Value Tensions in OpenStreetMap: Openness, Membership, and Policy in Online Communities

AARJAV CHAUHAN, University of Toronto, Canada
DIPTO SARKAR, Carleton University, Canada
TANEEA S AGRAWAAL, University of Toronto, Canada
ROBERT SODEN, University of Toronto, Canada

The social life and long-term trajectories of online peer production communities are shaped and animated in part by value tensions that arise when distributed, heterogeneous participants are brought together into collaboration. This study of OpenStreetMap (OSM) draws upon values-based approaches to investigate how peer production communities enact their values and navigate tensions between them. We examine how conflicts within the community over the rise of corporate participation in OSM provided a stage for the articulation and enactment of community values, shedding light on the broader dynamics and trajectory of the platform and its participants. The contributions of this work include reflections on how increasing corporate participation in OSM intersects with discourses about the emancipatory potential of emerging mapping technologies, insights into the challenges of scaling membership in peer production communities, and exploring the role of values in understanding the social life and governance of online communities.

CCS Concepts: • **Human-centered computing** → **Empirical studies in collaborative and social computing**.

Additional Key Words and Phrases: Peer Production Communities, Crowdsourcing, Policy, OpenStreetMap, Values-based approaches in HCI

1 INTRODUCTION

OpenStreetMap (OSM) is the world's largest crowdsourced geographic information platform. It is free and open in that anyone with the proper tools, time, and skills may both contribute to it and access its underlying data. One of the reasons that OSM has garnered so much interest from scholars is that, historically, maps and cartography have been the domain of experts from government, military, and scientific entities [27]. To some, OSM has therefore offered the potential to support broader public participation in the construction of knowledge about the world [28]. In recent years, however, large technology companies such as Apple, Facebook, Microsoft, and Uber have begun to rely on OSM data for use in their tools [3]. In tandem, they have increasingly hired teams of paid contributors to add or edit OSM data. These changes, alongside other forms of

Authors' addresses: Aarjav Chauhan, University of Toronto, Toronto, Canada, aarjav.chauhan@mail.utoronto.ca; Dipto Sarkar, Carleton University, Ottawa, Canada, dipto.sarkar@carleton.ca; Taneea S Agrawaal, University of Toronto, Toronto, Canada, taneea.agrawaal@mail.utoronto.ca; Robert Soden, University of Toronto, Toronto, Canada, soden@cs.toronto.edu.

so-called "organized mapping", led to tense debates within the community and the creation of a policy – the Organized Editing Guidelines (OEG) – to govern how such mapping should occur. In this paper, we look at the values invoked by participants in debates over corporate mapping as a means of investigating the underlying values that guide OSM, the relationship between policy and community values in online peer production systems, and what these events may reveal about the democratizing potential of crowdsourced mapping.

OSM was founded in 2004 by software developers in the United Kingdom who were frustrated by the prohibitive costs and licensing associated with accessing data from the government [25]. Drawing inspiration from the open-source software movement, the early organizers created accessible tools for map editing, set up mailing lists and wikis to coordinate activities, and hosted local meetups as well as annual conferences [93]. OSM has steadily grown into a large and heterogeneous global community with diverse interests and motivations for participation [22, 30, 71]. Technology companies have been involved since the early days of the platform as key users and providers of data, sponsors of conferences, and sources of mapping expertise [3]. Since 2017, however, there has been an exponential rise in corporate contributions to the map itself, with some studies suggesting as much as 17% of global road network edits in 2020 were contributed by professional mappers [96]. This professionalization challenges earlier notions of OSM as a volunteer-driven community and has led to intense debates over the values, interests, and motivations of both corporate editors and non-corporate editors.

Human values invariably shape the design, maintenance, and use of online platforms. Recent research in HCI suggests that attending to such values can improve researchers' understanding of the social life and collaboration practices surrounding these technologies as well as help designers engage with them in a more intentional fashion [42, 59, 63, 70]. Approaches including Value Sensitive Design (VSD) highlight and help unpack the multiple ways in which values influence the design process [42]. Drawing on related work [59, 63], we position values as being collectively held, continually evolving, and intertwined with the policies of online peer production communities, thus relevant to design but also other vital moments in the life cycles of socio-technical systems. The enactment of values within a peer production community like OSM is therefore ongoing and requires continuous negotiation amongst the various involved stakeholders. Building on policy research in CSCW and social computing [62], this study looks to community policies as sites of examination for value-sensitive design research and practice and as a means for navigating value tensions in online communities. In doing so, we offer an in-depth example of how the collective values of the OSM community were revealed and articulated through the creation of and adherence to new policies developed in response to the rise of corporate editing.

In this research, we examined the values that surfaced through the response to the growth of corporate editing in OSM, and what they revealed about the social life, governance, and long-term trajectory of this large and complex online community. To do so, we conducted a study of conversations on the primary mailing lists used by the OSM community as it came to terms with and responded to the dramatic rise of corporate mapping. Using reflexive thematic analysis [18], we coded mailing list conversations concerning corporate editing, or the OEG, between 2013 and 2021 for the values invoked, either explicitly or implicitly, by discussion participants. In doing so, we interrogated the sorts of values expressed and enacted by an online peer production community in policy debates. Our study identified five values of the OSM community that were made visible in mailing list discussions over the rise of corporate editing and the creation of the OEG: 1. Local mapping; 2. Inclusivity; 3. Data quality; 4. Transparency; 5. Autonomy. We do not offer a final or comprehensive portrayal of the values of the OSM community writ large, something that, as noted by previous HCI literature on values [42] (p. 25–27), would neither be possible nor desirable. Instead, we look to these values and the particular ways in which they were expressed as a means

of understanding the dynamics and tensions surrounding the governance of the largest geospatial peer production community in the world.

Our study provides insights into the OSM community as well as wider concerns in CSCW related to online peer production communities, digital mapping, and the democratizing potential of internet technologies. First, we show how attention to values helps to unpack the conflicted relationship between corporate editing practices and other forms of mapping that co-exist on the platform. Next, we describe how tensions between core community values like autonomy and transparency that promote self-directedness, openness, and freedom of social activities within an open collaboration project surfaced through the proposal and implementation of the OEG. In particular, the thorny question of what constitutes membership in OSM emerged as a focal point for these tensions, something which the OEG sought to clarify. While the success or failure in mitigating these tensions will have far-reaching implications for the future direction of the platform, this research offers a valuable case study for CSCW research into how policies interact with values in the governance of peer production communities.

2 LITERATURE REVIEW

2.1 Heterogeneity and Debate within the OpenStreetMap Community

As an online peer production community, OSM is produced by a wide range of participants and subcommunities of mappers with varying interests, motivations, and contribution practices [21, 22]. One study found that some of the most common motivations of participants were having a strong OSM community, making map data freely available, and accurately representing local knowledge [22]. Other research has categorized OSM mappers by factors such as their contributions, degree of involvement, or quality of data uploaded within OSM. In addition to individual members, the OSM community includes a number of groups that facilitate organized activities such as small-scale local mapping parties, mapathons, humanitarian mapping through the Humanitarian OpenStreetMap Team (HOT), government mapping projects, and coordinated efforts by for-profit organizations [3, 66, 93]. These variance in motivations to map, mapping skills of the members, and ties to groups and organizations create a diverse landscape within OSM that yields both conflicts and negotiations over what is to be mapped, how mapping should take place, and how map data should be represented [7]. Despite such heterogeneity, OSM has also faced challenges resulting from a lack of social diversity and representation with regard to gender, race, and national origin [14, 24, 107].

