9

Maps as foams and the rheology of digital spatial media: a conceptual framework for considering mapping projects as they change over time

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Introduction

> The world of mapping has rapidly moved from provisioning users with static two-dimensional hard copy displays to maps that are on-line, immediate and dynamic. (Cartwright, 2013: 56)

With a curious twist, we have come to think of a map like a 'folding' map that we carry around on our travels – a tactile three-dimensional thing with movement encapsulated in its title – as *static* as Abend also argues in this volume. This kind of idea contrasts with the flat-screen worlds of digital mapping at which we gaze (often while sitting relatively inert). William Cartwright (2013) refers to a transition in mapping that is happening in our time. Published paper maps that provide static depictions of places, frozen at the moment of compilation, are being replaced by digital mapping which enables dynamic, interactive visualisations where map readers can track changes or make changes over time. In this chapter I explore how this dynamism changes the way we think about and study mapping. Unravelling the curious twist, I consider how maps can be dynamic in a number of different senses.

I begin by examining two senses in which contemporary maps or 'new spatial media' (Elwood and Leszczynski, 2012: 544) are dynamic. In the first sense, 'dynamism' is due to the technological possibilities of these new media, such as 'slippy interactive mashup map objects'; and second a 'dynamism' is described by theoretical perspectives drawn from contemporary critical cartography which see maps as 'mutable' and 'manifold'. Turning to the questions this raises

about how we might study maps as malleable changing objects, I suggest an analytical approach based on philosopher Peter Sloterdijk's (1998; 1999; 2004) concepts of *bubbles*, *spheres* and *foams*. These models, I argue, prove a useful way to conceptualise the fluid, contingent networks of relations that constitute dynamic mapping projects. Then, in order to illustrate how this conceptual model works, I examine a selection of crisis mapping practices focusing on the relations between maps and 'produsers'[1] (Bruns, 2006: 276); as well as the communities and interests that help determine the ultimate success and utility of crisis mapping efforts. Throughout, 'bubbles', 'foams' and the application of rheology (the physics of deformations and flows of matter) to mapping are up for discussion and critique.

Dynamic maps and new spatial media

In the online environment, maps can be very obviously dynamic; with interactive visual interfaces, possibilities for inputs by multiple produsers, and continually accumulating datasets. Functions like 'slippy maps' (where the map moves within a screen revealing more and more territory as we scroll) enable a haptic engagement where maps shift beneath our fingertips. Coding protocols promote the ready mixing and mashing of data into map interfaces, and datasets may continually accumulate as new data is fed into a map over time (sometimes purportedly in 'real-time'). Moving to mobile devices, we see maps change through our movement, navigating with us.

There are at least four different ways in which these new 'digital spatial media interfaces' are dynamic. First, there are animated visualisations, where different map features move on a screen interface to provide more information. For example, the effective animation in Figure 9.1 shows winds as they move around the globe.

Second, we see dynamism as a result of user manipulation of the map interface, such as slippy maps or the ability to select a particular base map, perform a sorting of map layers and so forth (Figure 9.2).

With the use of maps on mobile devices, user movement is integrated into the dynamic map interface such that the map moves in ways according to user location or preferences.

Third, there are maps where datasets are continually or periodically updated, either through automated feeds, user-entered data or the addition of updated information by the map administrators. The combination of crowd-sourcing with mapping encourages members of the public to add their own data or change data. The updated content might be geographic features in a base map or the

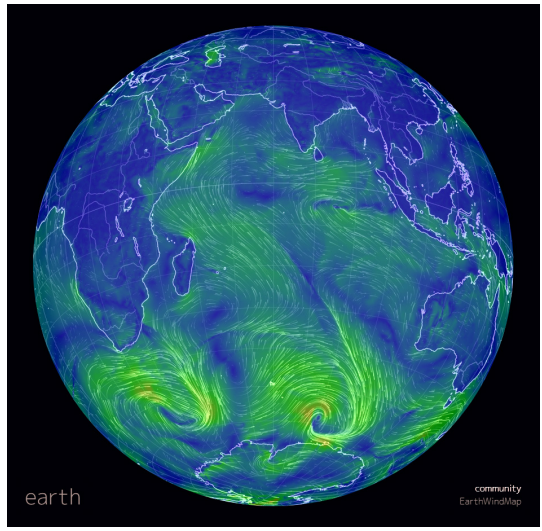

Figure 9.1 Wind map, showing the way winds are flowing around the Earth (https://earth.nullschool.net).

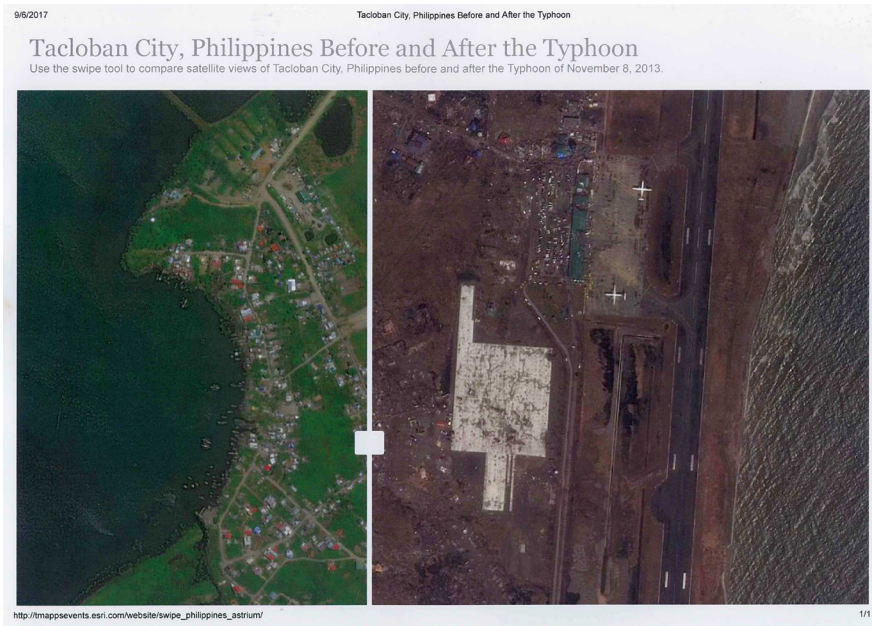

Figure 9.2 Haiyan/Yolanda Swipe Map, enabling comparison of before and after satellite imagery (www.esri.com/services/disaster-response/hurricanes/typhoon-haiyan-yolanda-swipe-map).

contribution of additional thematic data (see, for example ESRI, GIS Corps and StandbyTaskforce, 2013, where photos were added over time into a data layer).

