
433 rapidly to near zero.

#### 434 **NGO's and Citizen e-participation**

435 As part of the wider research study, presentations and interviews were undertaken with various NGOs  
436 running related VGI platforms to collect information about a variety of different purposes, such as  
437 cycling, road conditions or tourism opportunities. The objective of the interviews was to find out how  
438 the managers of these platforms were handling citizen e-participation and what success factors or  
439 constraints they reported.

#### 440 Drivers

441 Members of different NGOs considered that VGI platforms are very useful for reporting social  
442 problems; they believed that they recognize the value and expertise of local people, whilst under the  
443 current governmental cuts in Mexico, they reported that citizens may consider they have to engage  
444 more directly through these platforms to exhibit their social needs.

445 One important driver for these NGOs supporting VGI platforms is the possibility of reporting on real  
446 time events that have negative effects on people. If the event is relevant for the users, then the NGOs  
447 reported that user participation would peak for some weeks while people are reporting on a particular  
448 event, but later the interest will fade if the events do not continue to occur.

449 The NGOs interviewed were also exploring using social media to report features or events that  
450 concerned the sector to which they belonged. For many grassroots NGOs citizen participation is key,  
451 because they can use a high volume of popular interest to put pressure on the governmental  
452 institutions to make changes or provide aid. Since crowd-sourcing is an effective way of getting mass  
453 participation from citizens on particular issues, many NGOs are organising public events where people  
454 come together to show solidarity, or voice their concern and also download an app.

#### 455 Limitations

456 For web based VGI platforms and apps the limitations which the NGOs interviewed typically  
457 experienced were poor financial support, limited support for updating software and low participation  
458 rates from the public in general. The strategy they take to increase popularity of usage is to ask friends,  
459 relatives and other NGO with similar interests, to feed the platform with data, otherwise they find  
460 that their possibilities to influence policy design and access to resources is restricted because their  
461 platform does not attract sufficient popular interest.

462 In order to increase their influence, some NGOs have decided to join efforts and expand their reporting  
463 areas, nevertheless due to different place-based interests, and technical issues they find difficult to  
464 standardise the participation from different locations on one platform.

#### 465 **Scholars/academics and Citizen Participation**

466 One interesting sector of users the team was interested were scholars. There are a number of  
467 academic articles presenting reports of citizen science being used for monitoring environmental  
468 problems. The Proube app and web platform could be adapted as a platform for citizen science. We  
469 therefore interviewed researchers from different academic areas with the objective of collecting their  
470 opinions regarding VGI, Web based platforms and how they would use them.

#### 471 **Drivers**

472 For scholars, the issue of the low rate of citizen e-participation achieved by Proube was less relevant  
473 compared to the benefits that they believed an instrument like this could represent. This is probably  
474 because they believe they could connect successfully to a community of interested individuals with  
475 interest in a research topic and this would be the driver for successful use rather than the functionality  
476 of the platform. Most of the scholars interviewed considered that the Proube platform or a similar  
477 web based platform and application offered more opportunities than constraints for research.  
478 However we also found more traditional scholars who believed that citizens or laypeople are not able  
479 to generate reliable geographical information that could support decision making for governmental

480 organizations or scientific projects, and so creating a platform for public data collection would have  
481 these difficulties.

482 Scholars considered that a platform like this represented opportunities for monitoring events of  
483 different nature with the communities. They highlighted as a relevant feature the possibility of  
484 geographically referencing some of the local knowledge that was collected or shared.

485 Likewise, the possibility of different social agents cooperatively providing information in one platform  
486 is another positive driver for scholars to use it as well as the perceived simplicity of using the platform  
487 and being able to train technicians or local people to teach others how to use it.

488 One relevant aspect related to maintaining the platform over the long term, which that the team had  
489 not considered before was the possibility of collecting, mapping and keeping historical memories of  
490 events. This feature could for instance be used to record people's memories of places that have  
491 suffered from flooding in the past.

492 Constraints

493 Related to constraints for using the Proube platform, the more conservative scholars considered that  
494 data provided by citizens would not be accurate enough and that map construction cannot be left in  
495 the hands of non-experts, because of an implied lack of reliability. Likewise, these scholars considered  
496 that the simplicity and basic contents of the maps generated by laypeople do not contribute to  
497 geographical science.

498 **Citizen e-participation and the administrative governmental institutions**

499 Regarding the role of the government on the implementation of these type of platforms and the user  
500 testing they did with the Proube platform, a variety of federal and local officials from institutions  
501 developing or using web platforms and apps were interviewed.

