Mediating the Undercurrents: Using Social Media to Sustain a Social Movement

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ABSTRACT

While studies of social movements have mostly examined prevalent public discourses, undercurrents—the backstage practices consisting of meaning-making processes, narratives, and situated work—have received less attention. Through a qualitative interview study with sixteen participants, we examine the role of social media in supporting the undercurrents of the *Umbrella Movement* in Hong Kong. Interviews focused on an intense period of the movement exemplified by sit-in activities inspired by Occupy Wall Street in the United States. Whereas the use of Facebook for public discourse was similar to what has been reported in other studies, we found that an ecology of social media tools such as Facebook, WhatsApp, Telegram, and Google Docs mediated undercurrents that served to ground the public discourse of the movement. We discuss how the undercurrents sustained and developed public discourses in concrete ways.

Author Keywords

Umbrella movement; social media; social movement; undercurrents; discursive fields.

ACM Classification Keywords

H.5.3. Information interfaces and presentation (e.g., HCI): Group and organization interfaces – Theory and models.

INTRODUCTION

Social movements involve much work: tireless individuals, transitory organizations, planned and unplanned arrangements, and importantly, the various forms of social interactions supporting these activities. Previous investigations of social movements have mostly examined interactions from a public discourse perspective—that is, studies have focused on the collective action frames, or, the calls to action, employed by citizens through social media platforms such as Facebook and Twitter [1,5,7,14,17,18,25].

Beyond these public discourses, few researchers have examined the undercurrents, including the emergent activities and social tensions that underlie and, in turn, sustain these movements.

Research studies on social movements often emphasize high-level structures and ideologies, while paying little attention to micro-level activities and interpretive processes [3,26]. In fact, the collective action frame is also influenced by invisible interactions where meaning-making occurs at the grassroots level [3,26,27]. Large-scale civic action is complex, wherein the collective frame and the direction of the movement drift along with inner challenges, messiness, and spontaneity of the actions of its participants [3,26]. However, considering the invisibility of the activities underlying social movements, investigating these phenomena presents a variety of challenges—such as determining what types of activities to investigate, and how they support the emergent discourse that is visible to the greater public (see also [16,33]).

In this study, we used semi-structured interviews to examine social media use in the Umbrella Movement, which began in Hong Kong in September 2014. Our study suggests that information propagation over public media presents an abstract view of the underlying organization of a movement. While undercurrents directly influence future outcomes of public discourses, public information hides changing circumstances, conflicts, and dislocations, and thus does not account for what is emerging "on the ground" during social movements. *We contribute to the literature by articulating ways that undercurrents—supported by social media—shape public discourses and thus sustain a social movement.*

RELATED WORK

Public Discourses

Behind social movements are compelling and persuasive discourses. These discourses, brimming with calls to action, are best understood as *collective action frames* [26]. According to Snow [26], "frame articulation involves the connection and coordination of events, experiences, and strands of one or more ideologies so that they hang together in a relatively integrated and meaningful fashion." The importance of the collective frame is to bring together a myriad of dissimilar organizations and people to gather sufficient support to conduct the movement. For example,

the successful anti-IMF campaign in the 1980s brought together 133 different groups under the frame of anti-"world imperialism" [26]. Such frames are not creative slogans imagined to persuade participants to a cause; rather, they build on the participants' shared cultural history, so that the purpose of the movement reaches down and connects with "situation-relevant" meanings of groups of participants [26].

In human–computer interaction, studies of social movements have mostly been limited to analyzing the formation of *collective action frames* through information that is available on public social media channels, such as on Facebook and Twitter [11,19,24,31]. In general, findings suggest that during social movements, people are using social media for information seeking and dissemination [17,18,22,25,30], frame articulation work [5,7], expression of solidarity [30], and the development of counter-narratives [1,14]. While these findings have generated insight into the high-level discourse structures of any given movement, they have rarely revealed localized organizational forms and actions that may have also influenced the collective frames.

Recent work examining large corpuses of social media data have found that tools such as Twitter have aided citizens with dissemination of critical information during crises and political movements [17,18,25,30], supported citizens to collectively develop new frames [7], and to deliberate past and present actions [5]. Social media have also been used to express solidarity [31]. For example, in the 2013 social movement to support same-sex marriage, three million Facebook users changed their profile picture to express their support [32]. Finally, social media have been used to mediate the formation of engaged publics who use these tools to produce alternative content and counter-discourses, as opposed to those produced by traditional media [35]. For example, in the Egyptian revolution, analysis of blog content revealed that emerging public discourses served as counter-narratives to the government-reported version of these events [1,14].

When collective frames are more commonly chanted, headlined, and advertised over social media, they can be viewed as movements' purposes that are more visible to the public consciousness. Whereas previous studies provide much insight into the collective frames, or public discourses, of any given movement, social movements are much more complicated than what is publicly visible. Underlying social movements are nuanced activities and organizing work by those local and embedded actors within the public discourse [3,20]. Few studies have examined how various actors mobilize around any given movement, or how multiple voices and ideologies are tempered in support of establishing the collective action frame that sustains a movement [26].

