

# Chapter 4

## Emergent Social Roles in Wikipedia's Breaking News Collaborations

Brian C. Keegan

### 1 Introduction

2 Disasters and accidents are endemic to social life but so are the unique forms of social  
3 behavior and organization that emerge following them. The “improvisation of order  
4 out of chaos”, equanimity of victims, emergence of serendipitous and egalitarian  
5 social ties, and redemptive moments of solidarity have characterized postcatastrophe  
6 communities for centuries but are also intrinsically ephemeral and recede as the most  
7 acute phase passes (Quarantelli and Dynes 1977; Solnit 2010). Following unexpected  
8 and traumatic news events such as a major natural disaster, transportation accident,  
9 or mass shooting, familiar reference sources such as Wikipedia become the focus of  
10 many people seeking information to help them share information, learn about the  
11 response, and make sense of the event (Keegan 2013).

12 However, the vast majority of Wikipedia contributors are personally unaffected  
13 by the immediate consequences of these events and may not have the most up-to-date  
14 information about these events. This should inhibit their motivation to devote their  
15 time and expertise to topics so remote from their interests. Furthermore, Wikipedia's  
16 policies repeatedly emphasize that the content of its articles should take a historical  
17 perspective and rely upon neutral and reliable secondary sources; prerequisites that  
18 are obviously absent in the coverage immediately following a breaking news event.  
19 In addition to these barriers, developing a collaborative account of a breaking news  
20 event on a site where “anyone can edit” would seem to inhibit rather than promote  
21 the generation of a reliable account. Editors' diverse motivations and skills, their  
22 lack of experience working together, no expectation of collaborating in the future,  
23 and their volition to contribute as much as they prefer should lead to major break-  
24 downs in the process of collaborating together. The responsibilities for integrating  
25 and updating content, reverting vandalism, formatting citations, and mediating dis-  
26 putes are likewise diffused among all editors. This lack of clear roles or strong ties  
27 to bind participants together undermines crucial but unstated assumptions in many

---

B. C. Keegan(✉)  
Northeastern University, Boston, USA  
e-mail: b.keegan@neu.edu

28 theoretical approaches for understanding online communities and organizational be-  
29 havior. Furthermore, the volatile information environment, lack of a central authority  
30 to assign tasks, make decisions, or enforce rules, and need to sustain attention to de-  
31 velopments over long periods of time and across broad topical areas likewise should  
32 be a recipe for profound organizational dysfunction. Yet, the top 25 Wikipedia arti-  
33 cles by contributors every month since 2003 consist exclusively of articles pertinent  
34 to current events. Similarly, articles receiving the most unique edits and pageviews  
35 in any given week or month likewise demonstrate a substantial bias toward articles  
36 about current events. Wikipedia's coverage appears to thrive in spite of the serious  
37 challenges for organizing and coordinating responses to breaking news events on an  
38 open and large-scale collaboration system (Keegan et al. 2013).

39 How is Wikipedia able to cover breaking news events in spite of itself? I argue  
40 Wikipedia's ability to manage the complexities of breaking news collaborations de-  
41 rives from the ability of its contributors to improvise and regenerate organizational  
42 resources such as interactional roles, routines, and resources developed in previous  
43 collaborations. This would imply that breaking news collaborations involve editors  
44 who have repeatedly worked together or even specialized in editing content about  
45 breaking news articles. Analyzing these patterns requires data that can capture the  
46 interactions of Wikipedians with each other as well as changes in these interactions  
47 over time. Empirical analyses of Wikipedia collaboration structure use event logs  
48 that archive records of changes editors have made to artifacts. Event logs gener-  
49 ally contain information about the agent, artifact, order, and action taken such as a  
50 Wikipedia editor (agent) making an edit (action) to an article (artifact) at a specific  
51 time (order). The event logs of multiple articles are often combined to extract rela-  
52 tionships about which editors modified which articles. The resulting networks reveal  
53 large-scale patterns of collaboration around who edits which articles (Keegan et al.  
54 2011a) and how these editing patterns are distinct from typical forms of collaboration  
55 on Wikipedia (Keegan et al. 2012a, 2013).

56 However, these analyses usually examine patterns of editor collaboration *across*  
57 articles rather than the evolution of editor behavior occurring *within* an editor's con-  
58 tribution history. The temporal ordering of sequential contributions with a single  
59 editor's event logs also encodes relationships reflecting the editor's shifting interests  
60 and attention. Looking at these records of what an editor modified over time can  
61 provide a new perspective on the structure and evolution of their role within collabo-  
62 rations. A "user sociotechnical trajectories" reflects the time evolution of how a single  
63 editor's behavior changed through his or her contributions to articles (Iba et al. 2010;  
64 Keegan et al. 2012b). These implicit, indirect, and latent interactions of editors'  
65 sequential modifications potentially capture unique social roles and collaboration  
66 processes that have been overlooked before.

67 This chapter reviews prior work that has examined relationships and social roles  
68 within Wikipedia, provides methodological detail about the construction of soci-  
69 otechnical trajectories, and explores the concept with a case study of several users  
70 who edited articles related to the 2011 Japanese earthquake and tsunami. These col-  
71 laborations bring together a unique cast of characters with disparate backgrounds  
72 that fulfill distinct roles in these collaborations. This analysis suggests that breaking

73 news article collaborations rely to a great extent on interactional roles of motivated  
74 editors self-selecting into these collaborations rather than structural roles such as  
75 news editors wholly dedicated to editing breaking news articles. Editors exhibit  
76 considerable variability in the structure of their editing trajectories reflecting their  
77 diverse backgrounds. The emergence and expansion of collaborative infrastructure  
78 on these breaking articles employ more improvisational features like disaster re-  
79 sponse rather than the regeneration of collaborative infrastructures like emergency  
80 room care. I conclude by outlining a research agenda for how researchers can employ  
81 the sociotechnical trajectories of editors to understand social roles, organizational  
82 routines, and behavioral patterns that lead to more reliable user-generated content,  
83 and emergence of leadership within self-organizing systems.

## 84 **Background**

### 85 *Networks on Wikipedia*

86 Wikipedia is not only the “encyclopedia that anyone can edit”, but the accessibility  
87 of its databases has also made it the “dataset that anyone can analyze.” There are a  
88 variety of user-to-user, user-to-artifact, and artifact-to-artifact relationships that can  
89 be explored within Wikipedia (Keegan et al. 2013). Prior work on Wikipedia has  
90 analyzed the structure of editors contributing to articles (Capocci et al. 2006; Jesus  
91 et al. 2009; Laniado and Tasso 2011; Keegan et al. 2012a), articles linking to other  
92 articles (Kamps and Koolen 2009; Kane 2009; West et al. 2009), editors modifying  
93 other editors’ contributions (Brandes et al. 2009; Turek et al. 2010; Keegan et al.  
94 2012b), editors’ discussions with other editors (Laniado et al. 2011; Leskovec et al.  
95 2010; Massa 2011), and changes in these structures over time (Buriol et al. 2006;  
96 Iba et al. 2010; Scripps et al. 2009). In addition to characterizing the structure of  
97 the networks of collaborators and hyperlinks among articles, researchers have also  
98 examined how these structures influence the quality of articles (Ransbotham et al.  
99 2012; Wilkinson and Huberman 2007; Kittur and Kraut 2008; Hu et al. 2007) and  
100 the relationships between concepts across languages (Hecht and Gergle 2010; Bao  
101 et al. 2012). However, the network structure of an editors’s changing interests and  
102 roles is more difficult to capture with static network analyses—which articles did she  
103 edit first and which has she contributed to most recently? These shifts in topic and  
104 type of page over time are strong behavioral signatures of social roles yet ignored in  
105 most empirical network analyses of Wikipedia and other peer production platforms.

### 106 *Social Roles on Wikipedia*

107 Social roles describe the positions individuals hold within social structures and  
108 the expectations individuals have for their own and others’ behaviors. Theories  
109 of social roles abound, but two dominant theories merit discussion. Interaction-  
110 ists perceive roles as focused on the individual and his or her subjective perceptions,

111 negotiations, contextual demands, and informal interactions. Structuralists perceive  
112 roles as focused on the social environment and the cultural or institutional processes  
113 that generate patterns of behavior and relationships that individuals occupy (Biddle  
114 1986). However, roles are not stable, but can change in accessibility (barriers to  
115 entry), prestige (social and cultural value), and contingency (relevance to specific  
116 contexts) (Callero. 1994). Gleave et al. (2009) provide a detailed theoretical and  
117 operational definition of social roles in online communities as emerging from behav-  
118 ioral regularities, network attributes, social actions, self-identification, and formal  
119 classifications. Social roles may also be defined as an “ecology” in which one role  
120 operates in relation to others such as antivandals acting to revert the damage done  
121 by vandals (Welser et al. 2007; Geiger and Ribes 2010).