It follows that OSM, like all maps, is not an objective representation of what is 'on the ground', but as it is produced by tens of thousands of contributors, its subjective character is further magnified. Crowdsourced mapping is the widespread voluntary engagement of large numbers of participants in the creation of geographic information [55]. This results in the map being an amalgamation of varying political, cultural, and economic choices created through the activities made by its participants [71]. Previous studies have sought to understand biases in OSM that result from different factors such as political boundaries, gender representation and urban/rural disparities [14, 24, 30, 107] and the delegitimization of other forms of geographic knowledge due to OSM's inheritance of traditional views of what counts as spatial data [98]. For example, mapping of the deeply contested region of Israel and Palestine within OSM reveals a one-sided story weighted towards Israel's claims over the area [14, 24]. Other studies have highlighted gender bias on OSM as a result of data created predominantly by men, with low female participation leading to a 'male view of the landscape' [30, 107]. These studies illustrate OSM's position as a meeting place amongst a plethora of ideals, beliefs, and motivations through its members and social contexts.

As a means of engaging with the research challenges created by this heterogeneity, some research has sought to characterize OSM as a boundary object [71]. Boundary objects are defined as being

both 'plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites' [105]. They are vital tools in developing and maintaining collaboration across intersecting social worlds. Peer production communities, when viewed through the lens of boundary objects, rely on standards, tools, and processes of both formal authority and decentralized self-governance to bridge varying motivations and interests within the community [22, 80]. Previous studies have examined how OSM behaves as a boundary object by engaging and mobilizing actors and groups from different social worlds [71, 101]. For example, Lin argued that the production of map data within OSM is accomplished through the involvement of actors and the negotiations between four primary social worlds: 1. business; 2. government; 3. NGO/Third Sector; 4. less organized communities (including individuals) [71]. The mapping practices of the OSM community are a result of the 'co-fabrication of cartographies by human and non-human assemblages, from entanglements of codes and digital spaces to heated arguments via electronic mailing lists' [52]. As we will examine, recent debates over the role of corporate influence in the OSM community provide a stage for the enactment of conflicts that arise when participants from different social worlds collaborate and co-produce.

2.2   Conflicts in Online Peer Production Communities

Studies of online peer production and Free and/or Open-Source Software (F/OSS) communities have shown that conflicts are important and that they affect the motivations and quality of work of participants [4, 5, 36]. Wikipedia, one of the most popular peer production communities, has been the subject of multiple studies about conflicts, edit wars, and tensions within the community, calling attention to the diverse composition of participants and identifying solutions to best harness the knowledge and energy of the diverse contributors [4, 5, 67]. Though the diversity of both opinions and knowledge is important to the success of an open collaborative system such as Wikipedia and OSM, researchers have argued that understanding the sources of conflict as well as implementing effective conflict management mechanisms are crucial in achieving the potential of this diversity [5, 6, 36]. These systems, acting as boundary objects, face the challenge of facilitating collaboration across different social worlds; they provide spaces both for creativity and agonistic collaborations [92, 109]. Design scholars have identified the potential benefits of enabling productive conflict through stakeholder diversity. Design approaches through dialectics [40], agonism [15], and adversarial design [32] have attempted to draw out ways of facilitating *rough consensus* between stakeholders with competing interests. Within peer production and F/OSS communities, stakeholders manage conflict resolution through behavioral norms, guidelines, open participation, and moderation to maintain information quality and productive collaboration amongst stakeholders [4, 5, 26, 67].

Our research examines how OSM enacts and articulates community values through the participation of different stakeholder groups. Digital commons-based peer production communities such as OSM can be viewed as socio-economic systems that are characterized by collaboration amongst large groups of individuals in an attempt to provide information, knowledge, or cultural goods without relying on either the market or organizational hierarchies to coordinate their common enterprise [12]. Heterogeneity of participant backgrounds is a core feature of these systems, challenging the prevailing narrative of seamless flow of global capital, command of commodity supply chains, and increased control and discipline of labor [81]. So, while proprietary platforms generate value through market growth and centrally held capital, digital commons systems co-create and manage resources available to those connected to the network [11]. These different conceptions of value create a possible conflict wherein peer-based communities wanting to ensure creative autonomy for their members as well as the sustainability of the commons may be at odds with corporate entities engaged in more extractive relationships to the commons [81]. It is therefore

important to examine motivations to participate beyond monetary incentives to factors such as self-efficacy, community building, and social use value [78] when assessing emerging forms of corporate engagements within open-source or commons-based projects [51, 54].

The involvement of corporate organizations with F/OSS communities has been studied within HCI and adjacent fields. An increasing number of corporations, noting the success of F/OSS projects, have steadily incorporated F/OSS models of development, practices, and projects [37, 53]. Corporate engagement within OSS projects has been described as corporate-communalism, a combination of the profit-laden values of corporations with the communal aspects of structures commonly found within open-source projects [53, 54]. This rise of corporate-communal engagements has resulted in the blurring and shifting of identities of contributors between serving corporate and communal interests [53]. Studies have also explored the potential impacts of F/OSS ideologies on corporate employees who have been tasked to work on F/OSS projects [29]. Ågerfalk and Fitzgerald notably introduced the term *opensourcing*, a rising trend wherein corporations and OSS community members collaborate towards corporate projects [1]. In this argument, OSS culture and practice have changed from early emphasis on free software to contemporary priorities around 'mainstream and commercially viable forms'. Writing in 2006, Fitzgerald further predicted that emerging forms of corporate participation in OSS culture would inevitably create new tensions between community values [37], which is what this paper investigates.

2.3 Values-based Approaches in HCI

Discussions related to the integration of values into technology design were present as early as the participatory design research in the 1980s. Efforts to democratize the design process towards worker rights were inherently a value-laden undertaking [35]. As such, participatory means of designing technologies were stated to be intricately tied to and made explicit human values [108]. In the 1990s, the HCI community expanded its study of the role that human values play in the design and maintenance of technologies and their surrounding social practices. Initial investigations into human values explored the forms of biases that emerged during the design, development, and use of technologies [45]. Research at the intersection of moral agency and design from this period sought to understand and promote ideals of responsible computing and computing for the social 'good' [44, 45]. Over time, multiple strands of theoretical and methodological approaches and frameworks that explored values in design emerged within HCI such as embodying values in design [38], reflective design [97], speculative design [34, 48], and ludic design [49]. A collection of work published by Friedman, Kahn, and Borning drew explicit attention to the role of values in design and was framed as *value-sensitive design* [43].

The VSD framework emerged as a systematic methodology in the late 1990s to divert the attention of designers towards values in the design of technologies [41]. VSD has been used to understand what values are and how they interact with each other by incorporating a tripartite methodology of conceptual, empirical, and technical investigations [42]. The framework examines how 'existing technological properties and their underlying mechanisms support or hinder human values' through empirical investigations into the context lying at the intersection of human values and technical artifacts. It places importance on both social and technical aspects in an integrated analysis, creating a flexible framework that encapsulates values into the entire design process of socio-technical systems. Prior research using VSD, relevant to our study, has explored motivations of participants in Wikipedia [69], identified values through co-design for cooperative communities [8], differentiated ethical values between direct and indirect stakeholders in OSM [64], and examined values tensions between Wikipedia stakeholders over the use of machine learning algorithms [100]. Our study thus extends prior work at the intersection of values-based approaches in HCI and peer production

communities to help make debates in online communities over their long-term evolution more tractable to researchers investigating large-scale collaboration.