Beneath the Discourses: Undercurrents as Discursive Fields and Organizational Work

Within social movements, undercurrents consist of a myriad of differing opinions, social dissonance, hidden tensions, and confusion over on-the-ground tasks and actions. The effectiveness of a social movement (e.g., whether it is broadening or losing support) cannot be adequately understood by solely analyzing the public frame; it is important to acknowledge that the public frame is also being shaped by *invisible* forces which offer limited accessibility to the public. The enlarged scope of discourse—including both visible public frames and invisible undercurrents—make up the complex discourse terrains in a social movement, also known as the *discursive fields* in which "meaning contests occur" [28].

The invisible work supporting a social movement goes beyond public discourses, and also includes *free spaces* that function as "seedbeds for democratic movements and alternative ways of seeing the world, beyond the commonplaces and inequalities woven into everyday life" [3]. Today, people have access to a variety of social media, and different platforms with varying affordances can be used to serve varying functions. In this view, there exists an ecology of tools through which people can engage in the discursive, organizing work, integral to the function of a social movement [21]. For example, technologies such as Twitter and Facebook enable users to broadcast messages to larger audiences, whereas technologies like WhatsApp and Instant Messenger facilitate more local, nuanced organizing work between different actors underlying a movement.

Recent work using in-person interviews to investigate the use of social media for political deliberation found that, contrary to the findings of publicly available social media data, citizens use an ecology of social media to manage tensions and reach out to different crowds in order to seek a more diverse and representative set of political opinions, as each media connects users with different audiences [22]. Similarly, people who perceive political differences with their friends tend to avoid Facebook as a discussion platform [10]. These findings emphasize, firstly, the importance of exploring the underlying use of social media during social movements, but also the importance of looking across technologies in relation to the broad spectrum of activities underlying a social movement.

In line with this view and most relevant to our study, Wulf, Misaki, Atam, Randall, and Rohde [37] caution against a deterministic view of social media as being the only channel used to influence the *online* discourse that emerges during a social movement. They argue that these tools may also aid participants on the ground as they organize their movement of resistance that may not be visible via public channels [37]. For example, during the Tunisian Revolution, social media were used by young activists to organize resistance movements in Sidi Bouzid [37]. Also, during periods of crisis and disruptions, citizens often leverage different social media to establish new routines and social

norms in order to return to normalcy [2,13,24]. Thus Wulf et al. [37] propose using on-the-ground fieldwork to triangulate with online public reports to identify the "reality" of a movement.

In human–computer interaction, we have long analyzed existence of work that is undocumented and informal (i.e., *invisible*) in organizations and theorized their formation [16]. In institutions, work can become invisible for many reasons: (1) the work is taken for granted as routines [29]; (2) the work is performed by devalued "non-persons" (e.g., domestic workers) [6,29]; (3) the work is an undocumented workaround [12]; or (4) the work is done "backstage" and away from the crowd so as to accentuate its "public performance" [29]. The last form of invisible work, backstage activities, explains why undercurrents need to be hidden beneath the public discourse—that is, *organizers want to amplify the collective frames to a sympathetic audience without revealing its complexities, contradictions, and inner tensions.*

The work underlying a social movement emerges within a larger context through which participants are trying to organize around a singular cause, yet little is known about how public discourses are sustained by the invisible work— the undercurrents—underlying such movements, and we wish to address this critical gap.

RESEARCH SETTING

Hong Kong had been a British colony for more than 150 years, until its reversion to the People's Republic of China (PRC) in 1997. As a Special Administrative Region (SAR), Hong Kong's administration has remained largely autonomous and led by a chief executive (the equivalent of a governor). By being autonomous, Hong Kong has kept an international border with mainland China; it also possesses a largely independent legislature, police force, academic system, and many of the freedoms enjoyed by Western countries, such as freedom of speech, the press, and protest.

In 2017, all of Hong Kong's citizens will have the opportunity to vote for their chief executive, but the nomination process remains controversial. According to the "831 decision" (signifying the date of the legislation made on August 31) of the National People's Congress, the national legislature of the PRC, two to three candidates will be nominated by a 1200-member committee. One controversy arises from the fact that more than 60 percent of the nominating committee members will be comprised of representatives from various industries and professional associations, instead of residential districts. The second controversy lies in the PRC commanding the final approval of any elected candidates, alluding to the fact that the nomination committee will select candidates who are likely to conform to broad national policies, rather than represent the interests of the general population of Hong Kong.

Citizens' dissatisfaction with the 831 decision was a major motivation for the *Umbrella Movement*. The movement encompassed a series of civil disobedience activities, including widely publicized sit-in protests that took place at the three major commercial districts of Admiralty, Mongkok, and Causeway Bay, from September 28, 2014 to December 15, 2014. The sit-in protests, known as *Occupy Central*, were partly inspired by Occupy Wall Street. The Umbrella Movement obtained its name from the protesters' use of umbrellas, during the sit-ins, as shields against pepper spray.