The possibilities for recombination offered by digital presentation bring a fourth kind of dynamism. Maps are web elements which can be easily be cut, pasted, mashed-up, re-purposed and hyper-linked. Hence, the surrounding web context of the map changes. The website in which a map is embedded equates to what Woods and Fels (2008: 8–12) term the 'paramap', that is, the context surrounding a map that affects how it looks and is interpreted. The 'paramap' includes map elements such as title and legend (known as the 'perimap') but also extends to any documentation that explains what the map is showing (the 'epimap'). Maps thus change when a website design is updated or the map is re-presented in new sites, such as when a map is republished in a news report.

In each of these four ways, the content of the map and/or the interface is dynamic. Maps move, acquire data, have multiple authors and are adapted and re-purposed. The re-presentation of maps in a digital form also has implications for how we might 'date stamp' them or order them temporally. Websites might be periodically updated but there is no one moment of publication as there is with a paper map. Indeed, digital media in general is complex in terms of temporality. Following Tim Barker's writing about *Time and the Digital*, particularly his discussion of the philosophical work of Serres and Deleuze, it is probably useful to think of digital media as combining multiple temporalities (Barker, 2012). For example, when we access websites we consider them as 'present' or even as being in 'real-time', yet they build on a concatenation of data, conventions and actions from the past, and go on to have implications affecting users into the future. This complex temporality adds a further dimension to the dynamic map content and interactive interfaces described above. In the next section, I first discuss mutability of map objects and the implications of contingency for the study of maps or mapping projects, this leads on to a deeper consideration of temporality.

Mutability and contingency

Various authors writing within sciences studies and critical cartography have explored the ways in which maps change and move. Bruno Latour (1990: 37) famously coined the term 'immutable mobile' to describe how knowledge (geographic and otherwise) moves through the world using transferable yet fixed ways of understanding or acting – see Latour (1990). Sybille Lammes (2011) draws on this when analysing the mutability of maps used in online gaming

contexts. Lammes (2011) describes how due to the mobility of players and the mutability of the 'image of the map' (i.e. the graphic interface) the 'playing field' has become transformable, rather than static as with conventional board games. To Lammes, this makes the map almost a '*mutable* mobile' (Lammes, 2011: 3). But not quite, I presume, because there are still some enduring elements: conventions, code, rules and expectations that enable these maps to be recombined and reproduced. Nevertheless, Lammes (2011: 3) claims, 'the map itself has lost some of its immutability since the image of the map is constantly altered by the actions of the mobile player'. As such the visual experience of cartography within games, and much other digital spatial media, is dynamic.

Broadening our view to expand out from the central 'map image' to consider a mapping project or set of practices within which maps are embedded, we find another sense in which maps are dynamic, such that even good old paper maps, seemingly static on the page, are dynamic too. Del Casino and Hanna (2006: 36) call maps 'mobile subjects': 'infused with meaning through contested, complex, intertextual, and interrelated sets of socio-spatial practices'. They account for these practices in their study of the map use of tourism planners and tourists exploring place. Their work demonstrates that map making does not stop with the cartographer and continues through use and performative reproduction. The extension from 'map' to 'mapping project' signals the expansion of analysis away from the map object to a whole assemblage of actors – an ever-shifting constellation of the various cartographers, software, conventions, organisations and data sources (particularly previous maps), that, in combination, work to make, and continually re-make, a map.

Even when a map has been printed on paper fixed at a point in time, this network of actors and relations is fluid. The contingency of cartographic processes such as data collection, assigning of categories, and the different circumstances of map use (the same map being used in different ways in different circumstances) mean that maps as they are put together, reworked, folded or read are constantly in a state of becoming. Martin Dodge and Rob Kitchin (2007: 331) thus consider maps to be 'ontogenic'; their very being changing through use and context. There is a parallel here to Tim Barker's use of process philosophy in conceptualising digital media. He writes:

> the digital image, whether static or in motion, is the result of continuous and ongoing computations. It does not exist as a thing made but as a thing that is continually *in the making*. (Barker, 2012: 264)

Maps in whatever form are not static objects, but rather are dynamic, fluid and emerging.

The implications of such ontological instability for research about cartography are manifold. For critical cartographers, there is a practical conundrum of how to study and account for continually changing objects: if maps are so dynamic, continually changing, contingent upon context and use, how can we pin them down so as to discuss their content, intent and effects? Do we need to freeze these shifting multiple objects in order to analyse them? Through what means can we best understand these mobile subjects, mappings and mutabilities?

Several authors have approached this conundrum by taking what Kitchin, Gleeson and Dodge (2013: 480) describe as a 'processual approach'; analysing not only the visual content of maps, but the practices of production and consumption, performance and negotiation associated with maps or mapping projects. In practical terms, a variety of methods are used to examine mapping processes. Kitchin, Gleeson and Dodge (2013) employ an insider ethnography to relate the dynamic process of data collection and map making/use/re-use/re-authoring, akin to a diary or narrative journal of the life of their map(s). Through interviews and participant observation, Del Casino and Hanna (2006) used performative and ethnographic methods to explore their 'map spaces'. Chris Perkins writes too that performative approaches may be fruitful as these 'see mapping as not only taking place in time and space, but also capable of constituting both' (Perkins, 2009: 2).

In a recent paper, Bittner, Glasze and Turk (2013) discussed the applicability of Laclau and Mouffe's theory of discourse and hegemony as a way of conceptualising the contingency of mapping projects. This takes the idea that the world is constituted by linguistic and extra linguistic articulations that become fixed at moments of 'sedimentation', but that these discourses are always able to be contested. As a consequence, discourses, in this case maps or elements within maps and the map making process, are contingent upon assemblages of actors and practices. Again, in order to understand what the map is we need to analyse not only the map but the suite of people and practices that articulate and contest it.

Bittner, Glasze and Turk (2013) engage actor-network theory as a means of gathering together the actors and forces that influence a map, and hence conceptualise a map assemblage. ANT has been applied to examinations of contemporary cartography by several authors including: Chris Perkins in his study of mapping golf (Perkins, 2006) and Francis Harvey's analysis of the GIS in administrative contexts in the USA (Harvey, Kwan and Pavlovskaya, 2005). In their 'Manifesto for map studies', Dodge, Perkins and Kitchin (2009) suggest that network analyses could be particularly appropriate for studies of collaborative and open-source projects. For the study of digital spatial media, and more specifically interactive and collaborative mapping projects, ANT offers a

useful means of tracking and linking the various actors, including non-human actors (like datasets or software programs) as they affect a map over time. The network can encompass map producers, map users and the wider assemblages of actors supporting map production and use. It is a good way of sketching out myriad data sources and thinking about the chains of technologies that lead to a final map image.