Recent contributions to HCI's understanding of values have questioned the ways that designers conceive of the relations between values, technology, and design practice. These approaches critiqued VSD for presenting overly individualistic, static, Western-biased, and universalized understandings of values [59, 70]. They argued for critical reflection on the agency of designers when engaging with evolving socio-technical contexts where the meanings of values change and adapt [33, 63]. JafariNaimi et al. [63] note that historical emphasis on the *identification* and *application* of values within design situations has led to the treatment of values as formulaic entities that are removed from the design process in an attempt to 'yield proper courses of action'. For example, in delimiting 12 'values of ethical import', VSD may undermine other values and tensions within those values which may be discovered through more processual, inductive, or interpretive approaches [59, 70]. In addition, critics have argued that VSD's *identify* and *apply* logic bifurcates 'the work of understanding a value and the work of applying a value to design', ignoring the ongoing *stories* where values enact, retire, and endure [63]. Instead, they argue that recognizing values serve as *hypotheses* i.e., 'they aid in examining particular situations, possible courses of action, and how they might transform the situation'. Such a perspective of values, as per JafariNaimi et al., allows for designers to more responsibly engage with complex, problematic, or changing situations.

Tensions inevitably arise between and within values, but when reasonably balanced, they 'work together to hold each respective value in place' [42]. Socio-technical systems, particularly online peer production communities such as OSM, include diverse stakeholders with their own contextualized set of motivations and values. HCI research on values has argued that value conflicts are a necessary and vital aspect of the design process that emerge during collaborations with stakeholders [61]. VSD literature also emphasizes the importance of recognizing direct and indirect stakeholders in the design process, as differences amongst stakeholder groups can lead to tensions within values [42] (p. 44). Articulating the relationships between and within values as tensions allows space for design solutions that may balance the values in relation to others. Previous studies have explored the role of value tensions from varying perspectives such as their potential in generating novel design ideas [46], how the identification of value tensions can illuminate socio-technical challenges [74, 79]. Conversely, neglecting value tensions may lead to adverse consequences ranging from 'lack of appropriation by disadvantaged groups' to more severe consequences such as 'system sabotage' [74]. Research has shown that during moments of tension and conflict in online communities, it is important to untangle the values at stake [63, 70].

Drawing from the wide-ranging body of HCI research into values, we understand values to be *active, mutable, and context-specific expressions of underlying normative principles that are collectively enacted across a range of socio-technical settings including, but not limited to, design processes.* Though we take guidance from the specific moral and ethical values identified by VSD, we depart from this list in favor of examining the dynamic nature of values in situ and the *evolving* tensions emerging within and across them in the OSM community. In our study, we use contemporary conceptualizations of values and technology [59, 63], where values are inextricably connected to ongoing social practices. We also draw inspiration from recent contributions to VSD theory that point to the need for identifying tensions between values in a given research setting [42] (p. 44-51). In doing so, we are able to draw out some of the values enacted by the OSM community in response to rising corporate editing, their influence on the design and implementation of the OEG, and how the particular enactments of the values transformed the OSM community over time.

3 BACKGROUND: CORPORATE EDITING IN OPENSTREETMAP AND THE CREATION OF THE OEG

While this research project explores the value tensions related to corporate editing within the OSM community between 2013-2021, corporations have been involved within OSM since the early days of the platform [3]. Similar to the scholarship on corporate influence within OSM [3, 96, 110], parallel research, conducted under the umbrella term — 'location economy', has explored the socio-political implications and commodification practices of spatial data due to rising corporate involvement within geospatial systems [75, 76]. Within OSM, studies have discussed the historical involvement corporations have had in the community, pointing, in particular, to 2006 when Yahoo allowed their satellite imagery to be used as a backdrop for producing the map [3, 96]. This change was pivotal as it removed the necessity of a GPS device for mapping and birthed the concept of 'armchair' or 'remote' mappers, individuals who could map any part of the world remotely by 'tracing features on satellite imagery to create map objects' [96]. In response to armchair mapping, the OSM community published guidelines on their wiki to ensure the quality of remotely produced maps and reduce tracing errors in 2012 [86]. The usage of satellite imagery has since grown due to the rising involvement of multiple providers (Bing, IRS, Landsat, ESRI, Digital Globe and Mapbox) and has expanded to humanitarian mapping efforts by the Humanitarian OSM Team. Logistic and transport companies such as Amazon and Uber have contributed map data to OSM using telemetry — which are large-scale projects that involve many devices and complex data integration processes [96]. Other forms of corporate involvement within OSM have been through data dumps where companies, such as Microsoft, have contributed large-scale datasets to the OSM platform for integration. Over the years corporations such as Mapbox, Stamen, geofabrik, Mapquest, Mapzen, and CampToCamp have provided services to the OSM ranging from financial support to OSM conferences, creating end-user documentation to technical support such as providing OSM data extracts, webmap layers for online mapping, and specialist visualizations [77].

Initial concerns over corporate editing were raised on the public mailing list as early as November 2013, with some members of the OSM community questioning potential risks that may arise from such practices. Debates over the following year were concerned with understanding the impacts of corporate editing on the community, the biases and subjectivities inherent to map making, quality issues within the map arising from organized edits, and recognizing who was involved in such edits. Between 2014 and 2017 editing from corporations rose dramatically within the OSM ecosystem with multiple companies like Microsoft, Apple, Mapbox, Amazon, Telenav, and Grab hiring large paid editing teams to better represent places and map features of strategic importance to these corporations [3]. Figure 1 shows the changing trends of paid editing between 2016-2020. Additional maps and data showcasing the global footprint of corporate editing can be found in Anderson et al.'s 2019 study [3]. After 2013, the OSM community had a number of mailing list debates around the role of corporations in the project, which led to calls for initial guidelines around organized editing. Terms such as 'corporate editing', 'paid editing', 'directed editing', and 'organized editing' begun to appear regularly as the community came to terms with understanding the extent of this form of mass editing.

In 2017, a survey was sent out to inform the OSM community of potential guidelines and garner community opinions of the extent of the guidelines' influence pertaining to organized editing [83]. Corporate editing was the primary form of organized mapping the proposed guidelines were targeting. The OSM Foundation had earlier stated the need of potential guidelines as "increased interest on OSM from corporations" could create communication issues, and power imbalances within the communities of OSM, thus necessitating an understanding of "how to regulate this [corporate editing] to ensure fair play" [82]. The survey results showcased the division within

Fig. 1. Change in the percentage of paid edits per country each year between 2016-2020 [2]
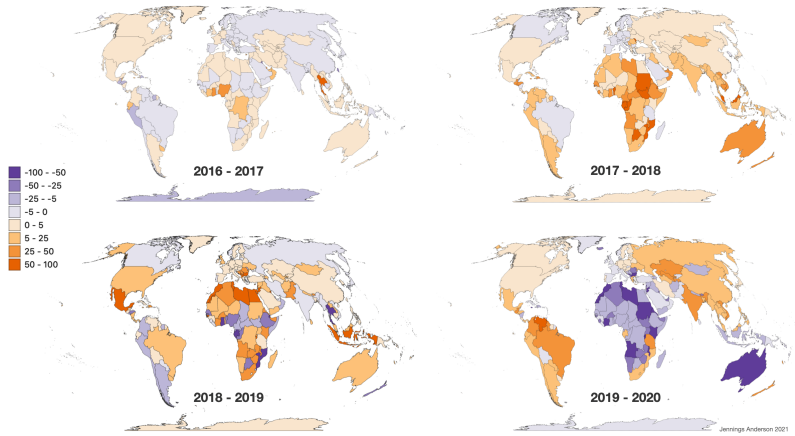
the community around policies concerning transparency and accountability, with 43% of paid editors—compared to 17% of all respondents— opposing policies that guide editing activities [83]. Following a period of intense debate, the OSM Foundation published the OEG in 2018, which applied to "edits that involve more than one person and can be grouped under one or more sizeable, substantial, coordinated editing initiatives" [84]. The new OEG included instructions for creating appropriate documentation on the wiki, maintaining meaningful communication with the community, training mappers, and mapping practices to avoid as an organized editor [84].