502 Drivers

503 Governmental administrative organizations stated that they want to exchange information with  
504 citizens, for better decision making, nevertheless few real steps appear to have been taken in this  
505 regard. This limited previous implementation was a motivating factor for them to set up the web based  
506 platform Prourbe.

507 One chief of staff suggested that a driver for them to set a platform up is the possibility of tracking  
508 land use change, and cadastral changes while at the same time they were being informed by citizens  
509 about ownership, hazards, etc. This suggests that they could be creating a system for purposes other  
510 than the one for which they are asking information from citizens, due to the ability to cross reference  
511 the information received and use this for different purposes. This raises questions about transparency  
512 of purpose, if citizens believe the information is to be used for one purpose, when it may also be used  
513 for another undeclared purpose.

#### 514 Constraints

515 Staff interviewed from institutions that administered a platform, were collecting their own data for  
516 diverse purposes such as security, monitoring of car accidents, and monitoring of transit on city roads.  
517 In these cases policemen or staff from these institutions collect the information in the field and later  
518 they upload the information at the offices. These institutions produce maps and information that is  
519 not available for regular citizens, for example information and maps related to security and hazardous  
520 areas is considered reserved information in Mexico. We observed that this unidirectional collecting of  
521 data using VGI platforms in these cases is very much for internal state or authority functioning, and  
522 overlooks the possibility for either collecting information from citizens, or reporting it (in any form) to  
523 them.

524 When asked why they do not ask citizens for data, one of the key constraint that governmental officials  
525 regularly reported is the lack of trust in the information provided by citizens. They do not consider it  
526 reliable for decision making or for planning emergency response. Some officials also believed that

527 exposing the information upon which they base their decisions upon to the public may diminish their  
528 authority or leave them open to unwanted scrutiny.

529 Under budgetary cuts, there are limitations in the development and testing of VGI platforms in many  
530 government agencies in Mexico. Nevertheless even under these constraining economic conditions  
531 there are different platforms advertised in 2017 in the city for security, mapping of risky areas for  
532 women. Governmental institutions certainly expect to receive information from citizens through a  
533 proliferating number of VGI platforms but the interviews with these officials suggest they are not really  
534 prepared to exchange in a dialogue about the reported issues with citizens. We argue that most of  
535 these are not functioning as platforms for public engagement; these are platforms designed to collect  
536 information from citizens or disseminate information about events happening in the city but not to  
537 enable an exchange of information (analogous to a conversation) with the citizens.

#### 538 **Discussion**

539 Much of the literature on VGI and Citizen participation describes the role of different social agents and  
540 how these design, interact, use and sometimes control web based platforms. Seldom do studies  
541 explore the relations between social agents using VGI platforms, their influences upon Citizen e-  
542 Participation and how this links to democracy. This is an unfortunate lacuna. At this moment, in the  
543 history of contemporary western societies technology gives us the ability to analyse, classify and  
544 synthesize Big Data provided by citizens, but the social institutions and particularly the governmental  
545 administrative organizations are still assessing how to approach the possibility of a new version of a  
546 direct democracy. Participation with technological devices- particularly mobiles- can be individual  
547 (direct participation), because every person with a device can upload their opinion, and at the same  
548 time every single contribution can turn into massive participation, when a big number of citizens  
549 express their opinion regarding one problem, interest or decision.

550 The role of governmental institutions is key to strengthening and encouraging a meaningful Citizen  
551 participation in policy design and decision making. At the moment, many platforms collect data from



552 citizens and do not provide any type of exchange or answer. We cannot suggest that government  
553 organizations are discouraging participation on purpose, but we observe how Citizen participation is  
554 not stimulated, therefore involvement and commitment with *the Polis* is difficult (Elwood 2009;  
555 Harvey & Tulloch 2006).

556 The construction of participatory approaches requires to be designed according to the needs of  
557 different social agents, and is necessary to include both the needs of those who deploy a platform for  
558 VGI and those who are asked to contribute to it. The *Proube* project was deployed to test mobile  
559 technologies and to analyse the performance of a VGI platform in both social and technical dimensions  
560 – i.e. its socio-technical performance. The *Proube* prototype was intended to reveal the challenges to  
561 Citizen participation, and identify these as gaps for further research studies to explore. In this project  
562 it was discovered that for obtaining a meaningful contribution on a VGI platform, large numbers of  
563 people need to use it frequently and this has not always been the case. The team found that initially  
564 during testing sessions and training workshops, many of the social agents involved were enthusiastic  
565 about it. Nevertheless, after experiencing various technical limitations, and the costs of data charges  
566 from use on their mobiles, as well as realising the need for a more continuous and extended  
567 commitment of time, reluctance to participate grew among many participants. Research into means  
568 to overcome these socio-economic impediments to continuing citizen participation using mobile  
569 technologies is clearly needed as much, if not more than further research to improve e.g. the software  
570 interfaces and speed of responsiveness of VGI platforms, in order for the combined socio-technical  
571 solution to perform its function effectively as truly e-engaging.