Yet there are also limitations in using ANT to examine map assemblages. Foremost, while ANT helps us to consider and account for a broad range of actors, it does not, to my mind, provide a nuanced way of considering the relationships between actors. Despite attempts to differentiate and visualise the connections between actors, like that in Figure 9.3 from Jean-Christophe Plantin (2012), it is difficult to incorporate *how* organisations and things are linked to each other.

Moreover (and critically in the context of this chapter and book) it is difficult to incorporate *changes* in these relations, and hence to demonstrate how different actors work to produce maps or how these roles evolve *over time*. Returning to the question of how we account for the mutability of maps, we need rather a methodology which helps us to incorporate ideas of dynamic interfaces as well as shifting constellations of actors. Because maps are fluid, ontogenetic and

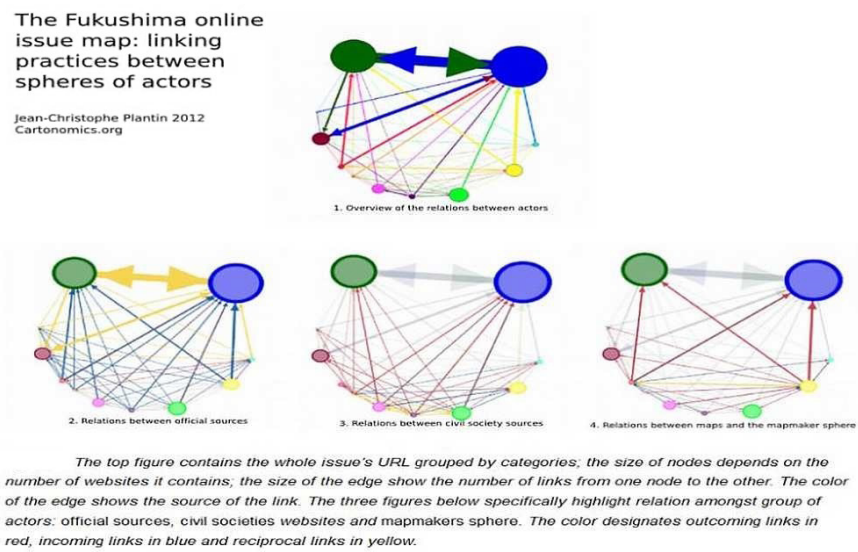

Figure 9.3 Differentiating relations in a network (from J. C. Plantin, 'The Fukushima online issues map: linking practices between spheres of actors', *Cartonomics*: *Space, Web and Society*, 2012).

contingent upon networks of relations, such a methodology should help us to identify factors that affect a mapping project through time, such as what leads to stability, rupture, wide acceptance or use.

Bubbles and foams

Philosopher Peter Sloterdijk's concepts of 'bubbles', 'spheres' and 'foams' offer just this: a way to conceptualise contingency and temporal variability in maps. In three connected books (Sloterdijk, 1998; 1999; 2004), Sloterdijk uses three sorts of sphere metaphors, or 'thought figures' as he prefers to call them (Funcke and Sloterdijk, 2005: 4), to examine social relations. The 'bubble' stands for the internalised world of the individual, insulated within a membrane yet in dyadic relations with the outside. 'Spheres' describes the idealised spaces of modernity, as all-encompassing universes; and 'foams' poses an alternative geometry for social relations where individual (bubbles) jostle within a 'multi-chambered system' (Sloterdijk, 2009: no pagination). Sloterdijk states:

> I try to describe these multiplicities of modern life in terms of foam-making – all individuals are living in a specific bubble within a communicating foam. (Sloterdijk, quoted in Morse, 2009: no pagination)

This idea of individual 'bubbles' within collective 'foams' has been taken up within cultural and architectural theory. Hélène Frichot (2009: 4) writes: 'contemporary society in the habitat of the city can be really said to behave in this way, like seething foam, co-isolated bubbles networked in … clusters and symbioses'. While my discussion of maps and mapping practices does not describe society at large and operates on quite another level, I find the concept compelling and applicable to the study of contemporary cartography, precisely because it is able to accommodate a communicating assemblage that 'seethes' through time. Mapping projects, like 'bubbles', depend upon internal substance as well as relationships with outside networks or 'foams' of actors. We can think too about the 'bubble wall' as an interface between the map and these actors, and ask questions about the quality of the interface, its stability and continuing utility through time. Third, a 'foam' is fluid and dynamic, seething as 'bubbles' merge and expand, fluid interfaces recombining to make new 'bubbles'. There is the interplay of surface tension in bubbles and jostling from neighbours, sometimes shaped by larger forces but also capable of maintaining a stable form for a while. In the next sections, I look at these three aspects of the metaphor (networks, interfaces and dynamics) in turn, before coming back

to the idea of temporality and going on to apply the maps as foams metaphor to a case study.

Networks, assemblages, foams

Taking a map as a 'bubble' in an actor-network of 'foam', I imagine individual maps as bounded objects with particular combinations of content, sitting within networks of other bubbles. As Frichot (2009: 3) suggests: 'the operational analogy of foam offers an alternative model to help understand these networks of humans and things'. Applying the foam metaphor, we can see how a map is not only connected to other actors, but created through its relations with them. A map is a contingent object held together by data, technology, use and reputation. It is formed through the interfaces with other actors. It is as if we inflate the nodes in a network such that rather than connections being the thin strings of a web, each entity shares an interface with the neighbouring actors. Figure 9.4 shows the difference between an illustration of the network of actors combining in a mapping project (taken from Bittner, Glasze and Turk, 2013) to a foam of the same actors, as a basic visualisation of the shift in conceptualising this assemblage.

This step is a critical difference from the network in that the very objects are constituted by their relations with other things. I find the emphasis on contingency useful in directing my research, not just to gather together all the actors involved in a mapping project, but to critically examine the ways in which they relate to each other. The surfaces connecting bubbles are interfaces that can be observed over time to gauge how other actors (other bubbles) affect the shape of the bubble, its stability and longevity – and ultimately its existence.