122 Several previous studies have employed a social role framework to examine  
123 knowledge collaboration in Wikipedia and provided diverse findings. Although  
124 Wikipedia has some formally credentialed roles such as administrator and bureau-  
125 crat, these are a tiny minority of the editor population. The majority of editors inhabit  
126 emergent roles organized around practices such as vandal fighting, copyediting, new  
127 page patrolling, content standardization, administration, article evaluation, tool de-  
128 velopment, and new editor welcoming. Gaved et al. (2006) gave one of the earliest  
129 examinations of role ecologies on a Wiki identifying “locators” who identify specific  
130 information on a topic, “explorers” who gather general information on a topic, “graz-  
131 ers” who move between topics, “monitors” who check known sources, and “sharers”  
132 who make information more accessible. Kane et al. (2009) identified “flitterers” who  
133 place ideas then leave, “idea champions” who ensure the kernel of idea is maintained  
134 and evolved, and “defenders” who use technology to respond to adverse changes in  
135 the content. Yates et al. (2010) identified “placeholders”, “completers”, “housekeep-  
136 ers”, and “shapers” who contribute, integrate, and synthesize content on Wikipedia.  
137 Welser et al. (2011) identify four distinct social roles: technical editors correcting  
138 small style and formatting errors, vandal fighters reverting vandalism and sanction-  
139 ing norm violators, substantive experts who specialize in improving articles within  
140 a particular domain, and social networkers who use the Wiki as a platform for inter-  
141 personal relations rather than substantive contributions to content or administration.  
142 While these analyses of social roles in Wikipedia are instructive for identifying gen-  
143 eral behavioral regularities and interactions, they do not examine the roles used for  
144 high tempo knowledge collaboration that operate under very different coordination  
145 conditions.

## 146 *Social Roles for High-Tempo Collaboration*

147 Social roles also play an important part in the operation of organizations that must  
148 respond to unpredictable and urgent tasks such as disaster response (Majchrzak et  
149 al. 2007), emergency medicine (Faraj and Xiao 2006), aircraft carrier flight decks  
150 (Weick and Roberts 1993), or breaking news journalism (Berkowitz 1992). Highly  
151 differentiated and formalized roles such as attending doctor versus nurse allow  
152 individuals to adopt a swift and depersonalized trust based on arbitrary category

153 membership heuristics alone (Meyerson et al. 1996). The roles in these systems are  
154 often stable and endure through successive temporary organizations (Bechky 2006;  
155 Bechky and Okhuysen 2011; Klein et al. 2006). However, some temporary organi-  
156 zations like disaster response teams lack the role clarity or group stability of other  
157 temporary organizations like emergency room teams. The former have diverse moti-  
158 vations, mixed perspectives, varied resources to contribute, and substantial volition to  
159 come and go as they please. Factors like these contribute to unstable task definitions  
160 and the pursuit of multiple and potentially conflicting goals. These *emergent response*  
161 *groups* are characterized by participants orienting to what is known about the situa-  
162 tion, the history of actions already taken, developing “swift trust”, and focusing on  
163 relationships between people and tasks rather than people and expertise (Majchrzak  
164 et al. 2007). Even these theoretical approaches assume collocation of group members  
165 and material or physical tasks, neither of which apply to distributed online Wikipedia  
166 collaborations. However, this approach emphasizes the ability for Wikipedians to  
167 step in and assume roles without prior qualifications, which is appealing for mod-  
168 eling Wikipedia’s “anyone can edit” ethos. However, these interactionist roles have  
169 problematic implications as it suggests that editors need to “learn the ropes” and im-  
170 prove the necessary social roles and behaviors rather than regenerating previously  
171 effective roles and behaviors.

172 Other scholars criticize approaches emphasizing temporary organizations’ man-  
173 agement of ephemerality through improvisation and “swift trust”. Coordination and  
174 self-organization in temporary teams can also proceed by participants regenerating,  
175 adapting, and improvising roles and routines used in previous projects and collabora-  
176 tions (Klein et al. 2006; Bechky 2006; Bakker 2010; Bechky and Okhuysen 2011).  
177 Temporary organizations can be organized around enduring, structured role systems  
178 that are negotiated, reproduced, and reinforced across collaborations within indus-  
179 tries characterized by temporary organizing. Entrants to a position find expectations  
180 through socialization and interaction, encounter and deploy resources with which  
181 to negotiate expectations, and enact the position in response to particular situations.  
182 Role expectations guide interpersonal relationships and the execution of tasks, but  
183 this role structure simultaneously provided continuity and stability that temporary  
184 projects lack (Bechky 2006; Ratcheva and Simpson 2011). This approach is ap-  
185 pealing for the study of Wikipedia’s breaking news articles because it suggests that  
186 editors occupy structural roles that allow them to specialize in particular types of  
187 editing. But because they can regenerate and adapt social roles and behaviors from  
188 prior work, this may limit their ability to incorporate innovations and best practices  
189 learned outside of this community compared to interactionist roles.

## 190 **Event Logs and Sociotechnical Trajectories**

191 To explore which of these role types prevail in Wikipedia’s breaking news col-  
192 laborations, editors’ behavioral histories need to be collected and analyzed. Many  
193 sociotechnical systems archive records and other meta-data about changes in the state  
194 of the system into event logs. These data are valuable for editors to trace changes

195 across versions of documents, evaluate other editors' contributions, and build additional  
196 tools to support collaboration.<sup>1</sup> Wikipedia editors can review the history of  
197 every change made to almost any article since the first edit as well as every revision  
198 made by any user. A *temporal adjacency* is the relationship from an artifact  
199 a user acted upon to the next artifact the user acted upon. Because sociotechnical  
200 trajectories are built from temporal adjacencies in event log data, they capture important  
201 temporal contexts and dependencies *in the structure of the network itself*. As  
202 we review below, these temporal adjacencies are overlooked in traditional network  
203 analysis approaches, but nevertheless encode complex behaviors into micro- and  
204 macro-level structures denoting distinct behavioral patterns and dispositions.

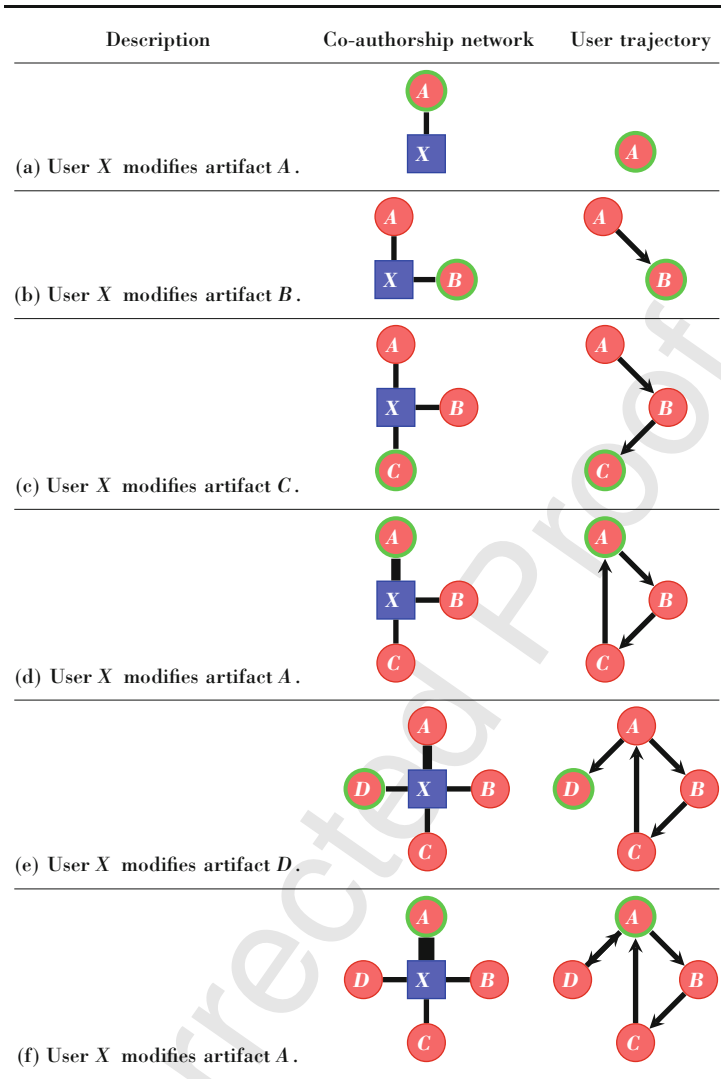
205 A *sociotechnical trajectory* of a user traces the path of users "moving through" the  
206 artifacts they have interacted with over time. The aggregation of temporal adjacencies  
207 in an editor's contribution history reflects the shifting interests, motivations, and roles  
208 from his or her first contribution. These contributions may be highly erratic in the  
209 case of vandal fighters moving rapidly between articles or they may be highly focused  
210 on a single topic. Using an event log archiving the records of a single user's actions  
211 to one or more artifacts, a temporal adjacency exists from artifact  $i$  to artifact  $j$  when  
212 a user's actions on artifact  $j$  immediately follow an action on artifact  $i$ . The final  
213 user trajectory ultimately contains the set of artifacts that the user has taken action  
214 on and the temporal adjacencies between artifacts based on the user's event log.

215 The differences in the construction and interpretations of a traditional editor-  
216 article collaboration network and sociotechnical trajectory are illustrated in Fig. 4.1.  
217 This example is drawn from the event log in Table 4.1 where one editor makes six  
218 contributions to four articles. Using the same event log, the traditional method of  
219 constructing collaboration networks of editors and articles is illustrated in the left  
220 column and the construction of the user's sociotechnical trajectory is illustrated in  
221 the right column.