572 This paper began by discussing Citizen participation and its relation with democracy, using as a context  
573 the *Proube* VGI platform and mobile app. Heeding the work of Dahl (1989) Citizen participation is a  
574 necessary element for democracy, but in practice, citizen participation is at best an imperfect  
575 reflection of democratic ideals. Literature on the field of VGI presents it as: an opportunity for citizen  
576 engagement, for the inclusion of local knowledge on decision making and as a means of low cost data

577 collection. In practice, many different factors influence citizen participation and of these, one main  
578 challenge for VGI is often the lack of interest from citizens in participating. A useful perspective on VGI  
579 and Citizen participation is taken from the work of Nuijten (2002), who emphasizes that when  
580 designing such systems one needs to carefully consider participatory approaches, especially those that  
581 do not understand or ignore the nature of the different fields of power linked to the issues that harm  
582 communities. Examples such as the slum clearances in India which occurred after a participatory  
583 mapping project which intended to improve services for slum dwellers is an example of negative  
584 outcomes that sometimes result from an uncritical use of these approaches or when these power  
585 relationships are not well understood (Sanchez, et al., 2013; Bunch, et al. 2012). Finally, we aimed to  
586 understand the sociotechnical factors around these situations. We suggest that the apparent lack of  
587 people`s commitment with everyday issues happening in *the Polis*, arises from complex factors, and  
588 in the Mexican case was found to be related to an underlying institutional neglect of citizens,  
589 generalized corruption, tokenism being using as a way of controlling access to social benefits and  
590 clientelism together with lack of political will and interest to solve social issues (see [REDACTED]).  
591 From the governmental institutions, we also found a continuing lack of trust or value from experts in  
592 the knowledge of citizens, and a dismissive attitude from some high ranking governmental officials,  
593 particularly towards the attitudes or concerns of poor people. All these factors combined undermine  
594 the political legitimacy of the VGI deployment, and in the end of the governmental administrative  
595 bodies in the eyes of the citizens.

## 596 **Conclusions**

597 We summarise our conclusions according to three research questions we posed in the Proube study,  
598 as we believe these also have wider significance for other similar VGI deployments and the ways in  
599 which citizens in other developing countries may respond to these

600 *To what extent is citizen participation promoted or facilitated by VGI platforms?*

601 Today's modern VGI platforms offer an exciting opportunity for more frequent citizen engagement  
602 with the state and local authorities. They can enable the inclusion of more local knowledge into public  
603 decision making and can be a means of enabling low cost data collection of large volumes of  
604 information, including the views and aspirations of the public in relation to plans or proposals, as well  
605 as an opportunity for citizens to make counter-proposals. In order to realise the potential of the  
606 technology however, VGI needs to be deployed as part of a credible effort by those with governance  
607 responsibilities to create examples of what Johnson & Sieber (2003) call *engaged citizens*.

608 If VGI is just used as a tool for data collection and for dissemination of final decisions, but does not  
609 facilitate or encourage higher levels of e-participation such as a two way dialogue with authorities,  
610 then it lacks credibility as a method of engagement, and is perhaps no better than a badly attended  
611 public meeting. VGI can support many processes including protecting citizen anonymity, empowering  
612 minority voices and facilitating transparency of engagement and decision making processes if these  
613 processes are desired, but like any consultation tool, VGI does not deliver these benefits if the views  
614 gathered are subsequently sidelined, discounted or overlooked at decision time.

615 We suggest that greater transparency is needed from those who make VGI deployments, about for  
616 example what citizens are being asked to contribute, how their objections, concerns or counter-  
617 proposals will be used by the state, and whether or if they can expect to be identified in this process,  
618 for example. All of these functions can be operationalized using technology available today; what is  
619 arguably needed is for authorities to be more transparent with citizens about their purpose for inviting  
620 participation, before then designing the enabling technology such as the VGI platform. In this way, we  
621 may seek to avoid prior criticisms of many so-called public participatory GIS systems, which as Wood  
622 (2010) and others have demonstrated, are sometimes not being used in truly participatory or  
623 democratic ways.