Since the launch of the OEG, practices of corporate editing within OSM have evolved in multiple ways, including the incorporation of novel forms of technology. Debates within the OSM community around corporate editing took a new form with the advent of Facebook's AI-Assisted Road Tracing project [85]. Facebook's project initially mapped out roads in Thailand and Indonesia with a goal to understand how machine learning could be integrated into the mapping workflow. In 2019, Facebook released RapID (a forked version of the primary web based OSM mapping editor, iD) for public use of AI assisted mapping [88]. While proponents of the new tool argued that AI-assisted mapping could help OSM address the difficulties of conducting large-scale data imports manually, other members of the OSM community raised concerns around data quality issues. As a result, Facebook responded by adding a human review process to AI-assisted edits [88]. Discussions of the OEG have since continued on the mailing lists as the community attempts to keep up with the evolving facets of corporate editing.

4   RESEARCH METHODS

This study is based on an interpretive [102] and qualitative examination of debates over corporate editing on OpenStreetMap email lists. F/OSS communities have long relied on public mailing lists as channels to coordinate development processes and project communications [56]. For our period of study, they were (and remain) one of the primary traditional communication channels of the OpenStreetMap project. The mailing list archives thus provide a long history of public discourse and discussion on the chosen mailing lists, which are open to all members of the OSM community. Although in recent years communication through other forms of social platforms such as Slack and Discord has increased, the mailing list remains the only platform where OSM members are notified

of community discussions and can respond to them without signing up for another platform. They therefore offer invaluable access to community discourse for this research.

We analyzed discussions on the two primary public mailing lists used by the community – talk (OpenStreetMap contributor and user discussions) [91] and osmf-talk (discussions amongst the OSM Foundation Members) [90], which are primarily in English. Anderson et al. [3] estimated significant corporate editing involvement started as early as 2014, and so for this study, we evaluated discussions within the mailing lists held between November 2013 to July 2021. Since this research focuses on examining discussions around corporate editing practices in relation to OSM community values, our mailing analysis began with identifying the mailing list threads that contained conversations relevant to our inquiry. We found that discussions related to forms of 'corporate editing' were either found within focused email threads about corporate involvement or broader conversations concerning organized editing within OSM. Thus, we included discussions within the mailing lists that had any mention of 'corporate editing', 'organized editing,', 'paid mapping', 'directed mapping', and 'organized editing guidelines' into our dataset. We also scanned mailing list threads that discussed specific corporations (such as Facebook) or were concerned with corporate influence within OSM. This process resulted in a set of 907 messages from 57 mailing list threads. Messages from the dataset that did not involve relevant discussions or deviated from the topics of corporate influence, corporate editing, or remote mapping practices were subsequently removed to ensure the analysis focused solely on the key issues directly related to the research objectives. The final data set consisted of 139 messages.

We conducted a reflexive thematic analysis as described by Braun and Clarke [18, 19]. The first author familiarized themselves with the data by engaging in iterative readings to develop initial understandings of the dataset. This was followed by the first author sharing written familiarization notes of the data and having multiple discussions with the research supervisor regarding initial interpretations of the data. Next, the dataset was coded with the aim of identifying key patterns within the data that were relevant to the research objectives. Following the coding process, similar codes were consolidated as themes (see Supplementary Materials). Themes in thematic analysis are considered as "patterns of shared meaning, characterized by a central concept or idea" [20]. For example, codes such as 'onboarding new community members' and 'keeping a level playing field' were later understood as relating to the theme or value of inclusivity. Following our research priorities, the initial themes were re-interpreted as OSM community values expressed, explicitly or implicitly, through the messages in the dataset. Initial rounds of coding and theme development were informed by those offered by the VSD framework (see [41] p. 91), loosely following the methodological strategies offered by the framework [42] (p 87-94). Although this step was useful in orienting our themes around the community's values, we determined that the additional specificity of critical values we identified in our dataset such as local mapping and data quality were important and worth preserving. For our final analysis, we therefore chose to partially deviate from the core list of values offered by VSD, adopting a semi-inductive approach to identifying values expressed by the participants in the mailing list discussions.

The values we present below were then further developed through discussion and iteration with other members of the authoring team. The first, third, and fourth authors are familiar with qualitative methods of analysis. Both the second and the third authors were involved primarily in the write-up of the paper, contributing to areas of their expertise. The second author is familiar with the OSM community and corporate editing debates within the community, while the third author is familiar with HCI and CSCW theory. Discussions took place across several meetings during which the initial values were updated, and refined, and overlapping values were consolidated. The first author then followed an iterative process to apply a final set of values to the data. A series of short narratives and working definitions describing each of the values (see [42] p.91-92) were

then drafted by the first author. Our narratives included information on the values related to the OSM community and the growing presence of corporate editors on the platform. Next, drawing inspiration from VSD methods, we examined potential conflicts and tensions within and between values [41] (p.92). As a result, the narratives were then further refined to highlight *value tensions* through several successive rounds of discussions and writing, ultimately forming the arguments presented in the next section. Our findings thus describe some of the values surfaced in the OSM community's response to increasing corporate editing, along with the tensions within and between them.

5 FINDINGS: VALUE TENSIONS IN OPENSTREETMAP

5.1 Local Mapping

Access to Yahoo's satellite imagery for tracing building-footprints, roads, and other map features paved the way for remote mapping within OSM [3]. Previously, mappers usually needed to be at a location, using a GPS device, to physically collect map data to add to OSM. The practice of remote mapping allowed anyone to map by tracing on top of the provided satellite imagery, and thus introduced new possibilities for crowdsourced mapping. Remote, or armchair mappers as they are sometimes called, made pivotal contributions during the Haiti earthquake response in 2010, setting an example of how remote mapping could be meaningfully used during crises [25]. Since then, organizations such as the HOT, Youth Mappers, and Kathmandu Living Labs have harnessed the potential of remote mapping practices during crises [93]. The response to corporate mapping was not always as favorable. As one commenter wrote:

> "We will likely see more of this type of editing in the future, and while not necessarily bad, there are differences between it and **normal editing** (emphasis added)."

Although remote mapping was common practice by the time corporate editing had become a topic of debate within the OSM community, the increasing scale of influence and impact remote corporate editing practices had on the map raised questions regarding what constituted acceptable contributions to the map. For some participants, remote mapping by company employees was seen to be in tension with local efforts. A commenter pointed out that corporate editing was biased towards interpretations of the corporate mappers and often conflicted with map data being generated from local project efforts:

> "It's not infrequent for these organizations to be using remote mappers, so sometimes you will see things mapped how they think they should look based on where they live/how the imagery looks rather than the on the ground truth. This gets more complicated when conflicts arise between these remote mappers and existing mapped data from local contributors. It's not a matter of vandalism, because it's not malicious, but it can be hard to figure out the right way forward in these situations."

During discussions of corporate editing and remote mapping practices, many participants conveyed their preference for geographic information added by local mappers. Although remote mapping provides the convenience of mapping quickly from anywhere in the world, a participant articulated how paid remote mapping inherently differs from *"careful survey-based"* local mapping:

> "Armchair mapping can blatt [import] in data pretty quickly compared to survey-based mapping. *Paid* armchair mapping? Well I guess this is somewhere between those two, and far down the scale from the best kind of mapping: careful survey-based mapping by passionate local people."

Debates in the community over local versus paid remote mapping also surfaced concerns of disproportionate corporate influence on the map. This led to discussions on how to ensure that the

contributions of local mappers were not silenced or overwhelmed by large-scale corporate editing. One participant suggested that corporations hire local instead of remote mappers, arguing that locals have "inherent incentives" to help their community and were likely to result in fewer cases of conflict if all mappers were local:

> "Apart from that what I in general like to suggest to local communities dealing with organized remote activities is to put pressure on them to hire locals instead of people in some distant country to perform mapping tasks. First this is good for your local economy and second people mapping their local environment have a higher inherent incentive and ability to map in good quality than remote mappers mapping in a country they don't know first-hand"

The quote above suggests that, to the commenter, mapping practice has value beyond just the data collected through such practice. This evidences the belief that participation in OSM creates opportunities for local communities and should therefore be encouraged [60, 95].