- 222 1. At time 1, editor  $X$  makes a contribution to article  $A$ . In Fig. 4.1a, this creates  
223 a link between the editor and artifact in the collaboration network but creates an  
224 isolated editor node in the sociotechnical artifact trajectory. Note that editor  $X$   
225 does not appear in the user trajectory because the trajectory is unique to this user  
226 based solely on her behavior.
- 227 2. At time 2, editor  $X$  makes a contribution to article  $B$  and the number of articles  
228 in the collaboration grows to two which is reflected in both types of networks.  
229 However, the trajectory captures the temporal adjacency  $A \rightarrow B$  that is missed  
230 in the collaboration network. In other words, the editor can be said to have moved  
231 from article  $A$  to article  $B$ .
- 232 3. At time 3, the early stages of a "chain" begin to form in the artifact trajectory  
233 (Fig. 4.1c) as the editor modifies a third article but never returns to the articles  
234 she previously edited.

---

<sup>1</sup> In the remainder of this chapter, I will use the terms "editor" and "user" interchangeably to refer to members of the Wikipedia community who make contributions to the project on articles, discussions, and other pages. However, "users" can refer generally to individuals within other sociotechnical systems while "editors" are specific to Wikipedia.



**Fig. 4.1** A user sociotechnical trajectory. The user (*blue square*) contributed to 4 pages (*red circles*). Pages outlined in *green* received the most recent contribution. The edge width reflects the number of revisions the user made to the page

- 235 4. At time 4, this nascent chain ( $A \rightarrow B \rightarrow C \rightarrow A$ ) is closed and creates a “cluster”  
 236 or “cycle” where the editor returns back to editing an article she previously edited.  
 237 This cycle is a particular structural form that can be detected with traditional social  
 238 network metrics.
- 239 5. At time 5, that modifies article *D*. This temporal adjacency reveals *A*’s increasing  
 240 centrality as a place where the editor returns to and departs from that is obscured  
 241 in the collaboration network.

**Table 4.1** Example of an editor's event logs. The activities are all edits and the order are the timestamps of the contributions. The performer is user *X* and the cases are the set of artifacts  $\{A, B, C, D\}$

Activity	Case	Performer	Order
Commit	A	X	1:01
Commit	B	X	2:02
Commit	C	X	3:03
Commit	A	X	4:04
Commit	D	X	5:05
Commit	A	X	6:06

242 6. At time 6, editor *X*'s sixth contribution modifies article *A* yet again, reinforcing  
 243 article *A*'s centrality in the behavioral repertoire of the editor as well as creating  
 244 a reciprocated link between *A* and *D* that is distinct from the cycle.

245 Formally, the sociotechnical trajectory of a user is a one-mode directed graph wherein  
 246 an edge from artifact *i* to artifact *j* exists if and only if the user made a contribution  
 247 to artifact *j* immediately following a contribution to artifact *i* in a temporally-sorted  
 248 event log. Thus, a  $A \rightarrow B$  dyad in an article trajectory can be interpreted as "user  
 249 *i* contributed to artifact *B* after artifact *A*". These graphs are visualized using a  
 250 combination of spring-embedding algorithms within Gephi to ensure that nodes  
 251 with similar link patterns cluster together visually while nodes that do not share links  
 252 tend to be repulsed. While this structural method invites the application of existing  
 253 network analytic methods to understand positions, the focus here will instead be on  
 254 qualitatively examining features in these editors' trajectories that predispose them or  
 255 uniquely qualify them to participate in breaking news article collaborations.

256 The nodes in these visualizations are colored by their namespace or the page  
 257 type. There are at least 14 distinct namespaces on Wikipedia, but activity is pri-  
 258 marily concentrated in a handful of these. "Main" namespace is where the articles  
 259 themselves reside, "Talk" namespace is the discussion pages associated with these ar-  
 260 ticles, "User" namespace is where editors post information about themselves, "User  
 261 talk" is where editors communicate with other editors, "Wikipedia" namespace is for  
 262 administrative and policy-related content, "Wikipedia talk" is for discussions about  
 263 these policies and procedures. The remainder about files, MediaWiki, templates,  
 264 help, categories, and portals is highly specialized and make up a tiny fraction of total  
 265 contribution to the entire project. Because these patterns of contribution to specific  
 266 namespaces reflect distinct types of work and varying levels of familiarity with or-  
 267 ganizational norms, they are important for understanding editors' roles. The extent  
 268 to which editors' contributions are concentrated in any one of these namespaces re-  
 269 flects some social role or specialization on the part of the editor as a contributor,  
 270 copywriter, consensus-builder, vandal-fighter, policy-enforcer, or other roles.

271 The edges in this graph also encode information related to the delay or lag between  
 272 an editor's consecutive edits. Because an editor can potentially shift from editing ar-  
 273 ticle *A* to article *B* many times, this edge can contain multiple lag values that can vary  
 274 dramatically in their values. To simplify this array of lags, only the median value  
 275 reflecting a central tendency for the editor to wait before editing the next article is  
 276 used. Some lags may be very short, of the order of seconds or minutes, reflecting a  
 277 highly engaged editor moving quickly to update several articles in rapid succession



278 while other lags may be very long, of the order of months or years, reflecting an  
279 editor who went on hiatus between successive edits. These time lags are reflected  
280 in the trajectory by adjusting the darkness or opacity of the edges such that darker  
281 lines indicate shorter (median) lags reflecting immediate engagement while fainter or  
282 whiter lines indicate longer (median) lags reflecting incidental relationships. These  
283 distinctions are especially important in the context of a breaking news collaboration  
284 as the rapid engagement of editors across a variety of articles may reflect impor-  
285 tant coordination work responding to problematic editors, standardizing information  
286 across articles, or executing a decision made in discussion with others.

## 287 User Trajectories

288 This section explores the sociotechnical trajectories of editors who were significant  
289 contributors to articles around the 2011 Tōhoku earthquake and tsunami such as the  
290 “Fukushima Daiichi nuclear disaster” and “Fukushima Daiichi Nuclear Power Plant”  
291 (Keegan et al. 2011). These editors’ contributions are almost exclusively focused on  
292 a single article or handful of articles within this general topic. User L.tak extensively  
293 involved several articles related to the “Fukushima Daiichi nuclear disaster” and  
294 “Fukushima Daiichi Nuclear Power Plant” articles, talk pages, and related pages  
295 beginning on March 11. He (or she) continued editing these articles on a daily basis  
296 until April 1, ultimately making more than 211 revisions out of the 6165 revisions on  
297 the article. User Flodded edited the main article about the earthquake and tsunami  
298 exclusively approximately 14 h into the collaboration and continued to edit daily  
299 until March 23 making 542 of the article’s approximately 6000 revisions. L.tak’s  
300 contributions were also wide-ranging and varied. He was the most active editor on  
301 the articles for the “power plant” article and talk page as well as the second most  
302 active editor on the “nuclear disaster” article and seventh most active on its talk page.  
303 Like Flodded, L.tak’s involvement was extensive but temporary and appears to have  
304 stopped contributing to either article after early April.

305 Remarkably, neither of these editors ever crossed paths: they worked on their  
306 “own” articles independently of each other despite the similarity and timeliness of  
307 their topics. Alternatively, a user like ACSE edited many articles related to this break-  
308 ing news event, but concentrated attention on a pair of articles, editing the “nuclear  
309 disaster” article 160 times, the “earthquake and tsunami article” 83 times, and the  
310 other articles no more than 13 times. Thus, highly active editors appear to occupy dis-  
311 tinct social roles as either specialists focusing solely on a single article (like Flodded)  
312 or highly related topics (like L.tak) or as something like generalists moving between  
313 several or articles like ACSE. This specialization of prolific editors contributing to  
314 only a single article or subtopic is startling as it suggests substantive coordination  
315 or collaboration in coverage proceeds through other channels and mechanisms than  
316 coauthorship of articles. These features and these editors’ interactions with them will  
317 be explored in editor trajectory sections below.

318 *Flodded*

319 User Flodded was the prolific contributor to the “earthquake and tsunami” article,  
320 making the most contributions (560) in the corpus and is the first editor trajectory  
321 (Fig. 4.2). Flodded’s first edit was made in August 2009 to the article “Shellfish”  
322 and involved updating and adding citations. He edited an article about a failed dot-  
323 com company “AboveNet” and then went on a lengthy hiatus until January 2011.  
324 Flodded’s renewed editing activity was related to another breaking news event, Jared  
325 Lee Loughner’s assassination attempt against Gabrielle Giffords in Tuscon, Ari-  
326 zona. Flodded edited the articles “2011 Tuscon shooting”, “Jared Lee Loughner”,  
327 “Gabrielle Giffords”, and “United States Congressmen killed or wounded in office”  
328 in rapid succession over an 11-h period on January 11. Flodded was initially involved  
329 in copyediting the articles to remove unverifiable speculation and unencyclopedic  
330 content. As is often the case with breaking news articles, this article was “semipro-  
331 tected” by administrators to limit the changes made by novice or unregistered editors.  
332 Unregistered editors or editors who have been active for fewer than 4 days and 10 edits  
333 are blocked from editing, but may make requests for edits on the talk page. Flodded  
334 was involved in responding to several of these edit requests and then became involved  
335 in an intense discussion about whether Loughner identified as an atheist on both the  
336 discussion page and “Biographies of living persons” administrative notice board.  
337 He continued to perform copyediting duties on the Loughner article, fixing capital-  
338 izations, ensuring the consistency of names and styles, and correcting grammatical  
339 mistakes as well as remaining involved in the article’s discussion page. Despite the  
340 marathon 11-h editing session, Flodded abruptly stopped editing the article and did  
341 not make another contribution until February 21, performing daily antivandalism  
342 work on unrelated articles about “Extremes on earth”, “Bell Mobility”, “Lowest  
343 temperature record on earth”, and other topics on a daily basis. However, he was  
344 not deeply involved in the ongoing maintenance of these articles but simply made  
345 a single contribution and moved on to other topics. In early March 2011, he edited  
346 the article “Cheiracanthium”, a genus of spiders, to update information implicating  
347 them in a recall of Mazda vehicles.

