From Publics to Communities: Researching the Path of Shared Issues Through ICT

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Abstract. In recent years, citizens' movements such as the Arab Spring or Euromaidan protests have clearly shown that, whenever affected – whether negatively or positively – by the state and government decisions, citizens act to deal with the shared issues. Groups of people who organize themselves to address (mainly political) issues were defined as a 'public' by the philosopher John Dewey. He believed it is necessary to improve communication to create a 'Great Community' as a cohesive group of a public. Although information and communication technologies (ICT) lead to ambivalent effects on pursuing this goal and often distract the mass of people from discussing these issues, we argue that nowadays ICT can improve communication and has the potential to foster the detection of issues and therefore promote the (trans-)formation of a public into an issue-based community. As our foundation we took a literature study covering the formation of publics and their potential to evolve into communities, as well as their interplay with technology. This formed the basis for the development of our operational model that 'follows the issues' for capturing the (trans-)formation of a public. Based on our model, we outline different perspectives on detecting shared issues as early indicators for publics based on ICT and derive implications for researching this process from a practical perspective.

Keywords: Publics, Communities, Mobile devices, Social media, Infrastructures, CSCW

1. Introduction

A recent wave of citizen movements such as the Arab Spring (a series of revolutionary demonstrations in the Arab world aimed at a more participatory and representative political system and a fairer economic system), the Indignados (Spanish demonstrations demanding an improvement of the current social, economic and political situation) or the 'Stop Watching Us' protests (demanding the abolition of the NSA "mass surveillance" programs in the USA) clearly show that citizens – when affected by their state – will undertake actions towards solving their issues. This is not a novel insight. In 1927, John Dewey defined those groups of people who, when facing a similar (usually political) issue, recognize it as such and organize themselves so as to address it as a *public* (Dewey 1927). The term 'public' originates from the Latin 'populus' denoting a mass population in association with a matter of common shared interest. Dewey's pragmatist view characterizes publics not as a single constituted mass of people, but rather as a particular configuration of individuals bound by a common cause in confronting a shared issue. Publics are socially constructed through their relations to issues. He points out that "political concerns

[issues] have, of course, always had strong rivals" (Dewey 1927) that concern people. He explains that those rivals are far more prevalent and bountiful in today's society and cites technology as well as entertainment which are both numbing and distracting as the main perpetrators. Dewey believes that, to create a 'Great Community' as a cohesive group of publics, the solution must be to improve communication within the public. The importance of the 'issue' for applying Dewey's approach to interpret societal developments has been further strengthened by Marres (2007).

In contrast to publics, communities express their problems, issues and aspirations symbolically, thereby engendering a sense of a 'general will' (Stikkers 2010). Although Dewey argued that technology (such as mass media) can distract people from discussing issues and subsequently form forming a public will, he hoped that someday society would be able to use its existing technology to improve communication. His hope was that this would encourage and augment citizen engagement as well as the (trans-)formation of publics (Dewey 1927).

Today, formation processes of social groups in general have changed. Just a few decades ago, collaboration between individuals in work as well as private contexts was technically supported only by proprietary software. With the emergence of CSCW applications like groupware and social media as well as of new mobile devices this isolated software-based collaboration support changed. In particular, the global sales of smartphones and tablets continue to grow and both devices are currently both widespread and commonplace throughout the population. The functionalities of these devices stretch far beyond basic phone calls and messaging services. In many parts of the world, they have developed into individual personalized tools (Barkhuus and Polichar 2010) whose locations are implicitly determined by the dynamically changing locations of their owners (Fortunati 2005). As individuals tend to change location constantly, the mobile systems are also constantly subjected to changing places, conditions and situations. Mobile applications use the device's integrated sensors to support their owners 'in situ' (in a situation). This led to John Urry's argument (1999) that these devices are co-existent with new social 'mobilities', which he described as a "manifesto for a sociology that examines the diverse mobilities of people, objects, images, information and wastes; and of the complex interdependencies between, and social consequences of, these diverse mobilities". Furthermore, he claimed that mobile devices as well as networks have become units of analysis.