Finally, in discussions over the OEG, multiple participants further raised concerns that new policies could disproportionately impact local mappers, who were seen as the "most important OSM participants". One participant expressed their frustrations with the proposed community policies, conveying the burden of extra work put on those who wished to organize small mapping parties to revitalize OSM engagement within local communities. They wrote:

> "This looks like a rather burdensome policy for those that want to run a small mapping party to energize the local OSM community. If I decide to have a few people over to a local community center to collect and add data to OSM, am I required to generate a wiki page every time? How will the DWG (Data Working Group) enforce this policy? How will the DWG distinguish between directed and undirected mapping activity? It seems that DWG is trying to clamp down on what it sees as bad behavior from commercial entities by writing a policy that also requires more from the most important OSM volunteer participants."

The ability to map remotely paved the way for new mapping practices and initiatives (such as HOT) that expanded OSM's reach and usability to users spread across the globe – forming a map that incorporated diverse viewpoints and served multiple purposes. The adoption of remote mapping practices by corporations consequently challenged OSM's value of prioritizing local mapping, leading to internal community conflicts and debates concerning the production of map data and the rightful custodians of local map data.

5.2 Inclusivity

Another value raised in these discussions was that of inclusivity. Here we found the overall willingness of the OSM community to embrace any inclusion of map data, provided it adhered to community guidelines, challenged by concerns that corporate mappers might somehow overwhelm other contributors or introduce bias into the map through over-representation of corporate priorities. On the topic of inclusivity, some members of the community took the stance that all data mapped is factual, if 'correctly' mapped, and results in the overall improvement of the map. Simply put, *any data is useful data*. One participant wrote:

> "...could someone slip 'advertisement' like places of all shops of a specific brand? Yes! Do we care? No, as long as the data is factual. I don't care if someone is being paid to put data in OpenStreetMap as long as this data is correct and valid"

Some community members acknowledged the risk of large-scale directed mapping changes on the map but defended the practice as an inevitable outcome of participation within an open peer

production community. Such members held the belief that the implementation of new community policies and mapping guidelines would, over time, rectify the adverse consequences stemming from remote mapping. A participant's perspective on a potential future situation was captured in their comment:

> "...there is that risk, just like any open source community fears someone getting inside our open doors and then running amok. However, when that happens, and it surely will, we will tidy up the mess, analyse if it could have been prevented and then move on, but we will continue to leave the doors wide open because it is by leaving those doors open, no matter what, that defines all open source communities and what accrues all the benefits."

Others, however, pushed back against the idea of welcoming all data. For example, one worried participant raised the issue of selective mapping when practiced at scale:

> "This part of the argument essentially boils down to 'selective mapping', where 'selective' is not according to a mapper's personal interest but according to the interests of a business, and potentially done on a larger scale than one single mapper could."

The mapping activities undertaken by corporate editors are contingent upon the projects and interests of the employing company, with a focus on prioritizing the addition of data that align with the company's specific interests. While all forms of mapping can be defined as selective in nature, i.e., shaped by the perspective and motivations of the mapper, the challenge with corporate editing on OSM was the scale at which such mapping practices were being performed. One participant stated their concerns over how large-scale selective mapping could change the overall character of the map:

> "I fear that we can expect major problems for bicycle routing when a company that operates motorized taxies does the mapping. There is a basic conflict of interest: The motorized-taxi driver is only interested in information that regards his type of vehicle, whereas a person on a cycle needs much better information in order to be able to take advantage of this means of transport, i.e. many more routes are open to bicycles than to cars, when the map has the necessary additional information."

The aspect of inclusivity within the community was also brought up in conversations over the community guidelines that governed the manner in which various mapping activities were to be carried out. In discussions over the OEG, the community debated which mapping activities would fall within the parameters outlined in the prospective policies. Particular organized efforts, such as the humanitarian mapping group HOT, were viewed as beneficial and necessary directed editing efforts within the community. One participant stated that governing humanitarian mapping under the same community policies as other organized mapping efforts, such as corporate mapping, could potentially create future complications in the community:

> "Humanitarian activities deserve our fullest support. We therefore adapted the guidelines for them,... Some humanitarian edits have been problematic before, [but] the guidelines are easy to follow; a blanket exemption would send the wrong signal."

Other aspects of the OEG, such as their rhetoric and tone, were also relevant to the value of inclusivity. The choice of language employed in community policies plays a pivotal role in fostering inclusivity within the OSM community, as it directly influences the extent to which individuals from diverse backgrounds feel welcomed, respected, and empowered to actively participate in the collaborative mapping process. One participant expressed their perspective, stating:

> "The proposed policy contains the word 'must' eleven times – and not a single instance of 'welcome'. The tone is not encouraging. (And I believe it will fail to discourage any SEO [search engine optimization] mapper or other mappers with bad intentions.)"

The increasing influence of corporate editors on the map challenged some community members' views on inclusivity. And although peer production platforms, like OSM, stand to benefit from the inclusion of contributors from different backgrounds and motivations, this value was challenged when a particular stakeholder's (corporations) influence seemed to become more prominent than what many in the community had envisioned.

5.3 Data Quality

Discussions over several high-profile examples of poor mapping practices by corporate mappers are illustrative of another broadly held value in the community: data quality. Studies conducted before the growth of corporate editing found that "serious mappers" in OSM were motivated by the ability to showcase skills to potential employers and monetary incentives to an extent [22]. In contrast, some members of the OSM community voiced concerns about corporations that hired novice mappers solely for directed editing, claiming that the hired mappers were not trained on mapping best practices and that their increased participation would reduce the quality of data on the map leading since, in the words of a participant, *"sloppy mapping will occur more and more"*.

Mailing-list debates over the impact of corporate editing on map data quality occurred as early as November 2013. The OEG, published in 2018, addressed various aspects of data quality, such as documentation methods, communication procedures, and the duties of editors to ensure that their contributions met the standards of the broader OSM community [84]. Nonetheless, the frequency of data quality-related debates continued, particularly after Facebook's adoption of machine learning for their artificial intelligence (AI) assisted road tracing project. This sparked community discussions on reassessing the OEG and the implications of novel forms of technology for editing the map. Facebook's addition of AI-assisted data to the map was met with harsh criticism from the OSM community for multiple reasons. OSM members largely disapproved Facebook's repeated ignorance about rising community concerns over the quality of AI-assisted data and the corporations' tactics of generating positive PR about the project through media publications. One participant's statement encapsulated the general sentiment of the community:

> "I believe introducing into OSM technologies based in AI / machine learning REQUIRES a concomitant discussion about how the data WILL BE high quality,"

On the other hand, Facebook's use of AI for automated mapping was not completely opposed within the community, some of whom felt that it could encourage higher-quality map data. This perspective, contrary to the earlier critics, called for novel technologies to be adopted within the community, and downplayed the quality of human generated data. Most of the members that advocated for the increased adoption of machine learning on the map brought up concerns over maintaining a massive open collaboration community through manual techniques.

> "It's very difficult to keep something at that scale that is constantly changing up to date, and while OSM is very high quality in some areas, human mappers have not been able to produce high quality maps worldwide."

Facebook eventually responded to the critics of their AI-assisted project by creating a team to address the concerns raised and communicate directly with the OSM community. The responsibilities of this team also included a human review process for the data being uploaded through Facebook's AI-assisted program [85].