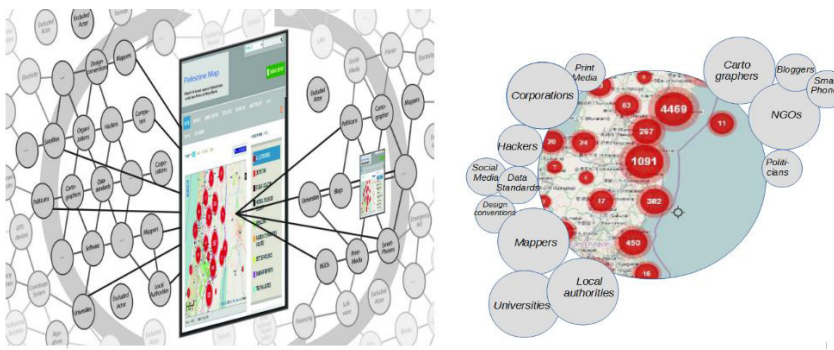

Figure 9.4 Assemblages – from network to foam. Based on original map by S. Adler, G. Glasze, C. Bittner and C. Turk.

Interfaces

Sloterdijk cites the architect Le Corbusier's reference to a soap bubble and his remark that: 'the outside is the product of an inside' (Sloterdijk, 2009: no pagination). This is true of a single bubble, where internal dynamics affect ultimate stability. But it is different in a foam: the outside of the bubble connects it to other actors. Bubble walls are interfaces, surfaces of exchange, representing continual to-ing and fro-ing between actors. These surfaces are the condition of contingency, as the means by which external actors affect the shape of the map-object. They are also a lens or film that mediates interaction. From the perspective of being within the foam, looking through the film from one bubble into another, the interface determines how neighbours exchange or view each other's content.

Thus, there are two ways in which we can make use of the idea of interfaces when imagining maps as bubbles – first, by examining the quality of relations between organisations and people and the exchanges or flows between them; and second, thinking more specifically about mapping, we can examine quite literally the quality of the mapping interface, such as cartographic design and usability. In so doing we need to take into account the multiple perspectives of users, imagining multiple positions from which we might look through interfaces into other bubbles. This ability to take positions is important to the study of interfaces, as Dodge and co-authors point out: 'interfaces en-frame and exclude, working as mediating windows onto the world … [thus] … the task of decoding the embedded cultural biases and distortions in processes of interface screening is challenging' (Dodge, Perkins and Kitchin, 2009: 222). Conceptualising interfaces as constituted by the interactions between actors means we are able to incorporate multiple (and hence biased) viewpoints.

Map interfaces are sites of exchange where information or influence moves between one entity and another. Rather than a strict boundary, the interface is a permeable structure made up of the exchanges to and fro between actors. Science studies scholar Andrew Pickering (2005: 21) has described these exchanges as a 'dance of agency' and, adding a temporal dimension, he shows how this dance constitutes the ongoing process of practice. Through working things out with others, an entity changes over time. Thus, the acknowledgement of contingency contains an inherently temporal dimension. Conversely, as Clive Barnett (2004: 17) describes, 'the poststructuralist understanding of temporality is in terms of a series of successive moments of pure contingency, tied together by nothing other than the force of an imposed convention or act of vitalistic will'. Coming back to our 'thought figure': through processes of articulation, the bubbles take on shapes and positions within a foam, yet these are, as Barnett (2004: 8) writes,

'only ever according to a contingent set of identifications that remain open to contestation'. The foam demonstrates the temporary nature of (map) assemblages, particularly the fluidity of interfaces/relations between actors.

Dynamics and temporality

> Time emerges from a process that flows through the nexus of perpetually perishing (and perpetually becoming) actual entities. (Barker, 2012: 1051)

Studying interfaces as constituted by the relations between actors in a foam leads then inevitably to a consideration of dynamics and temporality. The constellation of bubbles and the quality of interfaces are continually shifting, such that the contingent assemblage moves like a fizzy foam. There are a variety of ways in which we might observe how mapping projects (as foams) undertake transitions temporally. The bubble metaphor invites consideration of surface tension, playing off interior and exterior pressures. We might also study how map bubbles 'get oxygen' so to speak, or inflate through self-promotional 'hot air'. Even the stable maintenance of relations is a continual dance of agency between actors through time. Foam physicists (*rheologists*) describe transitions where bubbles switch neighbours or where bubbles are subsumed into others. Some of these may be appropriate descriptions of shifts between actors affording, building upon or diverging from each other in the course of a mapping project. Maps gain authority and stability from the stability and quantity of users or supporters, this too changes over time and affects the form of the map.

There are thus a variety of shifts or transitions we could use to describe the evolution of a mapping project. The complexity of relations is, however, only able to be captured approximately in the metaphor of the mass of foam. The messy frothing foam signals that multifarious processes take place simultaneously, some connected, others with slower knock-on effects. A research methodology might focus in on particular sets of exchanges and consider how they are part of interrelated dynamic processes, happening at different speeds and scales. Tim Barker describes the multiple temporalities of digital media, where 'the time of the software, the time of the network, and the time of other users are all put in relation and are experienced as a mesh of multiple domains of the temporal' (Barker, 2012: 1586). Examining these, we can also draw on James Williams' discussion of Deleuze that introduces 'a formal network of processes defining time as multiple … [operating] on one another but in different ways depending on which process takes another within itself' (Williams, 2011: 3).

Deleuze provides three different 'syntheses' of time that unsettle the concepts of 'past', 'present' and 'future' and examines how these concepts act upon each other as dimensions synthesised through particular processes (Williams, 2011). For example, Tim Barker suggests that: 'the digital medium is not merely a means of representing the world. Rather it is a mode of recomposing the present, of providing a means to rethink the present' (Barker, 2012: 102–103). He goes further to say digital media 'provides the potential for the actualisation of events and a state of presentness in which the past is constantly re-presented in the present' (Barker, 2012: 74). The endeavour to provide maps in 'real-time' underscores the emphasis on *representing* in online interactions, as previous datasets, programmed code and even future scenarios are drawn into suites of information exchanged in a present engagement between user and digital interface. In Barker's terms: 'the human user is temporalised by the digital process as his or her actions become transposed into the digital and this action alters his or her movements in the present' (Barker, 2012: 62).

Within the 'foam', we could account for multiple perspectives to examine how different actors in the assemblage 'temporalise' each other. How do past mappings work on new data? How do programming protocols produce particular ways of moving through sequences of dynamic maps? How are map curators temporalised by the flows of new map data? How does the presumed 'presentness' of real-time mapping feed into map use? Furthermore, acknowledging the multiple temporalities of digital spatial media, we might ask how these interactions are happening at different scales: from the micropolitics of interactions along 'bubble' interfaces to the larger ebbs and flows of the collective. Yet it is easy to get carried away with metaphors. The best test of utility is to see how the concept works with a concrete example, whether the 'thought figure' helps in shaping a research method.