Justified by the emergence of these, and hand in hand with the development of other new technologies, new kinds of infrastructures arose. We base our understanding of the term "infrastructure" on Star and Ruhleder (1996), who defined its salient characteristics. Their definition emphasizes the ongoing design process, as directed towards the perception of something, as an infrastructure. These characteristics include the embeddedness into other structures; embodiment of standards; that they are built on an installed base; their links with conventions of practices; transparency in use; the taken-for-grantedness; a reach or scope beyond a single event, and their

invisibility upon breakdown. Those infrastructures do not only cover official software systems, but the "entirety of devices, tools, technologies, standards, conventions, and protocols on which the individual worker or the collective rely to carry out the tasks and achieve the goals assigned" (Pipek and Wulf 2009). Star and Bowker (2002) also pointed out the importance of considering actors and change activities within an infrastructure.

Taking the development of CSCW and its technologies seriously, the infrastructures have grown from early forms of communication technology. Together with the infrastructures, the opportunities for citizens to collaborate, self-organize and engage with issues, have also grown and evolved. Within this paper, we aim at researching how information and communication technology (ICT) infrastructures can help to understand the formation of publics. Or to be more precise, we aim to develop a systematic approach of making use of recently developed ICT for tracing the way how (aware and active) publics (Grunig 1983) could turn into communities. We do this not by focusing on how publics are *formed by* or *engage with* design or technology. Rather we take the first step towards focusing on how the formation of publics – which face emergent shared issues – and their transformation into communities can be *captured by* modern ICT. We will first present the theoretical framing of publics and communities as cohesive groups of publics as well as focusing on the interplay between both groups and technologies (section 2). Afterwards we will present our research approach (section 3) and potential methodologies for detecting shared issues (section 4). Based on a systematic phase model of publics, we will then develop an operational model for the (trans-)formation of publics (section 5). This serves to outline directions for designing new socio-technical approaches that focus on discovering and capturing the (trans-)formation process of publics from the beginning by detecting and following shared issues. Neither in the theoretical exploration of our model of publics and communities nor in our exploration of socio-technical approaches and methods of tracking and mapping them do we include any qualitative analysis of these groups, or their actual impact or participation in deliberation. Based on the outlined socio-technical approaches, we further derive practical implications for supporting researchers when examining the (trans-)formation of publics (section 6).

2. Theoretical background: publics, communities and CSCW

In recent years a diverse research body has emerged in the fields of CSCW and Human-Computer Interaction (HCI) which focuses on the interplay between technology and the philosophical concept of publics. Most of the studies follow Dewey's pragmatic notion of publics. Unsurprisingly, in CSCW the focus has been on the way in which a technology (and its design) impacts on the formation, maintenance and function of publics. We can typically identify two main directions in this area: Firstly, it is often predicated on theoretical perspectives derived e.g. from Habermas (1984) and Dewey. Secondly, it is often explicitly interventionist; that is, the aim is to

support the way in which publics engage with, and respond to, shared issues as they emerge. Building on the theoretical framing of publics and their formation (section 2.1) as well as on community concepts (section 2.2) we will present the interplay between publics, communities and technologies (section 2.3). Based on this interplay, we will outline current studies in the field entailing the impact of technology and design on publics (section 2.4).

2.1. The public and its formation

As far back as 1964, the sociologist Philip Converse pointed out the difficulties involved in studying the ways in which belief systems are structured, drawing attention to the relationship between group interests, ideologies and information (Converse 1964). Using interview data, he was able to show that higher levels of political sophistication correlate with activism. Of course, this work took place long before current technologies afforded the rapid exchange of information. At around the same time, sociologists such as Howard Becker, Anselm Strauss and Herbert Blumer were concerned with notions relating to the construction of the social 'problem'. It was Becker (1963) who coined the term 'moral entrepreneurs' to categorize those who seek to create or enforce social norms. Generally speaking, some individuals are much more likely to concern themselves with 'issues' than others. Even so, such work told us little about how the constitution of information and belief informed the notion of 'publics'.