The OSM Foundation later added minimum training standards for participants in organized editing as well as post-mapping validation processes within the OEG to ensure a standard of data

quality is maintained during organized and ai-assisted editing efforts. Referring back to the OSM value of prioritizing local mapping, the community eventually agreed that human intervention was key in ensuring that map data uploaded via novel technologies, like AI, was of acceptable quality. Stressing the pivotal responsibility of local mappers in upholding data quality within their specific regions, the participant articulated the following viewpoint:

> "It is important for you to keep in mind that you, as the local hobby mappers, are the guardians of the data quality in your area. Ultimately the only real pressure you can put on organizations to ensure that is of course reverting their edits."

Corporate editing, whether manual or automated, created tensions that led to productive debates within the community over the standards of data quality and the use of novel technologies within the OSM community. The OSM community adopted guidelines, such as the OEG and a code of conduct (for automated edits) [87] to address data quality concerns and provide transparency on who uploads data, the projects for which map data is being uploaded, and the mechanisms through which data is uploaded to the map.

5.4 Transparency

The 2017 findings of the OSM community survey on organized editing stated that the *"guidelines will above all set out some transparency requirements for organized groups"* [83]. Peer production systems, like OSM, rely on transparency within organizational processes and communication between participants to maintain standards, correct errors, and enforce policies. The mailing list data showed that OSM members valued transparency within the community to build trust and accountability, and to maintain a standard of uploaded map data. In a discussion thread titled *"About OSM social implications and what can/should be displayed on the map (or not)"*, one participant identified the importance of transparency within the community:

> "Since most of OSM contributors decide to share their free time with other mappers around the world in making the best possible map, we could infer ... that we would love to live in a world where sharing was considered as a positive value and change-driver for a better world which also promoted other positive values such as openness to information, collaboration, inclusiveness, communication and discussion (which, surprise, are OSM's pillars)."

As conflicts concerning data quality escalated, the OSM community encountered challenges pertaining to communication and trust between corporate editors and the wider OSM community. Some community members grew concerned about being unable to keep up with the scale of organized map edits and the increasing number of ongoing corporate projects. They complained that corporations failed to disclose their activities and seldom replied when contacted by other OSM members. This lack of transparency created frustrations within the OSM community, as reflected in a participant's comment:

> "...we're seeing issues like: One mapper (on behalf of an organization) mapping in a very sloppy way... If you ask the mapper about what's going on, they don't answer. You might see more than one account doing the same type of mapping. The DWG [data working group] has to find the 'responsible party' on their own"

Within the mailing list data, we found multiple instances of community members frustrated by the mapping practices of corporate groups. Undisclosed edits by corporate mapping teams placed extra burdens on the map upon OSM community volunteer quality control groups and individuals. One participant stated their frustrations in this aspect:

> "Once a problem has been identified, it's often difficult to get the individual or organization to take ownership of the problem and especially to fix previous mistakes."

Some community members critiqued the lack of transparency by corporate groups in disclosing hired editors. This critique stemmed from concerns that undisclosed hired editors might introduce biases, prioritize corporate interests, or compromise the integrity and openness of the collaborative mapping process within the OSM community. These community members argued that transparency regarding the involvement of hired editors is essential for maintaining the community's trust and ensuring a level playing field where all contributors are aware of potential conflicts of interest. This call for transparency through accountability aimed to safeguard the principles of community-driven mapping and maintain the community's ability to collectively shape and maintain a high-quality, reliable, and open map dataset. This sentiment was seen in a participant's comment:

> "If it's a single vandal user, we take these problems as rogue 'bad actors', but if it turned out that all these editors were acting on behalf of a company, the question in my mind is 'What responsibility does the company have to the OSM community for the actions of its employees?'"

Ensuring transparency, open communication channels, and trust from corporate editors was seen as a challenging task, especially in the absence of relevant policies. The following participant called for guidelines to maintain the community's stance on transparency:

> "I am of the opinion that it would be good to have rules that ensure transparency is maintained in cases where people map on behalf of others (whether they are employed, contracted, or part of a learning course) – just so that everyone can see that here's a group of people working on a common agenda."

A key aspect of the OEG was to ensure organized editors were transparent about their mapping practices and to maintain *"a level playing field between individual community members and organised editing groups"* by *"ensur[ing] good communication"*.

The questions over transparency regarding mappers who were being compensated for their edits, prompted one participant to draw parallels to Wikipedia's policy on the topic. Drawing on the example of Wikipedia, which has implemented guidelines and mechanisms to address conflicts of interest and maintain transparency, the participant highlighted the importance of establishing similar practices within the OSM community:

> "The problem that Wikipedia tries to solve is a lack of transparency; they want to make sure that, where compensation is involved, the potential motives of contributors are out in the open. I think that a similar transparency policy – disclose if you map for compensation – would make sense in OSM as well. (I also think – but that is more of a practical matter – that it would in some cases be very helpful to know that a group of seemingly separate accounts are actually controlled by the same corporate entity.)"

Transparency guidelines in the final version of the OEG included requirements for creating a wiki page describing the organized editing activity, adding the project to a list of all organized activity underway within OSM, identifying a specific hashtag to be used within all edits of the project, providing contact channels with the organizer, listing the accounts of members of the project who wished to be identified, and providing result reports after the completion of the project [84]. The growth of corporate editing thus encouraged the community to articulate and enact the value of transparency through new and more specific policies.

5.5 Autonomy

In the VSD literature, Friedman et al. [42] define autonomy as 'people's ability to decide, plan, and act in ways that they believe will help them to achieve their goals.' The value of autonomy appeared in multiple forms in debates over corporate editing OSM community. Crowdsourced geographic information systems, like OSM, have in many cases de-emphasized centralized governance mechanisms in favor of individual agency and self-directedness [99]. Similarly, the prominence of the value of local mapping in these debates (Section 5.1) suggests that some members of the OSM community prefers local mappers with vested self-interest in mapping points of interest that may benefit their communities. This notion of autonomy while mapping was brought into tension with the increasing discussion and implementation of community policies and guidelines. Community members expressed concern over the influential reach and the forms of organized editing the proposed OEG was attempting to control. One participant shared their concerns:

> "What is the actual goal of such a policy? Does the DWG see a problem with HOT, Missing Maps, corporate editors, SEO editors? Who are you actually trying to target with this policy? If the target is SEO editors, which I think is the problem, this policy is way out of whack and won't actually get to the heart of how we as a community can police them..."

The OEG were also scrutinized for placing excessive requirements on existing OSM community members and groups. Critics argued that the guidelines seemed to introduce additional hurdles and bureaucratic processes that could potentially hinder the spontaneity and flexibility that have been historically integral to the OSM mapping ecosystem. Once again, participants were wary of policies that would overstep upon wider organized mapping efforts:

> "Why write a policy that directly targets the very groups that are bringing in and training new mappers, spending tons of time on validation, building better methods to track and engage mappers, and filling in gaps in the map that over a decade are still blank. It's because, this policy is written to try and drive existing organized groups away from OSM by making it burdensome to fulfill all the requirements"

The sentiments above convey how some OSM members felt that community guidelines would limit or constrain their participation in the platform. Other members of the community seemed to argue that the governance discussions themselves were a distraction from the issue, i.e., corporate editing on OSM. As argued by one participant:

> "The focus needs to be on a problem at hand [corporate editing], not on increasing bureaucracy for everyone acting with a common instructor or goal in mind."

Corporate editing was also seen as being in tension with self-directed forms of mapping within OSM. This tension was embedded in broader debates concerning the role of corporations within OSM and the platform's identity as a democratized approach to mapping. In the mailing list data, some members of the community questioned the potentially exploitative nature of paid editing. One participant characterized the situation in the following way:

> "Almost every rule-violating import or mass edit these days is done by low-paid, exploited workers somewhere in Asia or South America on behalf of US American companies. And now COMPANY Y gives us another tool whereby someone with money in country A can pay a poor person in country B a few peanuts to add a couple thousand roads in country C because that's where they want to develop new business or whatever."