Crisis mapping foams

Natural catastrophes, or crises, like earthquakes, typhoons, tsunamis and bushfires, are heightened events where time is said to be 'of the essence' in coordinating a response to save lives and property. Here I examine how dynamic maps, digital spatial media, are being used to respond to such crises. I use my approach to the analysis of interactive 'crisis mapping' projects as a means to explore and review how using the concepts of 'bubbles' and 'foams' can help us to make sense of these mapping projects over time. The mapping of crises is an apt case study because we see how maps seek to account for shifting landscapes

and changing circumstances, the temporal emergence of a crisis is echoed in the ways mappings emerge during crisis response.

Maps are an essential medium for organising and sharing information in emergency contexts – think of the big wall maps common in emergency coordination centres. *Crisis maps* are online collaborations where volunteers create maps to help understand and respond to natural disasters and political conflicts. For example, following the huge storm Typhoon Haiyan (locally known as Yolanda) which hit the Philippines in November 2013, several maps were created to help make sense of the crisis and to coordinate the aid response. Immediately after the storm, volunteer cartographers travelled to the Philippines to supply maps to the emergency responders. At the same time, mappers both amateur and professional worked together online to map the catastrophe from afar.

Here, through a 'foam' inspired investigation, I track these projects, exploring the actors they bring together, the way maps gain traction among actors (and hence relevance to the disaster response) and how this changes over time. Following archival research and participant observation, a range of mapping projects have been analysed (see Table 9.1 below).

Employing a methodology inspired by the bubble/foam metaphor, for each of these examples might usefully deploy questions documented in Table 9.2.

Table 9.1 Archival mapping sources used by author for analysis

Mapping project	Source
Humanitarian OpenStreetMap Team (2013)	https://wiki.openstreetmap.org/wiki/Typhoon_Haiyan
VISOV (Volontaires internationaux en soutien aux opérations virtuelles)/ Ushahidi Crowdmap (2013)	https://haiyan.crowdmap.com
University of Heidelberg/Ushahidi (2013)	http://crisismap.geog.uni-heidelberg.de/ushahidi/login
StandbyTaskforce/GIS Corps/ESRI (2013)	www.esri.com/services/disaster-response/hurricanes/typhoon-hayian-yolanda-maps
Google Crisis Response (2013)	http://google.org/crisismap/a/gmail.com/TyphoonYolanda
Tomnod Satellite Image assessment (2013)	www.tomnod.com/campaign/haiyantyphoon2013
Philflood map/Ushahidi Crowdmap (2013)	https://philfloodmap.crowdmap.com

Table 9.2 Questioning the mapping bubbles and form

Internal substance:	What is the content of the map? What form does the project take?
Relationships between networks/foams of actors:	Who is involved in making the map? Who uses it? How established are its supporters? Are potential actors left out? How does this change throughout the project? What sorts of practices maintain the foam?
The quality of the interface(s):	How is the map used? How is it communicated? How stable or credible does it seem (to other actors)? How do the actors interact with the map and with each other?
Continuing utility through time:	How has the map changed? How has the 'foam' around it shifted? What are the common understandings that hold a foam together? What sorts of data flows have been incorporated? What sorts of feedback processes does this entail?

Through this sort of analysis, it is possible to draw out factors that have influenced the ability of these crisis maps to reach their set objectives, considering, at the same time, barriers and rupture. Some of this research is presented here, demonstrating how the 'foam' metaphor and the emphasis on networks, interfaces and dynamics might be applied to an analysis of mapping.

Networks

Probably the most highly publicised map response to Typhoon Yolanda/Haiyan was the work of Humanitarian OpenStreetMap Team – HOT (2013). The 'Hotties', as they are known, engaged volunteers who worked together online to help trace map features from satellite imagery to create maps of the affected areas (examples of the HOT maps are shown below in figures 9.5, 9.6 and 9.7). This sub-group of the OSM community has established protocols for responding to crises and is part of international networks of institutions assisting disaster response. Furthermore, it has an established base of volunteers, who have mapping and programming skills, as well as resources for quickly training newcomers to help map. Communication channels are well set up and those contributing to the map can make use of an interface that has been evolving through user

feedback. As a result, the HOT team was able to rapidly supplement existing maps of the affected areas (using pre-disaster satellite images from Bing maps) and then, in a second phase, map the extent of damage because they were granted access to post-disaster satellite imagery.

This mapping project 'bubble' is well supported within a relatively stable 'foam' of significant long-term actors and many smaller contributors. The reputation of the existing organisation, the number of people contributing and the stability of key actors supporting this mapping project are all factors that have promoted the project's longevity and success, not only in getting the mapping work done, but in sharing the map with users (both in the disaster affected areas and elsewhere). The HOT map stands in contrast with maps that have had poor uptake due to a lack of engagement, such as https://philfloodmap.crowdmap.com/ where there have been few entries and hence a very small network of adjoining bubbles.

Interfaces 1

Often the quality of the interface plays a role in determining a map's wider circulation and use. This Google map (http://google.org/crisismap/a/gmail.com/TyphoonYolanda) has large icons which often overlap, making it hard to recognise resources available or get an overview of the situation. Thus, despite the overwhelming reputation of the parent organisation, the map has limited use. Another map drew on a popular crisis mapping software (Ushahidi), and was instigated by a reputable academic institution (University of Heidelberg, 2013) – both established actors – but password access meant that potential users were vetted. The audience of passive map viewers (who might have browsed the map but didn't want to register) was thus also restricted, limiting the circulation of the map. In these last two cases the interface – the ability of others to interact with the map – determines who is included in the (foam) assemblage and the terms of the relations. It is worth noting these are reciprocal conditions: the more actors there are, the more information that is able to be contributed to the map, and therefore it is more likely to attract further users. We might think of this as the 'stickiness' of the bubble assemblage.

Interfaces 2

More is revealed about these projects by examining the other sense of 'interfacing'; how map users or contributors interact with each other. Rob Kitchin and Martin Dodge have noted the way in which crowd-sourced projects, like OSM, demonstrate shifting ontologies of mapping projects because they expose

the decision-making processes and contingencies in map production. They write: 'OpenStreetMap is a valuable "live laboratory" in which to explore the ontological politics of cartography and the ways in which a mapping ontology "appears solid, but is in fact always shifting"' (Dodge and Kitchin, 2013: 29). Because discussions about decisions are archived in emails lists and a wiki, we can see through the discourse how and why curatorial choices were made. Actors work contingently to affect the OSM map making process, jostling in a way we might imagine as akin to bubbles shaping each other in a foam.