Both Habermas and Dewey had a more explicit interest in the political process. In 1984 Habermas argued in terms of a 'rational discourse' in the public sphere which encompassed both the instrumental and the normative (Habermas 1984). Fraser (1990), however, argues that Habermas' definition rested on specific kinds of social relations, which led both her and later Warner (2002) to employ the notion of 'counterpublics' to make space for marginalized views and disenfranchised participants (Le Dantec and DiSalvo 2013). Dewey, in what we feel is a more nuanced view, conceived publics to be: "those indirectly and seriously affected for good or for evil [who] form a group distinctive enough to require recognition and a name. The name selected is The Public" (Dewey 1927). He defined a pragmatic notion of a public, which is characterized not as a single constituted mass of people, but in contrast as a particular configuration of individuals bound by a common cause in confronting a shared issue (Dewey 1927).

A public is, therefore, by his definition a philosophical subject which is grounded and situated in a concrete situation of affectedness, consists of multiple individuals and responds to contextual and environmental factors. With his notion of a public, Dewey distinguishes between the 'state' represented by elected politicians and lawmakers and the often incoherent body of citizens who elect the state and are affected by the laws and decisions made. When laws have been passed or decisions have been made and ordinary citizens are indirectly affected (often in a negative way) by these laws and decisions and also their consequences, then a public is called into

being. The public tries to abate these externalities by finding an agreeable solution to the disputed issue; or at least by forming a public opinion to be brought into the purview of those whose duty it is to act on the issue through legislation (Dewey 1927; Pietilä 2001; Turner and Killian 1987). Dewey referred with his definitions of a public to a political public and its traditional representation as a counterpart of state. But his term "matters of concern" is so generalizable that all issues could be understood to call a public into being.

The fact that issues and publics are co-constituted is fundamental to Deweyian pragmatism and to the adoption of this stance by authors (Dantec 2012; DiSalvo 2009; Latour 2005; Marres 2007; Noortje Marres and Weltevrede 2013). One does not precede the other. The argument is shifting from understanding issues as affecting people to determining a public by how people are relevant to the issue. As such, the public defines the issue by being made relevant through their engagement with it. In their different ways, the authors above draw attention to the manner in which mass, amorphic pictures of a public do not do any justice to the nature of informed discourse. Warner (2002) makes this explicit in emphasizing a specific meaning of the word 'public' by pointing out that "multiple publics exist and one can belong to many different publics simultaneously".

Based upon Dewey's situational definition of a public, Grunig (1983) conducted two empirical studies and used the situational theory of communication to determine the nature of different environmental publics and their cognitive strategies to resolve shared environmental issues. He revealed eight environmental issues that were used for specifying communication behavior with questions eliciting the problem recognition, level of involvement and constraint recognition of the subjects for each issue. Grunig (1983) discovered that when an issue affects nearly each individual citizen – for example the issue of air pollution – people who normally would not be concerned all at once become "members" of a special environmental public. Based on these findings, he formed the "Situational Theory of Publics" which identifies and classifies a public based on its awareness about an issue or problem and a public's activity and response to it (Grunig and Hunt 1984). Although he focuses on the relations between organizations and the public, the theory examines how publics are formed and how an organization can segment publics accordingly to communicate with them. As Rawlins and Bowen (2005) summarize, Grunig (1983) distinguishes between *nonpublics* (who have no problem), *latent publics* (who have a problem), *aware publics* (who recognize that they have a problem), and *active publics* (who recognize a problem and do something about it). Latent publics, aware publics and active publics are each a subset of the construct of a public. Comparable to Grunigs's (1983) active publics and based on Dewey's situated notion of public, Blumer (1946) defined a public as a group of people who are confronted by an issue, share their ideas as to how to resolve the issue, and who engage in discussion about the issue. Taking the dimension of 'time' into account, publics can evolve. Figure 1 presents a simplified possible evolution from nonpublics to active publics, to which we will refer later.

Related to active public, yet more institutionalized, is the term of a 'social movement'. According to Tilly (2004), a social movement comprises a series of contentious performances, displays and campaigns ('repertoire of contention') by which people make collective claims on others. While Tilly in his research on social movements since the 18th century focused on the role and the dynamics of group activities to produce societal change, the notion of active publics in a Deweyian sense in our eyes focuses stronger on the formation processes and the co-evolution of issues and the groups they produced.