The impacts of directed mapping extended beyond individual contributors and users of the map to other members of OSM such as the Data Working Group (DWG). The DWG deals with accusations

of copyright infringement, imports, serious disputes, and vandalism. Members within the mailing list, as seen in the following comment, expressed increased burdens of time and resources on the DWG because of increasing large-scale corporate mapping practices:

> "The DWG is a small team staffed with volunteers. It is exceedingly unfair and a waste of their personal time to expect them to police individual mappers misbehaving, when the people in question are actually on the payroll of a company that is directing the activity."

Concerns over the growing burdens of map data moderation also extended from designated groups to individual mappers. Such mappers, often very passionate about mapping, saw themselves as custodians of the map data concerning their locality. Corporate edits that encroached on their mapped locality created unnecessary moderation work for these individuals, thus hindering their autonomy as crowdsource mappers. A member conveyed their frustrations below:

> "COMPANY X and a revolving door team of one-edit-and-done spam accounts keeps throwing paid contributions into Oklahoma that are of poorly aligned, largely fictional and low quality. I'm stuck cleaning up in a neglected part of North America some particularly low quality edits with limited resources and little ability to find more."

The questions in these debates regarding the autonomy of the OSM community were complex and multifaceted. Limits to the autonomy of the members surfaced as part of the *problems* i.e., corporate editing, but also to the proposed *solutions* i.e., the OEG. This highlights the tradeoffs between individual agency and collective decision-making, specifically the challenge of achieving a balance between preserving the community's self-directed nature and addressing emerging issues arising from organized editing, while simultaneously guaranteeing the long-term viability of OSM as a collaborative mapping platform.

6 DISCUSSION

This work is part of a body of research into the OpenStreetMap community that approaches it not as a uniform or homogeneous entity, but rather as a diverse collection of sub-communities with varying backgrounds, motivations, and relationships to the platform [71, 103]. Despite this heterogeneity, our study was able to identify a number of recurring values that participants invoked, though often indirectly, in mailing list debates over the rapid growth of large-scale corporate editing on the platform. In keeping with previous research [70], this study shows that these values are not fixed objects or abstract entities available to be embedded within technologies by their designers. Instead, they are continuously enacted, articulated, and, as we have shown here, contested, across the life cycles of socio-technical systems. In the mailing-list discussions surrounding corporate editing, participants both raised these values but also contextualized them within the contours of the particular debate. They reaffirmed, added nuance, or drew out the implications of the values at stake. In what follows, we 1) highlight a fundamental tension, identified through a values-based research approach, between prevalent understandings of openness in online participation and community involvement in peer production; 2) identify the challenges of inclusion, participation, and conflicting ideologies as forms of scalar debt that may arise from the success and growth of peer production communities; and 3) argue for the attention to values, particularly through a longitudinal approach, as a means of evaluating the design, adoption, and ultimate impact of policies in online communities.

6.1 Openness and the Democratization of Mapmaking

Over the course of the time-period we studied, the OSM community struggled to come to terms with the effects of rising corporate influence on the platform. Crucially, many aspects of these

debates resonate with wider discussions over the past two decades about the potential for emerging geospatial technologies to democratize mapmaking [57, 60, 76]. Here, tools such as mobile phones, crowdsourcing techniques, and broadband internet access are seen to offer the potential to reallocate the discursive power of mapmaking away from the traditional grip of elites toward a broader swath of the population. Some of the critics of corporate editing in the community feared that these editors' ability to make large scale organized changes to the map would challenge such democratization. However, many of the values of the OSM community, in particular those which emphasize open access to data as well as mapper autonomy and inclusiveness, would seem to be permissive of, or at least make it difficult to challenge, the presence of paid corporate editors on the platform. Emphasis on openness as individual freedom is common in open-source culture, from which OSM draws inspiration [94]. Contrary to the Free Software movement, open-source has historically been welcoming to, if not constituted by, the participation of tech companies [47, 51, 53, 65]. It is perhaps the pervasiveness of such ethics within the community that helps to explain why segments of the OSM community with concerns regarding these impacts of corporate editing and have not been successful in countering it.

Of the values expressed during mailing list discussions, only local mapping seemed to offer a meaningful challenge to corporate editing practices. As noted above, this value extended beyond possible benefits to data quality accrued as the result of the incorporation of local knowledge. On the contrary, there was a clear normative preference expressed by many discussants that local communities should be given priority in how their locality is represented on the map. This was a strong departure from a more utilitarian perspective that would value any and all contributions in an equivalent manner. Central to the distinction between these perspectives is the weight we should give to claims about the ultimately subjective nature of maps. As cartographers have long noted, the "map is not the territory [68]" and any efforts to produce representations of the world around us will necessarily involve choices about what to include and what to ignore [9]. Such choices are another means by which politics, aesthetics, and values are embedded in, and enacted through, mapping technologies [98]. Arguments that highlighted the value of local mapping, explicitly or implicitly, acknowledged and embraced this subjectivity, while proponents of corporate mapping tended to emphasize the idea that all contributions to the map should be equally welcomed, and the focus of community efforts should be on producing a more "complete" map for all to use.

If the values of the OSM community did not provide sufficient resources for those who sought to limit corporate editing on the platform, it is reasonable to ask whether corporate editing might co-exist with forms of mapping that foregrounds more local, subjective, and broadly democratic concerns. Recent examples of these forms of mapping within OSM include the growth of locally based and decentralized humanitarian mapping communities [58], indigenous-led participatory mapping initiatives that use OSM software [31], and counter-mapping projects led by crisis-affected communities [98]. Critics fear that growing corporate influence on the map and the community around it will change the character of both in ways that create an environment less hospitable to these forms of mapping. On the other hand, research on HCI and social justice has highlighted that people will always look for creative technical, social, institutional, and political measures to resist perceived hegemony [111]. Techniques of resistance, such as forking of FOSS projects, have also been seen within the open-source community [13]. Because OSM is the largest crowdsourced mapping platform in the world and so widely used, the stakes involved in how the community manages these tensions are high.

6.2 Membership and Inclusion as Scalar Debt

It is perhaps not surprising that the mailing lists, a site where many of the sub-communities of OSM come together, are frequently sites of tension, conflict, and debate. Participants in discussions

around corporate editing came from varying backgrounds, with many holding associations to groups such as the Humanitarian OpenStreetMap Team, tech companies, universities, or local mapping chapters. Tensions between members of the various social worlds who participate in boundary objects and the role that such tensions play in their overall evolution are, according to Star and Griesemer [105], defining characteristics of such objects. The fluctuating and voluntary nature of membership and participation within peer production creates complex challenges to their functioning as boundary objects when compared to Star and Griesemer's original study. Geiger et al. [51] find in their study of Free and/or Open-Source Software projects that "the ostensibly-technical work of software engineering takes on more organizational, communicative, and even competitive aspects at larger scales." This form of work, which they term "scalar labor", is precisely what participants in the OSM email discussions over corporate editing and the authors of the OEG were engaged in as they sought to respond to new forms of participation in the project.

A crucial point here is the somewhat amorphous category of "membership" within the OSM community, with regards to which the growth of corporate editing practices provoked something of a crisis. Bowker and Star (p. 295) describe membership challenges in socio-technical communities as being characterized by efforts to manage tensions between familiar and naturalized member categories, as shaped by the degree of openness to immigration of the other [17]. In the OSM mailing list debates, corporate editing teams were initially portrayed by critics as outsiders, or, in Bowker & Star's terms, "illegitimate strangers." The presence of these strangers provoked an interruption in the normal functioning of the community, while their presence had to be accounted for or reconciled with new norms or policies, in this case through the writing of the OEG. Prior work in online communities has found that such interruptions hold productive potential and should not necessarily be avoided [4, 36], and in this case, the interruptions paved the way for the OSM community at large to re-evaluate the meaning of membership as well as incorporate new mapping practices and norms in a changing socio-technological system.