Figure 1. An image of a protester holding up his umbrellas after tear gas was fired. Image: CC-BY-ND Pasu Au Yeung on Flickr.

After the "831 decision," pockets of student activities began to emerge in universities and high schools. Student unions began to organize information booths, panels, and lectures to increase the awareness of the "831 decision." On the evening of September 28, 2014, and during a week of a university-wide class boycott, one of our authors, Waikuen, joined thousands of protesters as an observer at Admiralty, the administrative district of the Hong Kong government. Many students brought along a list of standard items— masks, cling wraps, bottles of water, towels, and umbrellas—in anticipation of the use of pepper spray by the police force.

Figure 2. Admiralty was crowded with protesters at the peak of the sit-in movement on September 29, 2014. Image: CC-BY-ND Pasu Au Yeung on Flickr.

The gathering started as a peaceful congregation. However, suddenly and without warning, smoke canisters were thrown into the crowd. As one participant shouted, "Tear gas!" a canister landed a meter away from Waikuen and

then exploded, causing frenzy in the crowd trying to flee the scene (see Figure 1).

The participants, upon leaving Admiralty, began to spill over to Mongkok and Causeway Bay. The next day, sympathetic citizens such as professionals, business owners, teachers, and parents began to join the students in the sit-ins, and the number of protesters peaked at an estimated 100,000 (see Figure 2). The movement began to receive attention in the global media, including *Time Magazine*. Even though the sit-ins finally ended on December 15, 2014, pockets of Umbrella Movement activities against the "831 decision" continue even today (at the time when this paper was being written).

METHOD

The data presented in this study is based on a larger research program through which we are trying to better understand how people are using social media to engage in political deliberation and social movements. This particular study focuses on the real-world, in-situ practices of participants in the Umbrella Movement.

Participants and Recruitment

Between September 2014 and May 2015, we conducted field studies and in-depth interviews with 16 Umbrella Movement participants living in Hong Kong. We gained access to our interviewees using a snowball sampling technique, which began with Waikuen, who participated as a participant observer. In the course of her participation, Waikuen recruited eight interviewees, as well as eight others who were referrals. Our interviewees included thirteen college students and three working adults; nine of our interviewees were men and seven were women. Our interviewees did not receive remuneration for their participation in this study.

Our participants were mostly college students, whom comprised a majority of the active protesters working on the ground. There are two other major groups not represented in our study, for example, *Scholarism* consisted of high school students, and *Occupy Central with Love and Peace* (OCLP) comprised working adults. In comparison to Scholarism, college students have more personal freedom from parents and universities, and thus more time and energy to participate. In comparison to OCLP, college students were likely to be more proficient with mobile apps and social media.

Of our student interviewees, eight were from University A, four others were from Universities B, C, D, and E, and one from a private college. Working adults consisted of two recent graduates and one employee of a civil association. All of our interviewees were between 20 and 24 years old, except for a civil association employee, who was 35 at the time of our interview.

We conducted 13 interviews in person, and three on the phone. Each of the interviews lasted no more than an hour. We asked questions including: "Why did you participate in the movement?" "What was your role in the movement?" "What technologies did you use in the movement and why?" These questions were designed to inquire into the relations between social movement activities and technology use, yet were general enough to allow the participants to express their experiences in their own terms.

We also collected archival materials in the form of Facebook data and historical documents (i.e., news publications), which we triangulated with our interview data. Following each interview, we asked participants if we could add them as Facebook "friend" or "follow" their organizations' Pages, in order to observe their online "public" behavior. Subsequently we became Facebook friends with seven interviewees and followed four organizations on Facebook.

Eleven of our interviewees stated that they represented themselves during the protests, while five represented different organizations. These organizations included legalized groups (e.g., universities and student unions) which had existed with longer lasting purposes before the Umbrella Movement. They were important pillars of this movement as they lent readily available participants, material resources, and a history of expertise in related activities.

Moreover, several informal organizations were formed as temporary social networks to serve special and short-term purposes (see [8]). These included: the *Political Reform Committee*, organized by students of private colleges in Hong Kong (大專政改關注組); and the *Civil Association Supporting Student Actions* (支援學界全民抗命聯合陣線), a joint association of several civil interest groups supporting students' actions. The *Class Boycott Committee* (罷課委員會) was organized by University A Student Union (UA-SU) to manage the needs of participating students at the campus level. Specifically, the *Class Boycott Committee* organized participants by work functions, such as "Supplies" (物资), "Operation" (行动), "Social Media" (情报), "Publicity" (文宣), and "Legal Assistance" (被捕支援組) to support various needs within the increasingly complex movement. For example, *Operation* participants were in charge of on-site work activities; *Publicity* participants were in charge of information booths and leaflets distribution within campus; *Supplies* participants were in charge of collecting materials such as masks and water for sit-in activities; and *Social Media* participants were in charge of information updates on Facebook and WhatsApp.