2.2. Communities as cohesive groups of publics

Complementing the term publics, 'community', Latin *communitas* (from *communis*, things held in common) is defined as "a group of people living in the same place or having a particular characteristic in common" (Oxford dictionary). Tönnies (1887) distinguishes between 'Gemeinschaft' (German word, translated as community) and 'Gesellschaft' (German word for society) to categorize differences about social ties and social networks. Community refers to groupings based on togetherness due to personal social interactions while society is described as 'belonging to indirect interactions and formal values'. McMillan and Chavis (1986) describe the sense of a community as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together."

As Stikkers (2010) argues, a public is not only distinct from a state, but is also distinct from a community: "Communities contain private and public aspects, and while some publics include communities and some publics evolve into communities, not all publics are communities: publics may be mechanistic associations, aiming to solve their problems solely 'from external circumstances, pressure from without', lacking consciousness and feeling of a common inner life, shared meanings, and mutual interests. To become communities, publics must express symbolically their problems and aspirations as shared and thereby engender a felt sense of a 'general will'". He substantiates this differentiation by the example of the wish for better schools: "My problem and your problem initially merely happen to coincide – e.g.
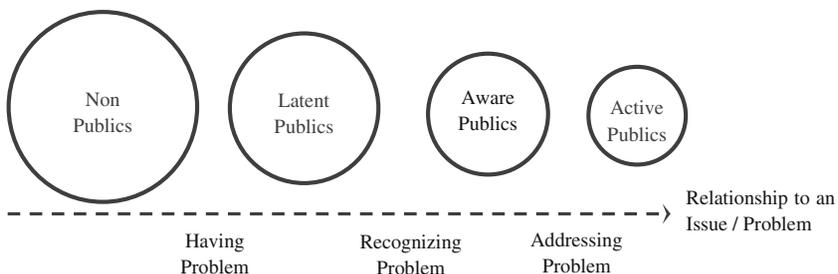

Figure 1. Evolving Publics

we each, independently and individually, want better schools for our children – and we each seek to solve that problem for ourselves individually and only incidentally in collaboration. But as a result of our working alongside one another, as a public, we come to experience the merging of my problem and your problem so that they become our problem, and my victory and your victory become our victory" (Stikkers 2010).

Stikkers (2010) further describes that without a proper access to, and appropriation of ICT "publics remain fractured, disorganized, and mere aggregates of self-interested individuals, i.e. they remain merely associations (Gesellschaft) and not yet communities (Gemeinschaft)". Referring to the concept of evolving publics (Grunig (1983) aware publics and active publics who are aware of an issue could evolve into a community that built upon the engagement with that issue. As Dewey (1916) already stated: "Men live in a community in virtue of the things which they have in common; and communication is the way in which they come to possess things in common. What they must have in common in order to form a community or society, are aims, beliefs, aspirations, knowledge – a common understanding – like-mindedness as the sociologists say." But as he further described "Such things cannot be passed physically from one to another, like bricks; they cannot be shared as persons would share a pie by dividing it into physical pieces. The communication which insures participation in a common understanding is one which secures similar emotional and intellectual dispositions – like ways of responding to expectations and requirements." Dewey refers to communication as "a process of sharing experience till it becomes a common possession" (Dewey 1916).

Taking the dimension of time into account again, the potential evolution of publics and the emergence of communities become blurred and communities may evolve from (communicative) aware publics and active publics (Figure 2).