In this case, a chain of emails between participants who helped HOT's online response to Typhoon Haiyan/Yolanda reveal some of the micro-dynamics of this mapping project: from the initial email before the storm warning alerting members of the possibility that their help may be needed, to the negotiations of specific mapping practices, such as how to label damaged buildings or gain access to satellite imagery. Emails written by different users give us positioned descriptions of the process, thus we can see how those new to HOT or OSM sought clarifications about mapping protocols, or those representing aid organisations put questions to the HOT community. Feedback from NGOs using the HOT map in the affected area helped to inform the way map features are edited, and some of the online mapping community even found opportunities to undertake fieldwork, further enriching the map. These processes of feedback at the interfaces (exposed for my research in this case in the HOT email list, but taking place continuously through discussions and interactions between actors) describe the continual shaping of the map.

Dynamics

Taking these exchanges as a starting point, the following sections and the accompanying cartoons (see Figures 9.5, 9.6 and 9.7) focus on micropractices at the interfaces between actors. They serve to demonstrate ways in which this approach helps to study the dynamics of mapping projects. Three different perspectives are presented examining: dynamics between actors; dynamics within a map; and dynamics of 'foams', respectively. Each shows how the 'foam' metaphor enables a consideration of temporality and changes in relations.

1 Dynamics between actors: shaping networks over time

The HOT mapping project, as described above, is an example of a well-supported and used map. The stability and established reputation of organisations associated with HOT has helped to circulate the map among emergency responders working on the ground in the Philippines, as well as among those

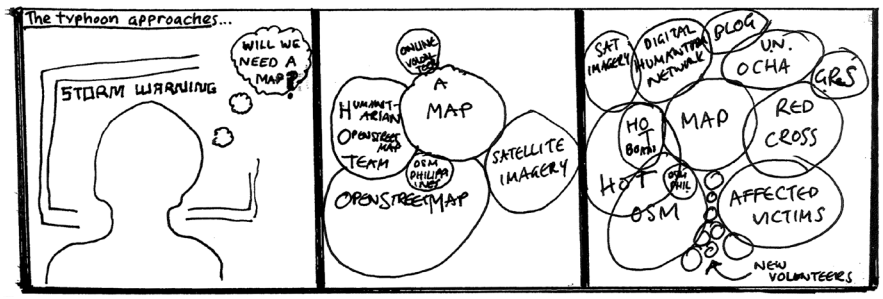

Figure 9.5 The HOT mapping deployment post Typhoon Haiyan/Yolanda: inception and growth (author's image).

coordinating the response. Here, the foam illustrates an assemblage where the support of significant actors gives credibility and extends the possibilities for wider map distribution and engagement. These stable actors give support to the project through the stability of the interface.

Yet there may also be dynamics that lead to the possibility of rupture. At one stage, the HOT email list shows frustrations felt in waiting for access to satellite imagery. While some of the coordinating group were undertaking negotiations with larger institutional partners, others set up a petition to try and lobby for speedier access to the imagery. Emails allude to tensions between the HOT board and a petitioner. In this case the bubble doesn't split but stability is disrupted.

Another example shows dynamics between actors and how we can take positioned viewpoints into account, looking through the foam.

This sequence of events shows how the network of significant actors, while promising stability, poses some risks for how the HOT map is viewed. In this case, a partnership within a network of emergency response organisations

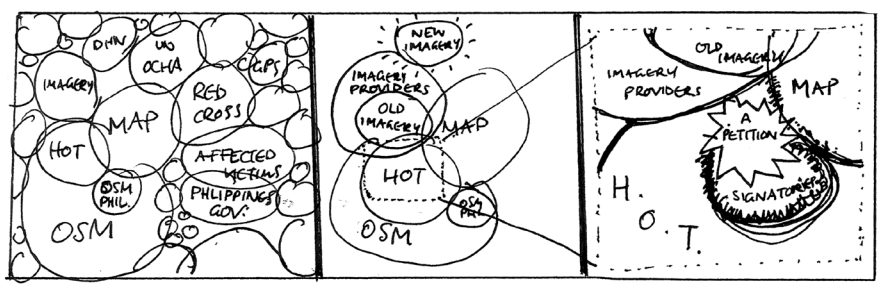

Figure 9.6 The HOT mapping deployment post Typhoon Haiyan/Yolanda: discussion and disruption (author's image).

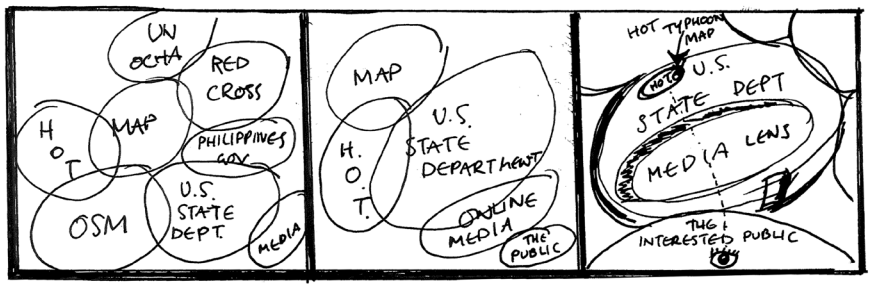

Figure 9.7 The HOT mapping deployment post Typhoon Haiyan/Yolanda: viewed through other actors (author's image).

and, in particular, a close engagement with the United States government's State Department, potentially overshadows the work of HOT. The ambiguous phrasing of this article (DipNote, 2015) about HOT work, in the context of a joint project with the State Department known as 'Mapgive', implicitly credits the US Department of State for the HOT's Haiyan/Yolanda response (Amrwaga, 2015). While the State Department would most probably clarify the nature of their engagement, from the perspective of an outside actor reading about these mapping activities, the State Department 'bubble' takes in the HOT work. These small interactions, insignificant in the overall work that these maps set out to do, are relevant here because they signal how a map is contingent upon the ways it is generated, presented and used.

2 *Time within a map*

Maps are opportunistic compilations of data, 'bricolage' as John Pickles puts it (2004: 88; following Lestringant, 1994). As such, data from different sources and time periods may be combined together into a map, sometimes in a chronological sequence, but often containing disjunctures and inconsistencies. Take as an example this screenshot (Figure 9.8) from the Volontaires internationaux en soutien aux opérations virtuelles (VISOV, 2013) Ushahidi Crowdmap of damage from the typhoon.