While the Class Boycott Committee encouraged students to participate in class boycotts, they left detailed matters, such as liaison with lecturers and class-related matters, to the students themselves. Other school-level class boycott committees were organized, including one among engineering majors, and another by public policy majors. These school-level committees managed local issues such as class attendance and course-related make-up arrangements.

Data Analysis

All interviews were recorded and transcribed in Cantonese, the native Chinese language of Hong Kong. The quotes were translated into English for the writing of this paper. All informants' names were anonymized and replaced by pseudonyms.

The coding process was initiated when interviews commenced, and continued after each respective interview was conducted and incorporated into the data corpus. Throughout the data collection and analysis, the research team met regularly to discuss trends in the observation and interview data. During this period, we also followed a total of 38 organizations' Facebook Pages, and received updates on a daily basis. The undercurrent theme emerged, and became the focus of this study, because our personal interviews had continued to uncover new practices unseen in this public media content. For example, the efforts students had made to liaise with lecturers and manage class requirements had remained a private activity.

We conducted a grounded theory-based iterative and inductive analysis of our field notes and interview transcripts using coding and memoing [4]. Through this iterative process, we identified, named and categorized phenomena found in the transcripts in order to generate general themes observed in the interview data. The goal was to understand and make sense of the subjective experience (phenomenology) of the research participants and allow themes to emerge naturally. Over time, the codes were reduced, under axial coding, to the themes presented in this paper.

MEDIATING THE UNDERCURRENTS

The majority of our informants reported using a variety of media, such as Facebook, WhatsApp, Firechat, Telegram, and Google Docs, to support different forms of work underlying the Umbrella Movement. Participants appropriated existing social media platforms to support the invisible work of the movement. In other words, people traversed an ecology of technological artifacts, and each artifact served different functions within the movement—for example, for public discourses or to mediate the undercurrents.

On the one hand, through analysis of informant Facebook accounts and organization pages, we found that Facebook was used to convey the public discourse of the movement. We found that these Facebook interactions were similar to what has been reported in previous work on social movements (e.g., [5,7]). For example, through our analysis of Facebook data, we found that people displayed solidarity in the movement by changing their profile pictures to a yellow ribbon in support of the movement, as well as to provide a counter-narrative to the news being reported by official government channels in Hong Kong (see Figure 3).

In Figure 3, we present a Facebook post shared on the Facebook page of a pro-democracy newspaper. The yellow ribbon illustrates how people were changing their profile pictures in solidarity with the movement, while the content of the post served to counter what was being presented in the mainstream news media. In other words, Facebook was used in support of developing a collective frame—that is, to present a unified front around a singular cause.

Figure 3. A Facebook post shared by a pro-democracy newspaper reporting on the tear gas incident.

Moreover, when looking at the broad range of technologies available, we discovered that people were appropriating an ecology of tools such as Facebook, WhatsApp, Telegram and Google Docs, to support the backstage, invisible work in support of the undercurrents of the movement. Our data reveals that social media platforms sustained the undercurrents of the Umbrella Movement in support of the public discourses, via the ability to mobilize personal networks, resolve gaps and breakdowns, and sustain "free spaces."

Mobilizing Personal Networks: Encouraging Participation in a Safe Environment

Social movements rely on participation by large groups of citizens that are already engaged in personal associations. In our study, these participants' involvements in various social groups preceded the movement. Their personal networks, a form of undercurrent, supported their migration towards new social causes that sustained the Umbrella Movement.

WhatsApp is a mobile instant messaging tool. It contains a "Group Chat" function, which facilitates persistent conversations with three or more of one's contacts. This function shares similar features with Facebook's social networks, but is centered around smart phones. In a way, the social networks mediated by WhatsApp existed as an alternative social network alongside Facebook. Before the Umbrella Movement, WhatsApp was already the preferred instant messenger for students coordinating school work, and our informants appropriated its use to encourage participation in the Umbrella Movement among their existing networks (see also [15]).

For example, S04 was already in a WhatsApp group with friends he had made during his freshman orientation program at the University A. The group, consisting of ten members, was discussing a variety of personal topics until one person brought up issues of the Umbrella Movement:

> Initially, I was already part of a group at [University A]. Some of our members began to participate in Occupy Central. And they began to share with us things related to Occupy Central. This went on for a while until it finally aroused my curiosity. Then, I decided: why don't we go together!

In these cases, private conversations allowed friends to encourage each other to participate in this protest. The personal feel of this conversational environment facilitated calls to action, as it supported direct, back-channel communication without the potential negative consequences that could arise from interacting in public channels visible by those opposing the movement. In these sit-ins, police officers would at times clear away barricades and supplies as the number of protesters dwindled to manageable levels. S03, who participated in the movement with a group of friends, had made use of her WhatsApp group to summon more participants when numbers at the protest sites were reducing to a critical point:

> For example, when the number of people at Lung Wui Road shrank to a critical level, we might send a WhatsApp message to inform our friends.