Furthermore, in addition to members of the OSM community who don't participate in mailing list discussions, whether for reasons of language, comfort, preference, or otherwise, there are several other important groups of stakeholders whose values are not enacted or otherwise made present in these debates. First are end users of the map (actual or potential) who rely on OSM as a valuable data source for their own cartographic, analysis, or navigation purposes. Second are the people whose communities, homes, places of work, and other vital places are represented on the map. Recent work in HCI has called attention to non-users, or people who don't directly interact with technology yet are significantly impacted by it nonetheless [10]. Many people who do not engage in mailing list discussions nonetheless continue to map, participate in local groups, or otherwise enact their values in meaningful and important ways. People who don't participate in OSM at all nonetheless have stakes in how the places they care about are represented in the map data. Along with previous HCI research on values [70], we observed that VSD's emphasis on recognizing direct and indirect stakeholders falls short when attempting to account for the complex scales of membership and interaction with OSM. Participation in a peer production community unsettles binary distinctions between users that directly interact with a technical system and "non-users" that are indirectly impacted by such systems. By examining the debates of policy creation and their relation to the evolving design of OSM, our study opens up space for considering a wider range of *relevant* stakeholders when using values-based approaches in research with online communities. Identifying more robust practices and mechanisms to evaluate and respond to the accountabilities suggested by these forms of pre-use, use, and non-use in the governance of peer produced knowledge systems thus emerges as an important challenge for future research [104].

Part of the challenge that OSM faces, but also perhaps a reason for its significant successes, has been the ability of the community to hold competing visions of the project in tension as it continues

to attract new users, retain longtime contributors, and produce an ever-more detailed map of the world [22]. However, the intense nature of the debates that emerge along the way does not always create a welcoming environment. Other messages in the email list archives noted that many active participants in the OSM community do not participate in these discussions, and there is, in many cases, a gendered and geographic dimension to individuals' choices to opt out. Research on debates in the Wikipedia community has argued that participants are willing to engage in difficult online discussions, a form of scalar labor [51], if they feel it will be productive [73]. Other work has shown that peer production communities require effective conflict resolution mechanisms to grow and diversify [5]. In December 2021, the OSM Foundation Board approved a set of etiquette guidelines and associated enforcement mechanisms for the primary OSM mailing lists. Their impact remains to be seen, and future work in CSCW could draw additional lessons from this example and the strategies the community has deployed as part of efforts to negotiate membership, identity, and heterogeneity as critical forms of scalar debt that successful online communities need to resolve as they grow.

6.3 Policies and Value Tensions in Peer Production Communities

The interplay between values and online community policies takes center stage in this study, revealing how policy debates, exemplified by the OEG, serve as crucial arenas for the articulation and enactment of community values. Our findings resonate with previous research within HCI [62] and organizational information systems [39] that show the design, collaboration practices, and policies of online communities are tightly woven and interlinked. Within the context of this research, rising concerns within the OSM community over *transparency*, *data quality*, and *local mapping* sparked by the growth of corporate editing led to policy-related work. As part of this, the survey about the proposed OEG gave the community an opportunity to question and assess proposed policies on the *autonomy* of mappers and boundaries of *inclusion* within the suggested community policies. Later, the introduction of novel AI techniques forced the community to revisit the OEG. The resulting version of OEG thus both articulates and helps to enact community values by mandating transparent communication channels (*transparency*), informing affected local OSM communities (*local mapping* and *transparency*), training editors (*data quality* and *inclusivity*), implementing data and map editing policies (*data quality* and *autonomy*), and lastly conveying 'what not to do' when participating in organized mapping efforts (*autonomy*) [84].

One of the reasons that the enactment of values in peer production communities is ongoing is that they are, in many cases, incommensurable. They therefore require continuous balancing, rebalancing, and negotiation between stakeholders, often through policy work. For example, the OSM community navigates frictions between values of data quality and contributor autonomy, as well as local mapping and inclusivity, using approaches such as guidelines, policies, and best practices published on the OSM community wiki [83, 89]. These approaches attempt to grant mappers flexibility (*autonomy*) while simultaneously ensuring some degree of consistency, accuracy (*data quality*), and *transparency* across a large and diverse body of contributors. Similarly, the community navigated a balance between a preference for *local mapping* practices while being *inclusive* to a growing variety of mappers and the diverse interests in the map that they held. The conflicting nature of these values raises questions about the potential and feasibility of constructive agonistic participation within a peer production community [92, 109]. This is juxtaposed with the prospect of undesirable outcomes and interpretations resulting from conflicting ideologies and beliefs. Lodato and DiSalvo characterize such instances as an ideological mismatch, which, in the context of OSM, poses a challenge to collaboration within the community [72]. These examples of value conflicts and the resulting efforts towards policies that assist in their resolution, in this case

through community guidelines, reinforce prior scholarship on the importance of robust conflict resolution processes in the functioning and governance of peer production communities [23, 50].

Within OSM, the OEG continues to be referenced in discussions amongst the community and will inevitably be subject to modification and update over time as new use cases and conflicts arise, new mappers join the community, and underlying values evolve. As this study suggests, peer production communities maintain and enact their values both during the creation of, as well as through their adherence (or not) to, community policies and norms. Conversely, this research also demonstrates that attention to value tensions can be useful for gaining insight into the design and uptake of policies that govern online communities. As we found, the ways in which online communities interpret, respond to, comply with, or defy policies are shaped by their values. Importantly, this includes not only the creation of community policies but also their maintenance, adoption, and modification over time. Understanding the import of a policy and its long-term effects thus requires an examination of not only it's written text, but also the community's underlying values.

Moments of conflict, episodes of policy work, and other forms of scalar labor emerge as important opportunities for gaining insight into the values of online communities that might otherwise be less readily apparent. Some of the values enacted by the OSM community in the debates over corporate editing are often left unstated, or needed to be re-articulated in response to the changing situation. As such, these events can be understood as a 'breakdown' [106], wherein the established patterns of participating in the OSM ecosystem were brought into contention. In our research, we found that the conflict served as an infrastructural inversion [16] that made shared values of the community more accessible as objects of study. Values are crucial aspects of the social infrastructure of an online community, and the conflict over corporate editing emerged as a breakdown that, for us, provided an opportunity to better understand OSM. Importantly, the breakdown also demanded attention from the OSM community, including sometimes painful debates on the mailing list, and was a driver for inventiveness and reconfiguration of community policy, social norms, and mapping practices. In other words, it led the community to enact its values in new ways. We anticipate that future studies into community policies through values-based approaches, as we have explored here, can yield further understanding of the governance of peer production for both scholars and the communities themselves.

7 CONCLUSION

The creation of the OEG, largely the result of community concerns about corporate editing, will have a long-term impact on the trajectory of OpenStreetMap. These guidelines may either, as some fear, lead to the eclipse of volunteer mappers by paid contributors or overly infringe on mappers' autonomy and limit new growth, either way leading to a hollowing out and decline of the community. More hopefully, these guidelines may help ensure that the community addresses some of the scalar debt [51] it has accumulated over the last decade of rapid growth, navigates the resulting challenges, and incorporates new members and approaches to mapping. The debates surrounding the development and implementation of the OEG have provided a site for the community to articulate and enact some of the shared values that animate the project. Through this work, we see value tensions, and the conflicts they may lead to, as inevitable, generative, and even beneficial characteristics of online collaborative systems. Furthermore, this study demonstrates that the values that direct and animate peer production are not static entities that remain constant during the life cycle of these communities. To the contrary, attending to the changing nature of values and their continuous re-enactment can yield important understandings of the long-term trajectories of online communities.

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