The screenshot shows map data in the form of a list of reported entries, mainly incorporating photographs of damage. Reports are date stamped at the right according to when they were entered into the 'crowdmap' database. Some reports contain dates as part of the data entered – see 'Nov 11 AFP' in the third entry, for example. We could assume this was when the photo was taken, but it could also be when the organisation received the photographs from someone else. So there are least two different times combined into the photo report and

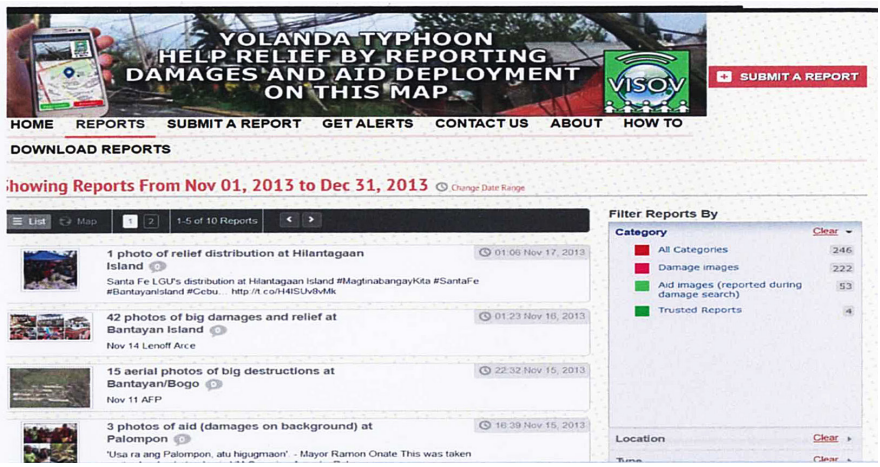

Figure 9.8 Mapping software collating crowd-sourced reports about storm damage (Volontaires internationaux en soutien aux opérations virtuelles, https://haiyan.crowdmap.com).

going back in the chronology there is also the time when the damage occurred. There will always be a time lag (no matter how sophisticated the software) between the moment an event happens and when it is recorded. In the online context, there is also the further issue of how the software copes with multiple time zones and correspondences between the time of the server and of the user. This series of times and events then becomes collapsed into a report which, in turn is translated into a dot on the map.

The crowdmap software enables users to filter reports according to date – noted here by the red text 'Showing Reports from Nov 01, 2013 to Dec 31, 2013' – such that a map image might only show a subset of reports. The map database, however, is an accumulation of reports over time (see Figure 9.9). Curators may have the ability to delete reports, but in practice most crowdmaps consist of a piling up of data, such that calling up a map in the present includes old and new data, some potentially out of date. There is therefore a need to interpret maps critically and ask whether the current version reflects a real-time present.

The processes of data capture and representation draw together events happening at different times and reconfigures them in a map interface. Again, employing the metaphor of a foam assemblage suggests honing in on particular practices that contribute to the temporality of a map through these technological engagements.

Like the adding of damage reports through the software interface, a second example of complex temporalities feeding into the map is that of mapping

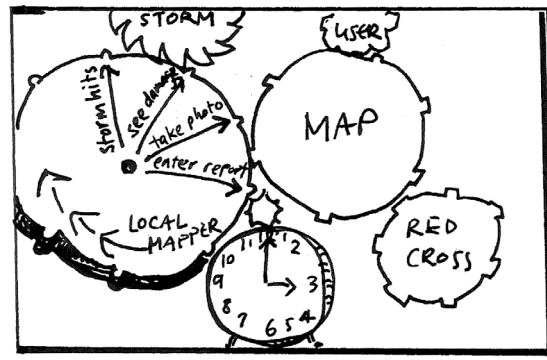

Figure 9.9 Foam interfaces can be thick with multiple temporalities (author's image).

damage from satellite imagery. A couple of the case study map examples make use of satellite imagery of the damaged areas as it becomes available. The Tomnod project (Digital Globe, 2013), one of these examples, invites members of the public to scan satellite imagery, crowd-sourcing the job of processing hundreds of square kilometres of land to recognise damage from the air. Taking a performative approach to these practices of doing the scanning work, we see how this process of map or image interpretation involves toggling backwards and forwards between pre- and post-disaster imagery. By undertaking this jumping through time, the user sees and experiences, albeit through a mouseclick, the effects of the storm. Each new tile viewed begins this process of time travel and (armchair) experience of the disaster again.

The HOT email list shows there was a considerable drive to achieve up-to-date maps using the latest satellite imagery (and this in a timely way), but even in this striving for proximity to real-time, the present is mapped with reference to the past. In order to map what is damaged we need to know what was there before. It is important to remember this, given the internet's sense of always being in the present, meaning what we access today we often assume to be current. This is particularly pertinent in the context of a 'crisis' where the urgency of response is a plaidoyer for attempting to map in real-time. Yes, in comparison to a static wall map, digital spatial media offers possibilities for integrating new data as it is produced, including incorporating non-human sensors. Further, the ability to animate the map provides an interface that seemingly moves with the times. We imagine real-time as represented by the moment new data pops into a map on our screen. Still, David Pinder's warning (2007: 460) not to get caught up 'in the giddy spectacularised techno-rush that promises even more powerful techniques of visualisation', is sound advice. In a way, as we focus in on the micropractices of mapping and take a 'freeze frame' in order to interpret

the gushing, foaming streams of crisis data, we heed his call for slowing down and pausing.

3 *Foams over time*

Yet how might we take an assemblage of seething foam into account? One way is to recognise and chart the multiple temporalities working on each other, such as the ways in which older data is incorporated, or how remarks about the present rely on knowledge about the past. As a crisis develops and mapping effort follows as part of the response, the expected temporality of rapid exchanges and updates may be frustrated or disrupted; the tempo changing depending on accessibility of information about the crisis or resources to help contribute to a map. Temporality is thus a significant dimension in the relations between actors in crisis mapping assemblages.

It is also possible to conceive of the temporality of the foam at another scale, not just in exchanges between individual actors, but as a way of considering how the collective moves and changes. From the jostling of bubbles and study of surface tensions, we could, maintaining the metaphor, go on to examine the larger 'oceanic' movements; the forces that churn the foam and affect the longer term progress of these projects (see Figure 9.10). Oceanic metaphors have also been used to refer to big data – we hear for instance about a 'tsunami of information' (D'Antonio, 2011; Brown, Vinzi and Glady, 2013). Crisis map project-histories could very well be put in similar terms coming into being on a tide of concern; being brought to the fore through media interest in the disaster, churning and collecting more actors; and sitting in clusters that after time and exposure become subsumed into the ether.