For participants who had previously organized other protests, they might activate their former participants to take part in the Umbrella Movement. For example, S01, an experienced activist and recent graduate of University E, had organized protests such as the "Opposition to Northeast New Territories" campaign—a protest against urban development of a key natural reserve area in Hong Kong. In both the new territories campaign and the Umbrella Movement, S01 used Facebook to call others to action.

S01 has also used social media to keep track of actionable information. Facebook is organized around users' own social networks. Therefore, a piece of information becomes more visible when shared by more users within their networks. Since September 26, 2014, S01 participated in the movement primarily because he felt that the younger students might encounter dangerous situations, and someone needed to be there to ensure the students' safety. He told us that he would leave the movement as soon as the students had decided to withdraw. Throughout the movement, he had continued to keep track of updated news on his own Facebook Page to determine if he should visit the protest sites. S01 told us:

> S01: First, I will head to any places that encounter situations. At times, I may receive words of people's attempt to stir up troubles [at the protest sites], and I will also head over.
>
> Interviewer: Where did you receive news of these incidents?
>
> S01: All from the Web.
>
> Interviewer: Facebook?
>
> S01: Facebook, eh—and also WhatsApp.

Here, S01 gave us the perspective of someone who could be mobilized for specific reasons, and the ways Facebook and WhatsApp provided him with actionable information.

Resolving Gaps and Breakdowns
Beneath social movements lie tensions, struggles, and breakdowns. Organizers attempt to sustain the movements by keeping these potential disruptions in check. In order to resolve breakdowns, people engaged in invisible work to: (1) organize people and the logistics in the field, (2) resolve issues faced by subsets of the participants (e.g., college students require alternative arrangements for taking classes and examinations), and (3) resolve disagreements between participants.

Directing and scheduling work: Virtual coordination to ensure safety
Organizing instructions were disseminated through social media. For example, social media were used to direct participants to specific places. Immediately after the tear gas incident on September 28, 2014, Facebook slowed to a halt, perhaps due to the large number of participants accessing it from Admiralty. Following this slowdown, the *Class Boycott Committee* of University A broadcasted messages on WhatsApp, reposted by the university's *Student Union* on their Facebook Page, urging students to leave the scene and reassemble at school, to ensure students' safety. Our participants forwarded the same information to their other WhatsApp groups, creating ripples of information across their social networks to announce a new gathering point.

Social media were used for scheduling public lectures and forums to teach ideologies and political theories. Between September 22 and 26, S08 invited many local professors to give lectures to local students regarding civil rights and issues in Hong Kong. During the sit-in, these civil classes, known as "Mobile Democracy Classes" (流動民主教室), were extended to the protest sites. Details of these lectures, including lecturer, topic, and schedule, were posted on

Google Docs, and shared on the group's Facebook Page (see Figure 4), and courses were visible to subscribers of the Page.

Figure 4 A schedule of public civil classes, publicly shared on Google Docs, that were taking place at the protest site.

Coordination work: Response and validation
Social media were used to organize remote participants for both work arrangements and contingency situations. During the 79-day sit-in, many students needed to return to class to take exams and catch up on schoolwork; with WhatsApp, they could be informed of arising needs on an as-needed basis, instead of being required to be present at the sites at all times. An example came from the *Class Boycott Committee*, where participants of various sub-groups were often put on standby to quickly respond to sudden changes at the protest sites.

Some students worked remotely, coordinating closely with students on the ground. For example, S01 and his friends organized themselves through a WhatsApp group into two *Fast Response Teams* (應急小組); one worked primarily on-site, while the other worked remotely. Much of the information being circulated on WhatsApp and Facebook could not be easily verified for authenticity. Through the Fast Response Team, on-site team members, which included S01, would "scout" the occupied areas for contingency situations, while the remote team would update verified information on social media. S01 said:

> Very early on, students from University E established a Fast Response Team ... We have a team of people [located] around the occupied area. For example, if they received information that many police are gathering at Des Voeux Road, our students will go to the site for actual verification. If it is true, [the second team working remotely] will disseminate the information [through WhatsApp groups].

For S01 and his teams, they were able to coordinate work across on-site and remote locations through the use of social media.