348 As discussed above, Flodded was a relatively early editor of the “earthquake and  
349 tsunami” article, but he was not among the first editors. His initial edits focused on  
350 removing over-specific information relating to areas where minor tsunami alerts had  
351 been issued justifying these edits on the talk page:

352 We could list out thousands of places with tsunami warnings or that received a few extra cm  
353 of water. Obviously this is not feasible, nor is it encyclopedic. I suggest a good balance would  
354 be to only list places that have reported more than minor damage, have reported casualties,  
355 have reported large-scale evacuations in mainstream media, or are otherwise notable.

356 Flodded was also an extremely active editor on the discussion pages, making 257  
357 revisions between March 11 and March 22 on topics like the looming nuclear dis-  
358 asters, finding sources to verify the extent to which the island of Honshu had been  
359 displaced, and increasingly on the topic of establishing reliable numbers about the  
360 casualty tolls. Flodded went on a remarkable 24-h editing marathon; between 19:35

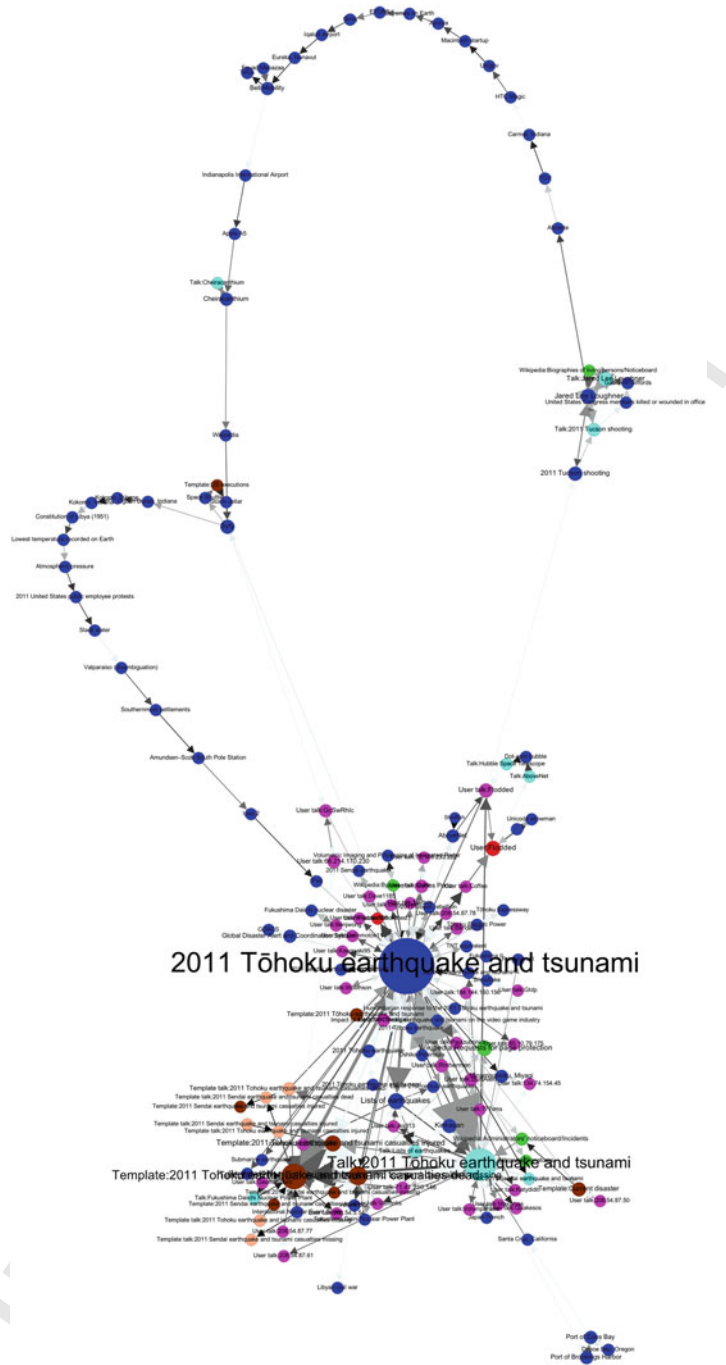


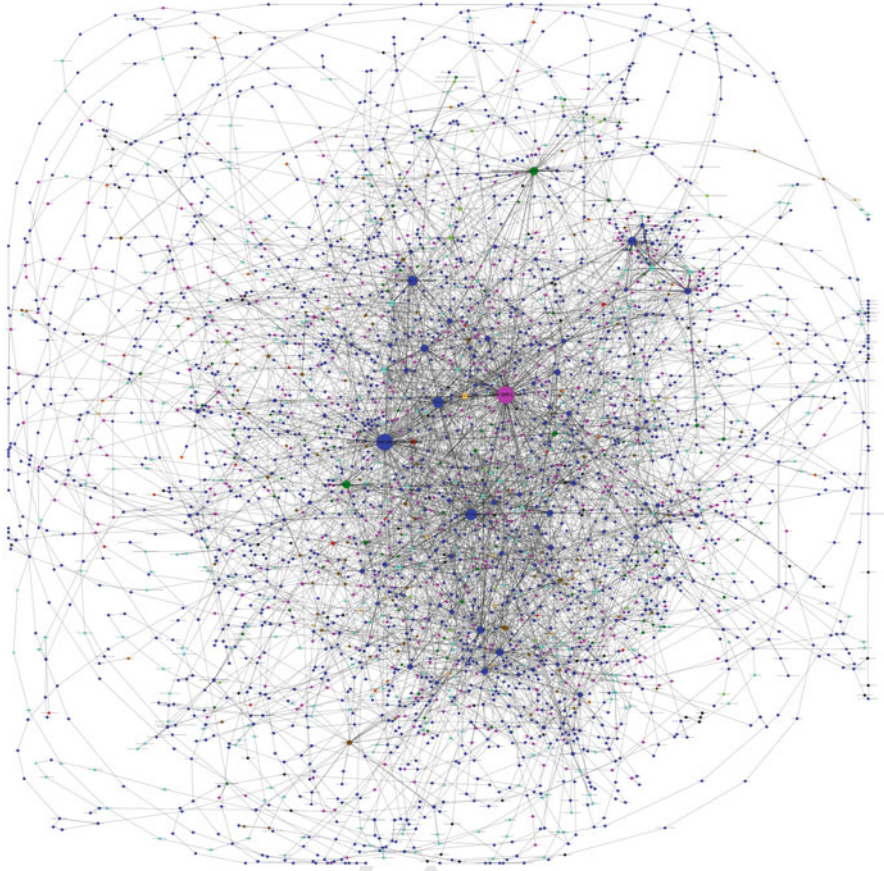
Fig. 4.2 User trajectory for Flodded

361 UTC on March 11 and 19:47 UTC on March 12. Flodded made several edits per  
362 hour presumably precluding the ability to sleep during this time frame. After a 7-h  
363 break, he embarked on another 24-h editing marathon stretching from 3:34 UTC on  
364 March 13 to 2:47 UTC on March 14 in which he made several changes per hour.

365 Returning to his editor trajectory, several structural features merit discussion.  
366 First, the graph is comparatively small, having only 149 nodes and 285 edges, but  
367 very dense (1.27e-2). The halo of light red points around the central “earthquake and  
368 tsunami” article represents the talk pages of other users Flodded communicated with  
369 about the article, warning them to stop reverting his changes or providing boilerplate  
370 welcome messages to new users cautioning them about the norms of editing on  
371 Wikipedia. This halo structure of pendants with reciprocated ties to the core article  
372 reveals that Flodded would be working on the earthquake and tsunami article, go  
373 to these users’ talk pages to warn them, and then return immediately to editing the  
374 central article again. Several articles are also present in this halo such as articles with  
375 alternative titles for the event (“2011 Sendai earthquake”, “Japanese earthquake and  
376 tsunami”, “2011 Tohoku earthquake”) that each redirect to the main article. The  
377 strong tie between the main article and the light blue dot reflects that a substantial  
378 amount of his total activity involved shuttling between the main namespace article  
379 and the article’s talk page in rapid succession, 107 transitions in total with a median  
380 edit lag of 4 min and 7 s. Flodded was also involved in a variety of administrative  
381 processes related to requesting page protection as well as filing reports related to  
382 user misbehavior which are the peripheral green nodes near the central node.