624 *What are the drivers and constraints to citizen e-participation (including reasons for non-*  
625 *participation)?*

626 Despite considerable research on VGI over the last decade, the reasons and the motivations for  
627 citizens to voluntarily participate, or choose not to participate with VGI platforms, remains  
628 underexplored. This study revealed evidence of various reasons for citizens' non-participation in a web  
629 based VGI platform designed to allow citizens to report instances of local urban flooding. Despite our  
630 assumptions that citizens commitments with the place where they live and the risks they might face  
631 would be enough reason to be motivated to participate and contribute as citizen sensors, the level of  
632 engagement in the Proube project trials in Mexico were modest from the start, and declined over  
633 time. Evidence from other similar studies (e.g. Zook et al, 2010) indicates that these type of platforms  
634 can achieve high levels of participation for short periods during emergencies but that later usage often  
635 declines. We also assumed that the technological novelty of a web platform and the smart phone app  
636 would attract people to participate. Despite the surprising finding that smart phone use by people  
637 who are clearly living in poverty in this area of Mexico is rapidly increasing, particularly among young  
638 people, many of these people reported that the App was not simple, intuitive or exciting enough to  
639 sustain their interest, and they found no benefit or reward from using it.

640 Although we do not know the motivations for non-participation from those who did not want to be  
641 interviewed, reasons reported by the citizens that we interviewed included: lack of time, security  
642 concerns about providing any personal information, the unfriendliness of the mobile application, "no  
643 fun using the app", a feeling that the authorities would distrust the citizen's information, and  
644 reflexively a lack of trust by citizens about the authorities in charge and their intentions. Although  
645 there were technical difficulties concerning, e.g. citizens lack of familiarity with the app, the majority  
646 of reasons cited for not contributing or for deciding not to continue to contribute were non-technical,  
647 relating mostly to a lack of trust in government administrative organizations, or suspicion about how  
648 their contributed information might be used. Whilst the software interfaces can be further improved  
649 and the responsiveness of the VGI platform improved, these findings suggest that these technological  
650 improvements by themselves are unlikely to change the attitudes and concerns of most citizens  
651 towards them becoming more active participators.

652 A lack of timely response or feedback was another key reason why the initial contributors had become  
653 demotivated and had stopped continuing to engage with the project. This study reinforces other  
654 recent findings (e.g. Leao & Izadpahani, 2016) that when VGI citizen platforms are deployed by (quasi  
655 or) governmental administrative organizations, failure by authorities to provide an answer back or  
656 show how the citizen's input is being incorporated when addressing the reported social issue, strongly  
657 discourages citizens from further participating. This also confirms what scholars have previously found  
658 regarding lack of commitment by the public to contribute to VGI platforms on a regular basis (in  
659 contrast to the way that people *are* motivated to regularly post to Facebook or Instagram); this is often  
660 attributed to the perceived lack of social reward, and/or access to any tangible benefits in return for  
661 these contributions (Agostino 2016)

662 *What are the consequences on democracy when citizen participation is little or absent?*

663 Facilitating Citizen participation in the democratic governance processes outside of national elections  
664 in Mexico presently remains problematic, as is the case in many countries. Despite its technical  
665 feasibility, the presumptions that a web-based solution can create a dialogue through e-participation,  
666 or that this is what the authorities desire, need to be questioned critically. The low level of e-  
667 participation that we found in the Mexican case was found to be related to an underlying institutional  
668 neglect of citizens, generalized corruption, a sense from citizens that the consultation was in fact  
669 simply tokenism and an evaluation that it would cost them, would probably not provide them with  
670 social benefits and in fact might have negative consequences for them. From the other side, the  
671 authorities expressed a general mistrust in the quality and the credibility of the data being provided  
672 by the citizens, effectively challenging the ability of citizens to self-report flooding events, although  
673 that what was the application facilitated them to do. This suggests that at least some in authority still  
674 question the validity of seeking Volunteered geographic information and its inclusion  
675 in decision making. It is therefore important to consider critically the purpose of VGI deployments to  
676 gather information for governance if low rates of citizen response are expected and achieved, arguably

677 in such cases the technology is at best accentuating expected biases (e.g Steinberg, 2015) or at worst  
678 being manipulated to create an impression of public participation but with a tacit expectation that this  
679 will not be fully realised. One might argue that creating platforms which swallow data without  
680 providing any response to the public are an electronic analogy of a manual process of mislaying or  
681 burying votes for options that an authority does not prefer, and one should be wary of cases where  
682 the potential of VGI is deviated to support less transparent or undemocratic processes, as this widens,  
683 not narrows the gap which Van Dijk (2012) describes between the vision and the reality of a digital  
684 democracy.

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689 “All procedures performed in studies involving human participants were in accordance with the ethical  
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691 declaration and its later amendments or comparable ethical standards.”

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