Negotiating rules and practices: Managing tensions between the movement and expectations for daily life
According to our study, social media were used to resolve social tensions and disagreement among participants of the protest. Certain undercurrents, despite their importance, contradicted the discourse of perceived solidarity, and the

resolution of these tensions was conducted outside of the public purview. S05, a male student from the University B, had participated in the Umbrella Movement since September 22, 2014, at the beginning of the class boycott. He joined the movement due to dissatisfaction towards the "831 decision." After more than forty days into the sit-in, he felt that the students had made little progress, public support was waning, and they should contemplate a new course of action. Yet, this was a sensitive topic, as it hinted at a possible unconditional withdrawal from the sit-ins—a widely unpopular idea among protesters. On October 21, 2014, the government of Hong Kong proposed, albeit ambiguously, that should students withdraw from the sit-ins, they would set up a platform for civil debates and discussion regarding the election in 2017. In response, the *Hong Kong Federation of Students*, a parent organization of all student unions in Hong Kong, proposed on October 26, 2014 to all Admiralty protesters to hold a referendum seeking consensus on whether to accept the government's proposal. However, many participants outright rejected the referendum, as they perceived the activity as a show of weakness and unhelpful towards their original objective (i.e., the abolishment of the "831 decision"). S05 explained their predicament:

> We had occupied [the streets] for more than 40 days, but the situation had remained as a stalemate. Nobody knew what we could do to help the situation. And there was insufficient communication among participants… I observed that there was not enough communication platform in the occupied area. The communication among protesters, and the communication among protesters and organizers like [the student unions] were inadequate... [even the referendum] itself was dismissed by protesters as a sign of failure. The reason that I had held [the "Umbrella Opinion Day"] was due to this unhealthy social atmosphere. Withdrawal was a taboo topic. But you need to know what should happen next. Do you really intend to stay there forever?

S05 revealed that 40 days into the 79-day sit-in, disagreement among students began to emerge about its unintended length, but it was a taboo topic that no student was willing to discuss in public forums. About the time of the referendum on October 26, the sit-in underwent a gradual decline.

S05 held the Umbrella Opinion Day in mid-November, and received over 2,100 responses answering questions about whether they would consider withdrawing, along with other open-ended questions. The event ended without any clear outcome, apart from the raw data that was published publicly on Google Drive, and shared on the Umbrella Opinion Day Facebook Page (see [34]).

Social media were also used to resolve barriers to participation. For example, our interviewee S02, a female student from University A, stated that she created the *Class Boycott Committee of Electronic Engineering* WhatsApp group for students of her major. S02 explained that engineering classes were often laden with tutorials

involving mandatory laboratory work. Unlike some other majors, engineering students could not perform these tutorials at home, and missing these sessions would seriously affect their grades. This WhatsApp group helped bring together engineering students facing a similar predicament, who also attended the same classes, to identify alternative arrangements to make up for their absence.

Sustaining "Free Spaces": Switching Between Social Media to Circumvent Authoritative Control

An important part of social movements is to maintain such free spaces in order to challenge policies put in place by authorities. In turn, authorities may attempt to disrupt the movement by suppressing the Internet networks [37]. For our participants, social media served as a way to support counter-measures in lieu of authoritative suppression. Through our analysis of informant accounts, we found that people were using social media platforms for secured communications, as a way of circumventing computer network blockage and censorship—or, to avoid surveillance by authorities.

During the protests, our informants feared that the government might attempt to shut down the mobile Internet to disrupt communication among participants. *FireChat* (firech.at), developed by Open Garden, Inc., is a mobile messaging application that allows users to connect to nearby users using Bluetooth. Like WhatsApp, FireChat offers a persistent chat environment. As FireChat can function without the mobile network, it was experimentally used by many active participants. But as hundreds of users were sharing one chat window, and without a pause function, the rapid posting of messages quickly made the app unusable. S03, a female student from University A and a user of FireChat, developed a weak workaround by turning off her Bluetooth network to pause the chat stream, so that she could take more time to read the texts. Though partially manageable, this largely limited the app's usefulness for engaging in deep conversation with other users. For that purpose, S03 relied on in-person discourse with friends when they met at the protest sites.

The protestors had feared that the police force had begun to monitor social media like WhatsApp for information regarding the protesters. Accordingly, the protesters began to set up secret chat channels at the protest sites. Telegram (telegram.org), an application similar to WhatsApp, is published by a German nonprofit organization, Telegram Messenger LLP. Telegram does not store deleted messages in their servers—when all chat participants delete a message, it can no longer be retrieved by anyone. Telegram users can also start a Secret Chat with others. Within a Secret Chat, all messages are encrypted and timed to self-destruct after all participants have read the message. However, since Telegram was a new and largely unknown social media app at that time, it was adopted only by the core group of on-site protesters, who were entrenched in day-to-day challenges and wished to use a secured

communication platform. S07, who frequently visited the protest sites, said:

> For example, we mainly use Telegram [for communications]. This is because everyone feels that it is safer. Also, we can delete our own chat history. In addition, we can choose not to save our messages. Therefore, I use the app to conduct all my key communications. Which means that we will only use WhatsApp for relatively shallow and trivial discussions, but leave all the important things to Telegram.

S09 was a student studying environmental issues at University A. Like S07, S09 adopted Telegram during the protest, but as a main communication platform among the Class Boycott Committee members. Through our analysis, we found that the more the protesters were embedded within the day-to-day actions of organizing on-the-ground activities, their technology uses shifted and adapted in response to the environment and challenges.