383 Flodded’s intense editing sessions became shorter and more infrequent and he  
384 began to shift attention to editing the casualty templates on March 16. As previously  
385 discussed, this is highly specialized and technical work involving knowledge of how  
386 to identify and locate templates, format them appropriately so they appear correctly  
387 in the rendered pages, and update the information contained within them on a regular  
388 basis. As the Japanese authorities released information about casualty numbers at  
389 the beginning and end of each day, Flodded would take these reports and update the  
390 numbers in the corresponding templates. Despite these contributions to the casualty  
391 templates, Flodded remained involved in many other aspects of the article, a “jack of  
392 all trades” involved in many discussion threads, communicating with users on their  
393 talk pages, performing copyediting, updating information on related articles such as  
394 “Lists of earthquakes by magnitude”, and participating in administrative discussions.  
395 His final edits on the topic were on March 23, and apart from 3 revisions to the Libyan  
396 civil war on April 3, Flodded has not made a single contribution since then.

397 Flodded fulfills an interesting role as an editor demonstrating a latent interest  
398 in not only editing articles about current events throughout his history but also un-  
399 usually dedicated by contributing for 48 h in a 55-h period of time and making a  
400 substantial number of edits in the successive weeks. Although his edits were highly  
401 concentrated, he nevertheless played a crucial coordinating role discussing a variety  
402 of topics with editors on the talk and their user pages. Despite the apparent lack  
403 of an editing history which would qualify him for this type of work, Flodded flu-  
404 ently engaged in a variety of tasks, demonstrating knowledge of Wikipedia policies  
405 justifying his editing decisions when challenged by other editors, participating in



**Fig. 4.3** User trajectory for L.Tak

406 arcane bureaucratic proceedings about protecting pages and notifying administra-  
 407 tors of trouble, and actively developing and modifying highly specialized templates  
 408 about casualty numbers.

409 ***L.Tak***

410 User L.Tak was the second most prolific editor in the corpus, the most active editor of  
 411 the “Fukushima Daiichi Nuclear Power Plant”, and the second most active editor of  
 412 the “nuclear disaster” article with 211 edits (after User Sandpiper’s 281 edits). L.Tak’s  
 413 editor trajectory is plotted in Fig. 4.3. This trajectory reveals several significant  
 414 differences from Flodded’s structure that in turn have implications for understanding  
 415 the role ecology of users responding to breaking news articles. First, it is clear

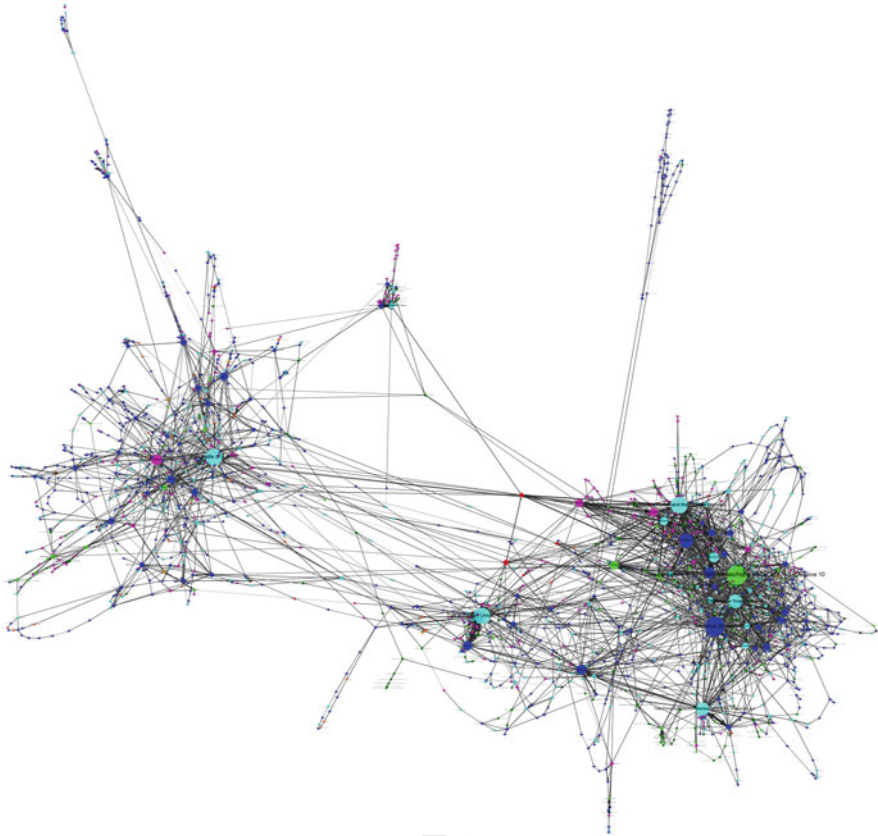
416 that L.Tak has a substantially deeper and more varied editing history than Flodded,  
417 making 9907 revisions since making his first contributions in late October 2007  
418 and then beginning to contribute regularly in May 2009 on the article “European  
419 Parliament election, 2009”. 63.9 % of L.Tak’s contributions are in the “Main” article  
420 namespace, 14.5 % in the “User talk” namespace, and 11.0 % in the “Talk” namespace  
421 for article discussions. With 3206 unique pages edited and 6105 unique edges, L.Tak  
422 has a substantially larger but also less dense ( $5.93e-4$ ) trajectory than Flodded.

423 While Flodded had a predilection for contributing to articles about events in the  
424 news, L.Tak’s extensive editing history is more complex. The most central article is  
425 his own talk page which suggests much of his activity involves responding to other  
426 editors’ queries and concerns. The history of this talk page suggests a problematic  
427 debut and struggle with the learning curve of Wikipedia norms and rules initially but  
428 more recently becoming a backchannel with other editors soliciting his opinion and  
429 asking for elaboration on actions performed elsewhere. Other central articles in his  
430 trajectory concern international trade, visa, and labor agreements as well as environ-  
431 mental organizations. L.Tak’s intense involvement in and extensive contributions to  
432 the “nuclear disaster” article motivating this analysis is, incidentally, very peripheral  
433 in his trajectory residing in the dense outlying subgraph at approximately 1 o’clock.  
434 The articles preceding his involvement in the nuclear disaster article are a variety of  
435 copyediting tasks and linking to other concepts on a variety of outwardly mundane  
436 topics like provincial and colonial governance in the Netherlands and the articles  
437 following his involvement are about the foreign relations of European countries and  
438 nuclear treaties. This trajectory suggests a passing interest in the social and cultural  
439 history about nuclear technologies and the environmental movement, information  
440 that became relevant in the aftermath of the tsunami-induced nuclear disasters.

441 The work L.tak performed was initially focused on the “nuclear plant” article  
442 copyediting to ensure the consistency of times and timezones, removing alarmist  
443 predictions, and plagiarized material. While L.tak did not have the marathon 24 h  
444 editing sessions of Flodded, he nevertheless made regular contributions over 6-, 8-,  
445 and even 14-h periods of time between March 11 and 15, with contributions slowing  
446 thereafter. L.Tak also fulfilled an essential coordinator role, with his contributions  
447 shuttling between the article page, discussion page, and user talk pages. The con-  
448 tributions L.Tak made during this time largely involved copyediting and removing  
449 duplicate information as well as adding information about the timeline of events and  
450 reliable sources.

## 451 *Sandpiper*

452 User Sandpiper was the sixth most active editor in the corpus and the most active  
453 editor of the “nuclear disaster” article and his user trajectory is plotted in Fig. 4.4.  
454 Sandpiper made 9240 revisions since starting June 2005, editing articles about Sussex  
455 and Harry Potter. Like L.Tak, his editing trajectory is also substantially more complex  
456 than Flodded but Sandpiper’s trajectory also has distinct subgraphs corresponding



**Fig. 4.4** User trajectory for Sandpiper

457 to distinct phases of his editing history. Dalliances with unrelated topics are also  
 458 apparent with a burst of editing relating to articles about English radio transmitting  
 459 station towers, “Cutty Sark”, and a large amount of activity on the 1916 “Battle  
 460 of Jutland”. Like L.Tak, Sandpiper’s participation in the “nuclear disaster” is not  
 461 embedded within a larger subgraph of breaking news events, but a tangent from his  
 462 typical edits. This trajectory is emblematic of an editor who focuses on a particular  
 463 topic and works extensively on a variety of articles within it but then moves on to an  
 464 entirely new topic. The diversity of the colors also reflects a diversity of activity in  
 465 making changes to articles, participating in discussions, and talking to other users.  
 466 This user is a generalist who specializes in both time and topic, unlike L.Tak who is  
 467 a generalist, who also edits a diverse set of articles but returns back to earlier articles  
 468 throughout.