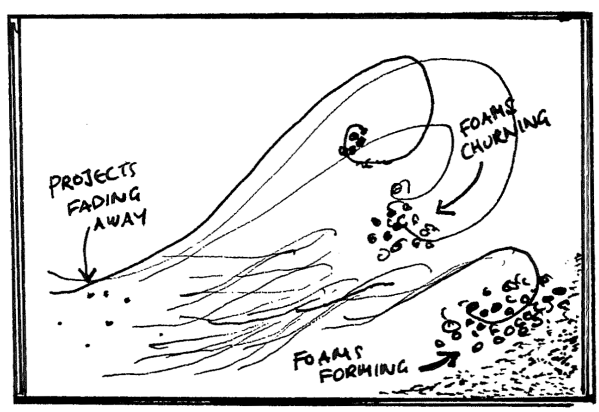

Figure 9.10 Map project histories, with apologies to Hokusai (author's image).

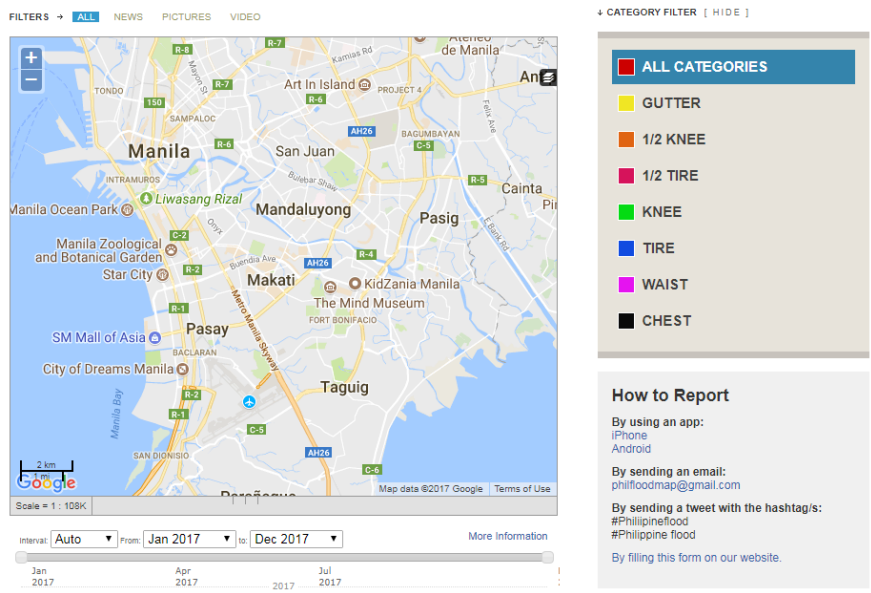

Figure 9.11 Crowd-sourced reporting of water heights. Information is current for a limited time. Philippine Flood Map 2013, https://philfloodmap.crowdmap.com. Map data © 2017 Google. This figure has not been made available under a CC licence. Permission to reproduce it must be sought from the copyright holder.

There is too the ephemeral nature of these maps and their overall relevance in the big scheme of disaster response. These maps are often a 'drop in the ocean', they have a moment of exposure and fizzle away. Unless a significant actor or a great many users latch onto the map, it is taken back into the sea of data. In the life of a 'fizzing map foam', new actors join, others leave, engaging or disengaging with the interface. Some maps, like the Philfloodmap example in Figure 9.11, are designed for a short period of use. In this case users should report in when water reaches a certain height.

The information is relevant for a brief, critical period and depends upon user input during this time in order to work. If there is poor exposure or users engage only briefly without contributing reports, then there is little content. The map may be subsumed among other sorts of crisis information and fizzle away.

Here the emphasis on the dynamics of map project history provides a more nuanced account of these maps and the work of those creating and employing them. As a method for studying maps, we can include a level of detail accounting for the multiple temporalities of map assemblages at different scales. This is particularly relevant to crisis mapping; where maps can be generated and edited quickly and the situations in which maps are used may also be subject to

rapid change. Often maps are being made in two time frames at once – sourcing pre-disaster information and attaching post-disaster reports. Furthermore, the constellations of actors move and slip as aid agencies, local communities and online collaborators join, make use of, or discard the maps produced. The foam provides a figure that helps to encompass these actors and actions, while maintaining a central interest in the map.

Conceptualising maps that shift with each moment

> Once you begin a hunt for spheres in the form of bubbles, globes and foam, and so forth, they seem to spring up everywhere, appearing in all variety of shapes and sizes and inaugurating all kinds of relations. (Frichot, 2009: 4)

Sloterdijk's 'thought figure' is compelling. The bubble/foam topology is an attractive way to conceptualise an assemblage. As Sloterdijk (2009: no pagination) himself has remarked however: 'it is not a universal theory but an explicit form of spatial interpretation'. Having explored the possibilities here, I consider it offers a useful way to organise research about relations between objects and the networks/foams within which they exist. Most importantly for our discussion here, the foam metaphor helps to convey the contingency of mapping projects and the dynamism of relations. Not only the dynamics of map content within new spatial media, but significantly the dynamism inherent in all maps. Furthermore, we can incorporate concepts of interactivity; bricolage (reuse and recombination of data etc.); stability and fragility; manifold perspectives and the mediation of interfaces; as well as ideas of (surface)tension and exchanges of agency. Not to mention the possibilities of viscosity: how foams fizzle and seethe according to multiple temporalities.

Through the example of mapping Typhoon Haiyan/Yolanda, we have been able to showcase some of the methods by which the foam metaphor can be applied to help shape the inquiry and better understand the dynamic relations within crisis mapping projects. This has helped to show projects where there is stability and good reception of the map, as well as how maps have utility for short periods of time or specific groups of users. As Annemarie Mol and Marianne de Laet say of the fluid networks surrounding the technology of the Zimbabwe bush pump (Mol and de Laet, 2000), there is no binary assessment of whether these maps are successful or not. Rather the researcher allows herself/himself to be moved by them. Along these lines, I should acknowledge that the fluid mass of foam includes me as researcher, my views on how these crisis mapping projects look and work are positioned within the foam too.

Considering digital spatial media as combining multiple temporalities, it is worth noting how data and relations accumulate in crisis maps over time, as well as how collaborating in real-time intersects with the contingency of mapping projects. Employing a method inspired by foams, we have accounted for these dynamics at different scales: both the micropolitics of interactions at the interface and the larger ebbs and flows of the collective. The transition from 'networks' to 'foam' incorporates concepts of 'ontogeny', and enables the processual approach to understanding maps to account for project histories. The jostling of bubbles in the foam is a potent way of imagining maps and engagements with maps, including the flurry to map order into a crisis.

Note

1 The term 'produsers' is used by Bruns (2006: 276) to reference a hybrid of map producers and users.

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