DISCUSSION

Whereas previous work has mostly focused on the public discourses of any given social movement [1,5,7,14,17,18,25], we extend recent scholarship by revealing the ways in which social media mediate not only the public discourses, but also sustain the undercurrents, including the "on-the-ground" activities, and the intricate dynamics between the former and the latter. The term *undercurrent* denotes activities taking place behind the scenes, which are difficult to identify on public media except by the participants (i.e., those who know where to look). In social movements, while public media often accentuate the public discourses (e.g., focusing on free elections, or economic losses and disruption), the on-the-ground activities that organizers have to deal with are often more complicated and conflictual than the intentionally clear-cut and compelling public discourses.

Importantly, undercurrents consist of the participants' on-the-ground experiences, and private interactions, which quietly influence the shifting edges of public discourses. The different forms of undercurrents, ranging from organizing logistics to resolving conflicts, require different forms of social media to mediate. The activities of any given movement emerge within a broad socio-political context where people are engaged in daily activities, such as going to school, while also trying to address an important social issue. Accordingly, there exist alternative social settings underlying public discourses for designers to investigate.

Understanding the Undercurrents

Undercurrents are concrete and persistent activities that exist before and after a social movement, encompassing people's personal networks, ecologies of resources, and free spaces. Compared to public discourses concentrated within centralized platforms, undercurrents are more distributed and less visible. Our findings suggest that the activities sustaining social movements, as well as emerging tensions, exist at a lower level of abstraction, and thus also

underscore the rise and decline of the Umbrella Movement. For example, S05 found that students were unable to openly discuss taboo topics such as withdrawal from the sit-in openly, as it ran against the thought current in the public discourse.

The foundation of undercurrents comprises core groups of citizens, in which group members share mutual trust. These core groups are often powered by citizen activities that are more persistent than, and foundational to, the on-site sit-ins, such as those found in personal associations (e.g., student bodies) and civic groups (e.g., environmental activists). Due to the necessity of nurturing this foundation over a long period of time, social movements are not "built in a day." Members of these social groups have joined the movement with already well-established social networks (e.g., WhatsApp Groups), and are thus quick to mobilize; and the members' pre-existing trust helps inspire other members to participate. Even after the sit-in, some of these building blocks may return to their mundane activities, but may exist as social fabrics of future civic activities.

The organization of work among these social groups requires coordination mechanisms. This organizational need arises from the challenge of optimizing the redistribution of work and available resources to so many disparate groups of citizens in order to achieve the best outcomes. In the case examined here, much coordination happened through embodied activities comprising undercurrents. For example, these include recruitment of participants, resource distribution, mediation of tensions, and formulation of long-term strategies.

These social groups also produce a great deal of information out of their distinct experiences in the movement. This information requires careful deliberation so as to resolve potential contradictions among social groups. In the handling of conflicts, organizers may arrange various forms of discussion so that citizens can achieve consensus and resolve tensions. The work of deliberation can also be used to validate possible misinformation. To maintain information accuracy, organizers may develop processes to verify a report before releasing the information onto public media.

Technology Selection and Use
Technology designers need to take into account in-situ technology use (i.e., where the action is) in order to develop appropriate tools. In our study, participants used an ecology of tools such as Facebook, WhatsApp, Telegram, Google Docs, and Firechat to cater to various undercurrent activities. For example, while Facebook was used most widely to engage publics that consumed and circulated a large volume of relevant information, undercurrents and subgroup interactions (e.g., class schedule) were purposefully targeting an intended audience. Alternative social media like WhatsApp were used by a small group of active participants to keep their social networks active (e.g., as participants of past social movements), and to mobilize

these participants for future activities. A smaller but more engaged audience (e.g., on-site participants) also tends to be more willing to adopt specialized tools such as Telegram.

To organize work among social groups, coordination mechanisms are embedded in diverse technology choices. For example, Google Docs provided an easy format for sharing schedules, which could then be shared on Facebook. Interestingly, some of these digital technologies had the unintended consequences of decentralizing many of the undercurrent activities away from the protest site; much of the social movement's work was conducted remotely and on social media. In addition, many "sit-in" protesters were not even on-site, but on standby on WhatsApp—ready to deploy at any given time. Students were able to resume mundane daily activities easily, while still being highly engaged in the movement, devising strategies to limit and work around government surveillance and potential action that could disrupt the movement. Even for on-site activities, social media can help restructure participants' communication practices [36]. With the right ecology of social media, social movements and their underlying organizing work can be decentralized in ways such that many of its component parts quietly disappear from public purview [20].

The work of deliberation also relies on careful choice of technology. Information that is circulated within public discourses tends to be carefully written and self-explanatory, but other information that needs to be deliberated among core participants is usually kept temporarily away from the public eye. In the Umbrella Movement, a rumor that needs to be verified is sometimes first deliberated by Fast Response Teams before being circulated to other WhatsApp groups. This information may then be disseminated to the public.