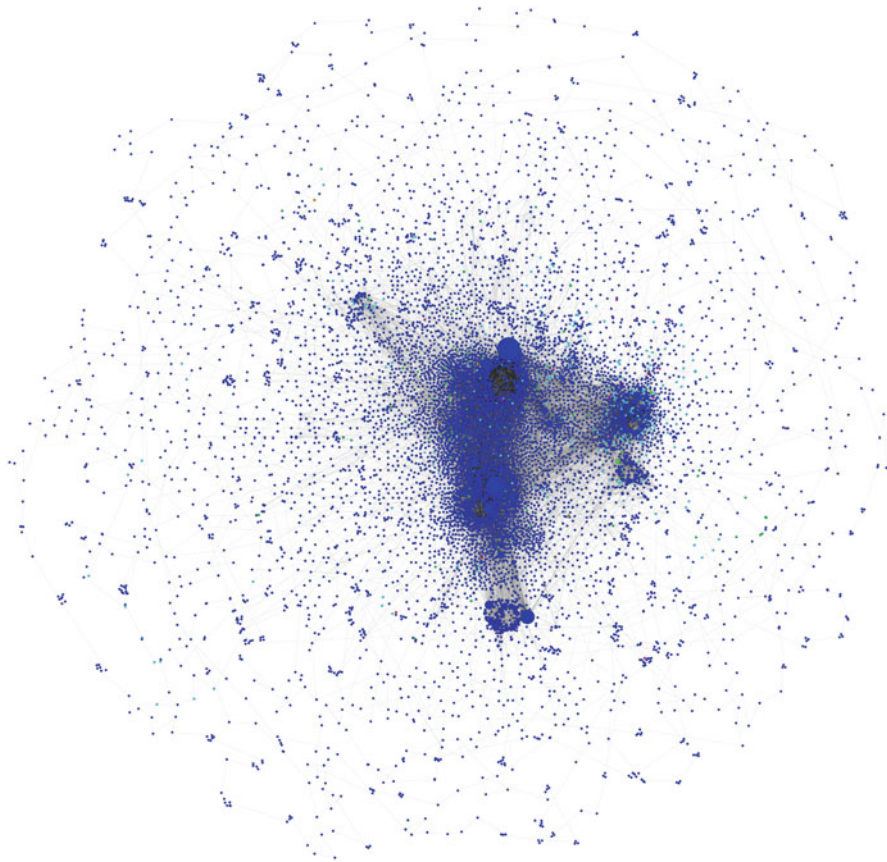


Fig. 4.5 User trajectory for ACSE

469 ***ACSE***

470 User ACSE's trajectory is plotted in Fig. 4.5. His 41,778 revision editing history  
471 focused predominately on a strange pair of topics, Japanese pop, and Japanese serial  
472 killers. But ACSE was also the editor who contributed to 34 articles in the Tohoku cor-  
473 pus, updating information on many of the preexisting articles about towns, villages,  
474 and other points of interest that had been affected by the tsunami as well as editing  
475 the "earthquake and tsunami" and "nuclear disaster" articles extensively. This lack  
476 of embeddedness in a larger context of current events editing occurs in many other  
477 editor trajectories as well. Although he is not a regular editor of breaking news arti-  
478 cles, this editing trajectory reveals a specific and important types of expertise about  
479 Japanese culture and geography. The preponderance of blue in this graph reflects the  
480 fact that ACSE engages minimally with discussions on article discussions or user talk



481 pages—his contributions are almost exclusively audience-facing. This may reflect  
482 preferences to eschew these discussions and move on to other topics or could also  
483 reflect the inherent credibility of his edits. The fact he edits article namespaces almost  
484 exclusively suggests his contributions may have high levels of credibility because  
485 few editors are reverting him or attempting to draw him into discussions.

## 486 Discussion

487 A characteristic feature of breaking news article collaborations is shifting attention  
488 across articles as collective effort initially focused on a central article (e.g., the  
489 earthquake and tsunami article) but then diffused to other articles and recentralized  
490 again on another related breaking event (the nuclear disasters) (Keegan et al. 2011a).  
491 Despite the opportunity for a single editor to make substantial contributions to each  
492 of the articles about parallel breaking news events, the most prolific editors on many  
493 articles like the nuclear disasters had negligible activity on others like the earthquake  
494 and tsunami. Examining the user trajectories of several top contributors suggests  
495 that prolific editors' investments in breaking news articles are at once novel but also  
496 reflect a latent interest or expertise in the topic. Editors of the articles about the  
497 nuclear disasters are drawn not from a cohort of editors dedicated to editing breaking  
498 news events, but rather editors like L.Tak with a background in international trade or  
499 ACSE's familiarity with Japanese pop culture. These editors' backgrounds conferred  
500 the collaborative competence, editing skills, and norm familiarity to extend and  
501 expand their repertoire of practices and routines necessary to manage a complex  
502 collaboration even if they had limited or no prior experience working on breaking  
503 news articles. This suggests that the capacity to engage in the intense coordination  
504 demanded on these articles can be acquired and learned in situ rather than developed  
505 from peripheral participation on prior breaking news articles or reliance on other  
506 editors with whom they have previously collaborated.

507 Wikipedia's collaborations on articles about current and breaking news events  
508 bring together a unique cast of characters with disparate backgrounds who fulfill  
509 distinct roles in these collaborations. This analysis suggests that breaking news article  
510 collaborations rely to a great extent on interactionist roles of motivated editors  
511 self-selecting into these articles rather than structural roles such as news editors  
512 wholly dedicated to editing breaking news articles. While editors exhibited considerable  
513 variability in the structure of their editing trajectories reflecting their diverse  
514 backgrounds, trajectories within breaking articles follow regular structural patterns  
515 reflecting the presence of a highly centralized coordinators and substantial churn in  
516 contributor cohorts. Across breaking articles, these central coordinators appear to be  
517 unique as well as otherwise inexperienced breaking news collaborators. This complicates  
518 attempts to frame these collaborations as communities of practice because  
519 they lack the deference to tenure and peripheral participation and instead appear to  
520 embody the improvisation and adaptation found in other high tempo and emergent  
521 response groups. The social roles that emerged on these breaking articles reflect more

522 of the interactionist dimension of disaster response teams rather than the regeneration  
523 of collaborative infrastructures found in ER teams.

524 These findings have theoretical implications for understanding the origins and  
525 transformation of social roles and structures. As other authors have noted, roles in  
526 Wikipedia are highly informal but these breaking news articles appear especially flex-  
527 ible given the variance in participants' backgrounds. Breaking news articles about  
528 major news events will inevitably attract a large number of editors making only pass-  
529 ing contributions. The responsibility for synthesizing, copyediting, and integrating  
530 these contributions fall to everyone in an open peer-production system, yet editors  
531 with some contextual background but wholly lacking the experience of working on  
532 other high tempo articles nevertheless appear to thrive and invest themselves heavily.  
533 As Bechky (2006) found in her study of role adoption, roles are not a consequent  
534 of position in a structure but resources that are claimed, negotiated, and enacted.  
535 Editors do not operate in a vacuum but continually encounter collaborations in the  
536 midst of their unfolding development complete with dependencies on synthesizing  
537 content across articles, copyediting new content, and explicitly coordinating efforts  
538 with other editors working in parallel. These overlapping dependencies constitute a  
539 dynamic environment of opportunities and resources which results in an ecology of  
540 roles which editors adopt and negotiate in response to others' actions as well as their  
541 own background.

#### 542 *Future Research Agenda*

543 The cases above are illustrative of the types of analyses that can be conducted by con-  
544 densing large and complex event log data into sociotechnical trajectories. Given the  
545 fluidity with which editors inhabit and shed roles in breaking news article collabora-  
546 tions, further analysis and methodological development is needed. In particular, the  
547 method for extracting and interpreting users' sociotechnical trajectories outlined here  
548 can be expanded into a larger research agenda to examine how users' trajectories in-  
549 teract with each other and overlap. The trajectory analogy can be extended in several  
550 ways to reveal temporal patterns ("velocity"), pervasive forces ("fields"), recurring  
551 patterns of actions ("orbits"), and actions preceding abrupt changes ("collisions")  
552 within sociotechnical systems:

553 **Velocity** The edges which link the nodes in artifact and user trajectories reflect the  
554 time elapsed or the delay between actions. Because some actions occur in quick  
555 succession (e.g., an antivandal bot reverting changes made by a troll) while other  
556 actions are prolonged (e.g., months passing between a editor's edits), these temporal  
557 lags can be called "velocities" to reflect the rapidity with which a user or artifact  
558 moved from one state to another. The distribution of velocities within a user suggests  
559 the intensity of work that he or she engages in. The history of contributing to one  
560 domain takes a leave of absence and then begins contributing to another. These low  
561 velocity transitions can be potentially highlighted as transitions or discounted as  
562 boundaries.

563 **Collisions** Mapping the trajectories of multiple users together provides an oppor-  
564 tunity to analyze a trajectory's "field." Again borrowing from classical mechanics,  
565 collisions occur when two trajectories intersect. If two editors edit the same article,  
566 their respective trajectories will collide at that article (albeit at different positions  
567 along their own trajectories) and these editors may exhibit similar behavior there-  
568 after, such as continuing to edit similar articles. If two articles are edited by the  
569 same editor, again these articles' trajectories will intersect. The position of this col-  
570 lision in each article trajectory might reveal whether the editor has a tendency to  
571 work on articles at certain stages of their development. The number of collisions be-  
572 tween different users' trajectories may reveal shared latent interests or even emergent  
573 communities of practice.