Social media can work both ways—for the citizens as well as for the authorities. While social media support work among citizens, they can also be used by authorities to perform censorship and surveillance. Our participants, in the maintenance of their free spaces, kept themselves up to date with technological options that circumvent information suppression and eavesdropping. For example, instead of using WhatsApp, some participants adopted Telegram, allowing for secured communications. But the appropriation of these tools for social movements is not without drawbacks. For example, while Firechat allows users to conduct on-site communication if the mobile network fails, a large crowd of users can easily clutter its chat stream—thus highlighting design challenges of social media supporting movements.

Lastly, we point to the changing design needs of social media during the course of social movement. As pointed out by S05, the build-up of tension among protesters, which appeared as a disagreement towards holding a referendum on October 26, was a culmination of ineffectiveness of social media, such as Facebook and WhatsApp, to research

popular opinions and mediate consensus-making within a large-scale and complex movement. Design needs of social media at the beginning of the protests, which generally focused on expanding the movement (i.e., to recruit, mobilize, and coordinate participants), may be different from when the movement has matured and requires consolidation (i.e., identifying popular opinions, and polling to make important decisions). This design gap appears to be a potentially rich area of work for designers with important implications to sustaining social movements.

Examining the Undercurrents
If discourses are visible "features" of a social movement, undercurrents are invisible activities that happen on the ground. Wulf et al. [37] suggest that on-the-ground studies are complementary to public data collection. We extend this by suggesting that examining the undercurrents could provide foresight to emergent features, thus broadening our understanding of technology use, and identifying deficiencies in the technologies supporting the activities that sustain undercurrents and thus social movements.

Undercurrents include both shared narratives at the subgroup level, and also embodied interactions at a personal level—as sights and sounds, and feelings of tensions and uncertainties. Such personal experiences are vitally important to social movements, as they motivate people to join the movement (or disenchant participants, prompting them to leave). And these personal experiences provide first-hand indications of whether the movement is going well: where barriers and obstacles to participation exist, and how participants feel about the movement. While these inner tensions are often so underreported that even a majority of users themselves may overlook them, it is the role of technology designers, who have a high stake in revealing ways that technologies mediate user interactions, to pay special attention to them and to identify design opportunities [9].

However, it is important to note that while on-the-ground methods may reveal underlying social tensions, participants may be more willing to reveal this information to researchers—but only if we are able to establish a participatory relationship with them. Fortunately, one of our authors was able to participate in the Umbrella Movement as a participant observer. Thus, we were able to uncover the social media strategies beyond collecting data on platforms like Facebook. We also gained access to core members and organizers of the movement, and acknowledge that such conditions may not exist in other studies of social movements.

Moreover, conducting on-the-ground investigation may be difficult, even dangerous to the field workers [37]. The Umbrella Movement was mostly peaceful, and actions of local police forces were generally restrained. In a climate of greater danger of violence, however, a workaround is to employ remote or retrospective interviews. In the area of crisis informatics, researchers have made use of phone interviews [23], and retrospective interviews with participants during events [23,37]. For example, Semaan and Mark [23] identified several examples of creative use of technologies, such as instant messaging, Skype, Facebook, and mobile phones, to mitigate problems in transportation, education, and information infrastructures. Wulf et al. [37], through their fieldwork in Tunisia in 2011 and one year after its revolution, managed to unveil information related to local organization of resistance and media suppression.

Despite these challenges, the benefits of examining the undercurrents should be enticing to designers. Beyond identifying social challenges of organizing on-the-ground activities, designers may uncover the extent of participants' finesse at adapting families of applications to organize progressively sophisticated collaborative work: switching from WhatsApp, to Telegram, to Firechat to mitigate surveillance, or the use of Telegram to coordinate on-site and off-site teams to respond effectively to contingency situations. While our research started with the intent to investigate hidden discursive terrains, what these participants have demonstrated are ways in which they could reconfigure this terrain—by using social media to improve the structure of activity and its performance. If not more relevant to design, these inventive work forms provide more compelling reasons, amongst others we have presented here, to examine the undercurrents.

CONCLUSION
While previous studies of social movements centered on discourse work has examined larger public discourses, our findings reveal that undercurrents among small social groups are equally important. Through our study, which examines social media uses in the Umbrella Movement in Hong Kong, we identified undercurrents including challenges in organizing as well as conflicting views among participants, leading to a dynamic discursive field. Undercurrents were often targeted at smaller subgroups, and for more specific purposes. Within a subgroup, participants were appropriating social media to mediate various on-the-ground activities, including mobilizing participants, and carrying out secured communications. We argue that undercurrents reveal the tangible design needs of participants within these hidden contexts. Thus, researchers should contemplate ways in which undercurrents can be effectively examined in social movements.

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