574 **Orbit** Highly regular or periodic action sequences observed across many user tra-  
575 jectories are "orbits." An orbit might be a sequence of articles which always have  
576 a tendency to be edited in succession. For example, a user responding to a vandal  
577 would first revert the damage to the article itself, warn the user on his talk page, and  
578 finally notify administrators on a notice board to take action against the vandal. These  
579 types of orbits capture organizational routines, many of which have been automated  
580 within Wikipedia (Geiger and Ribes 2010).

581 Researchers can employ the sociotechnical trajectories of users to not only understand  
582 social roles as I did here but also to examine organizational routines that generate  
583 credibility, behavioral patterns that lead to more reliable user-generated content,  
584 and emergence of leadership within self-organizing systems. Trajectories were only  
585 computed for four out of the hundreds of users who contributed to these articles, but  
586 trajectories could also be computed and compared across all these editors as well to  
587 look for similarities in their behavioral patterns.

588 This type of comparative analysis could begin to unpack whether particular types  
589 of sequences or structures are associated with editors becoming socialized into the  
590 community and learning to making valuable and high-quality contributions. Take  
591 for example an editor who wants to add new information across many articles. This  
592 editor could make the changes herself, editing each article individually and creating  
593 a "chain" within her sociotechnical trajectory. But these changes may also lack con-  
594 sensus within the community and lead to them being reverted and her then having to  
595 make appeals on discussion boards *afterwards* for others to adopt the changes. This  
596 would manifest as a high number of "collisions" with other editors across articles.  
597 Alternatively, we might imagine her canvassing editors and discussion boards ahead  
598 of time to develop consensus, creating a dense web of connections in her trajec-  
599 tory rather than a chain as she diplomatically shuttles between them. This pattern  
600 of collaboration might lead to higher quality edits that are more accepted by the  
601 community or may mobilize other editors to make the changes themselves. This  
602 thought experiment thus also documents behavioral patterns that lead to more reli-  
603 able user-generated content and the emergence of a leader within a self-organized  
604 system.

605 Researchers also might employ user trajectories to understand the dispositions and  
606 evolution of behavioral patterns that predict being elected to administrative roles.

607 Wikipedia administrators, for example, are granted a variety of tools that allow  
608 them to delete pages, ban editors, or protect articles from being edited after passing  
609 through an intensive screening process. Comparing the trajectories of these editors  
610 may reveal similarities in their behavior as they migrate toward particular editing  
611 patterns around antivandalism efforts or new content monitoring. For example, be-  
612 havioral regularities in reporting vandalism might involve reverting changes on the  
613 vandalised page, warning the responsible user on her talk page, and the notifying  
614 other users on administrative notice boards that would lead to characteristic cycles in  
615 a user's trajectory of moving from articles to user talk pages to administrative boards  
616 repeatedly. Users' trajectories that are characterized by high levels of cyclicity and  
617 reciprocity (consider again the example in Fig. 4.1) demonstrate higher levels of re-  
618 peat engagement and monitoring of articles. Thus the user's trajectory capturing the  
619 "velocity" of edits and number of "orbits" can serve as a proxy for her commitment  
620 and may forecast her effectiveness as a potential administrator.

621 The sociotechnical trajectory method outlined here opens up new domains for in-  
622 quiry into latent relationships that have been heretofore ignored in previous network  
623 analyses of Wikipedia. More than graphs of who edited what, these trajectories can  
624 be read as a narrative of editors inhabiting, discarding, and sampling different social  
625 identities over their history. But more than inhabiting a particular social role, the  
626 differences between trajectories may also reveal the extent to which authors product  
627 valuable content that does not require them to litigate it in other forums and fore-  
628 cast their leadership and influence as they actively move between domains within  
629 the system. Thus, sociotechnical trajectories allow the researcher to mix quantita-  
630 tive metrics for sampling or deductive inference with qualitative interpretations for  
631 contextualization and inductive inference, making them superlative tools for mixed  
632 methods research.

## 633 Conclusion

634 Wikipedia's coverage of breaking news events challenges traditional theoretical con-  
635 ceptions of organizational behavior and social roles. Despite being a radically open  
636 platform for participation that attracts hundreds of editors with mixed motives and  
637 expertise, the resulting articles are nevertheless exemplars of timeliness, depth, and  
638 style. Drawing on theories of both social roles in online communities as well as  
639 high-tempo organizing, this analysis examined whether the most active editors of  
640 articles related to a breaking news event performed social roles characterized by a  
641 regeneration of prior structural forms or improvisation of new interactional forms.  
642 Examination of several prominent editors' sociotechnical trajectories revealed that  
643 few possessed expertise specific to editing breaking news articles. However, these  
644 editors' histories revealed editors migrated very credible local reputations from  
645 other domains to these breaking articles. Editors improvised on their prior social  
646 roles as dispute mediators or experts in Japanese culture and emerged as cen-  
647 tral coordinators—sometimes even leaders—in the efforts to coordinate work on

648 breaking news articles. These findings suggest that rather than demanding explicit  
649 credentials to engage in some types of knowledge work or occupy certain social roles,  
650 editors focus on the task and trust each other to leverage their existing competencies  
651 or adapt to the needs at hand.

652 **Acknowledgements** I want to thank Darren Gergle, Noshir Contractor, and Daniel Gruber for  
653 feedback on earlier versions of this chapter.

## 654 References

- 655 Bakker, R. M. (2010). Taking stock of temporary organizational forms: A systematic review and  
656 research agenda. *International Journal of Management Reviews*, 12(4), 466–486.
- 657 Bao, P., Hecht, B., Carton, S., Quaderi, M., Horn, M., & Gergle, D. (2012). Omnipedia: bridg-  
658 ing the Wikipedia language gap. Proceedings of the 2012 ACM annual conference on human  
659 factors in computing systems, pp. 1075–1084. New York: ACM. <http://doi.acm.org/10.1145/2208516.2208553>. doi:10.1145/2208516.2208553.
- 661 Bechky, B. A. (2006). Gaffers, gofers, and grips: Role-based coordination in temporary  
662 organizations. *Organization Science*, 17(1), 3–21.
- 663 Bechky, B. A., & Okhuysen, G. A. (2011). Expecting the unexpected? How swat officers and film  
664 crews handle surprises. *Academy of Management Journal*, 54(2), 239–261.
- 665 Berkowitz, D. (1992). Non-routine news and newswork: Exploring a what-a-story. *Journal of*  
666 *Communication*, 42(1), 82–94.
- 667 Biddle, B. J. (1986). Recent development in role theory. *Annual review of sociology*, 12, 67–92.
- 668 Brandes, U., Kenis, P., Lerner, J., & van Raaij, D. (2009). *Network analysis of collabo-*  
669 *ration structure in Wikipedia*. Proceedings of the 18th international conference on World  
670 wide web, pp. 731–740. New York: ACM. <http://doi.acm.org/10.1145/1526709.1526808>.  
671 doi:10.1145/1526709.1526808.
- 672 Buriol, L. S., Castillo, C., Donato, D., Leonardi, S., & Millozzi, S. (2006). Temporal analysis of  
673 the Wikigraph. IEEE/WIC/ACM international conference on web intelligence, pp. 45–51.
- 674 Callero, P. L. (1994). From role-playing to role-using: Understanding role as resource. *Social*  
675 *Psychology Quarterly*, 57, 228–243.
- 676 Capocci, A., Servedio, V. D. P., Colaiori, F., Buriol, L. S., Donato, D., Leonardi, S., & Caldarelli,  
677 G. (2006). Preferential attachment in the growth of social networks: The internet encyclopedia  
678 Wikipedia. *Physical Review E*, 74(3), 036116.
- 679 Faraj, S., & Xiao, Y. (2006). Coordination in fast-response organizations. *Management science*,  
680 52(8), 1155–1169.
- 681 Gaved, M., Heath, T., & Eisenstadt, M. (2006). Wikis of locality: Insights from the open guides.  
682 Proceedings of the 2006 international symposium on Wikis, pp. 119–126. New York: ACM.  
683 <http://doi.acm.org/10.1145/1149453.1149475>. doi:10.1145/1149453.1149475.
- 684 Geiger, R. S., & Ribes, D. (2010). The work of sustaining order in Wikipedia: The banning  
685 of a vandal. Proceedings of the 2010 ACM conference on computer supported cooperative  
686 work, pp. 117–126. New York: ACM. <http://doi.acm.org/10.1145/1718918.1718941>.  
687 doi:10.1145/1718918.1718941.
- 688 Gleave, E., Welsler, H. T., Lento, T. M., & Smith, M. A. (2009). *A conceptual and operational*  
689 *definition of 'social role' in online community*. System Sciences, 2009. HICSS'09 42nd Hawaii  
690 international conference on, pp. 1–11.
- 691 Hecht, B., & Gergle, D. (2010). The tower of babel meets web 2.0: User-generated  
692 content and its applications in a multilingual context. Proceedings of the SIGCHI confer-  
693 ence on human factors in computing systems, pp. 291–300. New York: ACM.  
694 <http://doi.acm.org/10.1145/1753326.1753370>. doi:10.1145/1753326.1753370.

- 695 Hu, M., Lim, E.-P., Sun, A., Lauw, H. W., & Vuong, B.-Q. (2007). Measuring article quality in  
696 Wikipedia: Models and evaluation. Proceedings of the sixteenth ACM conference on informa-  
697 tion and knowledge management, pp. 243–252. New York: ACM. [http://doi.acm.org/10.1145/](http://doi.acm.org/10.1145/1321440.1321476)  
698 [1321440.1321476](http://doi.acm.org/10.1145/1321440.1321476). doi:10.1145/1321440.1321476.
- 699 Iba, T., Nemoto, K., Peters, B., & Gloor, P. A. (2010). Analyzing the creative editing behavior of  
700 Wikipedia editors: Through dynamic social network analysis. *Procedia-Social and Behavioral*  
701 *Sciences*, 2(4), 6441–6456.
- 702 Jesus, R., Schwartz, M., & Lehmann, S. (2009). Bipartite networks of Wikipedia's articles and  
703 authors: A meso-level approach. Proceedings of the 5th international symposium on Wikis and  
704 open collaboration, p. 5.
- 705 Kamps, J., & Koolen, M. (2009). Is Wikipedia link structure different? Proceedings of the second  
706 ACM international conference on Web search and data mining, pp. 232–241. New York: ACM.  
707 <http://doi.acm.org/10.1145/1498759.1498831>. doi:10.1145/1498759.1498831.
- 708 Kane, G. C. (2009). It's a network, not an encyclopedia: A social network perspective on Wikipedia  
709 collaboration. *Academy of Management Proceedings*, 2009, 1–6.
- 710 Kane, G. C., Majchrzak, A., Johnson, J., & Chenisern, L. (2009). A longitudinal model of  
711 perspective making and perspective taking within fluid online collectives. ICIS, Phoenix, p. 10.
- 712 Keegan, B. C. (2013). A history of newswork on Wikipedia. Proceedings of the 9th international  
713 symposium on open collaboration, pp. 7:1–7:10. New York: ACM. [http://doi.acm.org/10.1145/](http://doi.acm.org/10.1145/2491055.2491062)  
714 [2491055.2491062](http://doi.acm.org/10.1145/2491055.2491062). doi:10.1145/2491055.2491062.
- 715 Keegan, B. C., Gergle, D., & Contractor, N. (2011a). Hot off the Wiki: Dynamics, practices,  
716 and structures in Wikipedia's coverage of the Tōhoku catastrophes. Proceedings of the 7th  
717 international symposium on Wikis and open collaboration, pp. 105–113. New York: ACM.  
718 <http://doi.acm.org/10.1145/2038558.2038577>. doi:10.1145/2038558.2038577.
- 719 Keegan, B. C., Gergle, D., & Contractor, N. (2011b). Hot off the Wiki: Dynamics, practices,  
720 and structures in Wikipedia's coverage of the tōhoku catastrophes. Proceedings of the 7th  
721 international symposium on Wikis and open collaboration, pp. 105–113. New York: ACM.  
722 <http://doi.acm.org/10.1145/2038558.2038577>. doi:10.1145/2038558.2038577.
- 723 Keegan, B. C., Gergle, D., & Contractor, N. (2012a). Do editors or articles drive collaboration?:  
724 Multilevel statistical network analysis of Wikipedia coauthorship. Proceedings of the ACM 2012  
725 conference on computer supported cooperative work, pp. 427–436.
- 726 Keegan, B. C., Gergle, D., & Contractor, N. (2012b). Staying in the loop: Structure and dynamics  
727 of Wikipedia's breaking news collaborations. Proceedings of the 8th international symposium  
728 on Wikis and open collaboration.
- 729 Keegan, B. C., Ceni, A., & Smith, M. A. (2013a). Analyzing multi-dimensional net-  
730 works within mediawikis. Proceedings of the 9th international symposium on open col-  
731 laboration, pp. 1:1–1:10. New York: ACM. <http://doi.acm.org/10.1145/2491055.2491056>.  
732 doi:10.1145/2491055.2491056.
- 733 Keegan, B. C., Gergle, D., & Contractor, N. (2013b). Hot off the Wiki structures and dynamics of  
734 Wikipedia's coverage of breaking news events. *American Behavioral Scientist*, 57(5), 595–622.
- 735 Kittur, A., & Kraut, R. E. (2008). Harnessing the wisdom of crowds in Wikipedia: Quality  
736 through coordination. Proceedings of the 2008 ACM conference on computer supported co-  
737 operative work, pp. 37–46. New York: ACM. <http://doi.acm.org/10.1145/1460563.1460572>.  
738 doi:10.1145/1460563.1460572.
- 739 Klein, K. J., Ziegert, J. C., Knight, A. P., & Xiao, Y. (2006). Dynamic delegation: Shared, hierarchi-  
740 cal, and deindividualized leadership in extreme action teams. *Administrative Science Quarterly*,  
741 51(4), 590–621.
- 742 Laniado, D., & Tasso, R. (2011). Co-authorship 2.0: Patterns of collaboration in Wikipedia. Pro-  
743 ceedings of the 22nd ACM conference on hypertext and hypermedia, pp. 201–210. New York:  
744 ACM. <http://doi.acm.org/10.1145/1995966.1995994>. doi:10.1145/1995966.1995994.
- 745 Laniado, D., Tasso, R., Volkovich, Y., & Kaltenbrunner, A. (2011). When the Wikipedians talk:  
746 Network and tree structure of Wikipedia discussion pages. ICWSM'11-Proceedings of the fifth  
747 international AAAI conference on weblogs and social media.

- 748 Leskovec, J., Huttenlocher, D., & Kleinberg, J. (2010). Signed networks in social media. Proceedings of the SIGCHI conference on human factors in computing systems, pp. 1361–1370. New  
749 York: ACM. <http://doi.acm.org/10.1145/1753326.1753532>. doi:10.1145/1753326.1753532.
- 750
- 751 Majchrzak, A., Jarvenpaa, S. L., & Hollingshead, A. B. (2007). Coordinating expertise among  
752 emergent groups responding to disasters. *Organization Science*, 18(1), 147–161.
- 753 Massa, P. (2011). Social networks of Wikipedia. Proceedings of the 22nd ACM conference on  
754 hypertext and hypermedia, pp. 221–230.
- 755 Meyerson, D., Weick, K. E., & Kramer, R. M. (1996). Swift trust and temporary groups. *Trust in*  
756 *organizations: Frontiers of theory and research*, 166, 195.
- 757 Quarantelli, E. L., & Dynes, R. R. (1977). Response to social crisis and disaster. *Annual review of*  
758 *sociology*, 3, 23–49.
- 759 Ransbotham, S., Kane, G. C., & Lurie, N. H. (2012). Network characteristics and the value of  
760 collaborative user-generated content. *Marketing Science*, 31(3), 387–405.
- 761 Ratcheva, V., & Simpson, M. (2011). Temporary organisations: Implications for knowledge work.  
762 Available at SSRN 1853546.
- 763 Scripps, J., Tan, P.-N., & Esfahanian, A.-H. (2009). Measuring the effects of preprocessing decisions  
764 and network forces in dynamic network analysis. Proceedings of the 15th ACM SIGKDD  
765 international conference on knowledge discovery and data mining, pp. 747–756. New York:  
766 ACM. <http://doi.acm.org/10.1145/1557019.1557102>. doi:10.1145/1557019.1557102.
- 767 Solnit, R. (2010). *A paradise built in hell: The extraordinary communities that arise in disaster*.  
768 New York: Penguin Books.
- 769 Turek, P., Wierzbicki, A., Nielek, R., Hupa, A., & Datta, A. (2010). Learning about the quality  
770 of teamwork from Wikiteams. Proceedings of the second international conference on social  
771 computing (SocialCom), pp. 17–24. doi:10.1109/SocialCom.2010.13.
- 772 Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations: Heedful interrelating on  
773 flight decks. *Administrative science quarterly*, 38, 357–381.
- 774 Welser, H. T., Gleave, E., Fisher, D., & Smith, M. (2007). Visualizing the signatures of social roles  
775 in online discussion groups. *Journal of social structure*, 8(2), 1–32.
- 776 Welser, H. T., Cosley, D., Kossinets, G., Lin, A., Dokshin, F., Gay, G., & Smith, M. (2011). Finding  
777 social roles in Wikipedia. Proceedings of the 2011 conference, pp. 122–129. New York: ACM.  
778 <http://doi.acm.org/10.1145/1940761.1940778>. doi:10.1145/1940761.1940778.
- 779 West, R., Precup, D., & Pineau, J. (2009). Completing Wikipedia's hyperlink structure through di-  
780 mensionality reduction. Proceedings of the 18th ACM conference on information and knowledge  
781 management, pp. 1097–1106. New York: ACM. <http://doi.acm.org/10.1145/1645953.1646093>.  
782 doi:10.1145/1645953.1646093.
- 783 Wilkinson, D. M., & Huberman, B. A. (2007). Cooperation and quality in Wikipedia. Proceed-  
784 ings of the 2007 international symposium on Wikis, pp. 157–164. New York: ACM.  
785 <http://doi.acm.org/10.1145/1296951.1296968>. doi:10.1145/1296951.1296968.
- 786 Yates, D., Wagner, C., & Majchrzak, A. (2010). Factors affecting shapers of organizational Wikis.  
787 *Journal of the American Society for Information Science and Technology*, 61(3), 543–554.