2.3. The interplay between publics, communities and technologies

Drawing on literature, we can characterize publics as possessing three significant attributes: (1) they arise from, and respond to, emergent issues that are qualified by the context; (2) there is a multiplicity of publics with permeable borders; and (3) in addition to the situatedness and multiplicity of the Deweyan public, it is not exclusive to a particular class or social milieu (DiSalvo 2009). Dewey formulated his theory of publics in 1927. This era, referred to as the 'Roaring Twenties' in the US, was characterized as a period of sustained economic prosperity with widespread use of automobiles, telephones and electricity, coupled with industrial growth on an unprecedented scale. During this time, the nationwide mass media and movie industry evolved and political content for the masses was abandoned in favor of focusing on celebrities, sports and movies. Dewey (1927) argues that modern technologies such as "the movie, cheap reading matter and [the] motor car as drawing people's attention away from politics", because for common people these are more entertaining topics of discussion than political news.
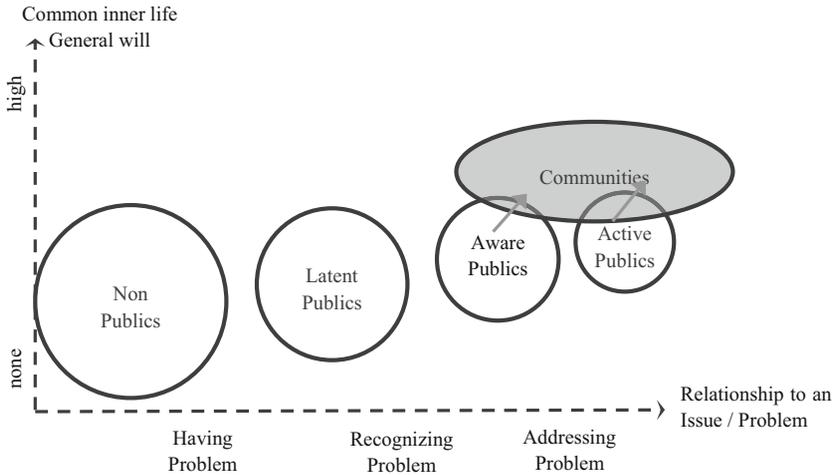
Figure 2. From Aware and Active Publics to Communities

Technologies in the context of a public are therefore a blessing and a curse at the same time. As Dewey (1927) stated, without communication the public will "remain shadowy and formless"; it is only by improving communication that the public will find itself and become a cohesive group (converting a "Great Society" into a "Great Community"). On the one hand, communication technology can be used to improve communication. This encourages engagement with issues and the formation of a 'public will'. On the other hand, as Stikkers (2010) stated, "a main present barrier to the transformation of publics into communities is that publics have become "eclipsed" by […] the vast, sophisticated communication technologies of our time". Both modern ICT – especially mainstream mass consumer technologies – and their design are situated within this area of tension. Just a few years ago the technical support of collaboration in business as well as in private contexts was only possible with proprietary software. Despite the fact that publics have always existed, the emergence and evolution of social media and mobile technologies has changed the way in which issues are communicated and discussed, as presented in various grassroots contexts such as in political uprisings (Wulf et al. 2013a; 2013b).

For more than a quarter of a century, CSCW applications have been being designed to deal with various specific forms of cooperative work (e.g. group work and team work) (Schmidt and Bannon 2013). In the jubilee issue of the CSCW journal, Monteiro et al. (2013) argue for a gentle weaning of "CSCW-in-use from its initial and founding preoccupations (the rather restricted, confined and specialized forms of cooperative work witnessed over the last two decades) towards a second wave of analyses that reflect the more open-ended agenda initially set out by Schmidt and Bannon (1992)". They use the notion of *information infrastructure,* character-ized by "openness to number and types of users […], interconnections of numerous modules/systems (i.e. multiplicity of purposes, agendas, strategies), dynamically

evolving portfolios of (an ecosystem of) systems and shaped by an installed base of existing systems and practices" to illustrate their perception (Monteiro et al. 2013).

The notion *infrastructure* arose from the Latin *infra* (below) and comprises all the basic structures which are needed for the operation of a society. Infrastructure is often perceived as something that lies in the background, is invisible, and frequently taken for granted (Star and Ruhleder 1996). It is shaped and "used across many different locales and endures over long periods" (Monteiro et al. 2013). Justified by the rise of various new technologies, the notion of infrastructure does not necessarily cover only official systems - according to some definitions, it comprises the "entirety of devices, tools, technologies, standards, conventions, and protocols on which the individual worker or the collective rely to carry out the tasks and achieve the goals assigned" (Pipek and Wulf 2009). By definition, technologies, when used by individual citizens or later communities, are part of their infrastructure. But somehow, groups always decide on specific parts of their infrastructure: *Infrastructuring* is understood as the practice of "re-conceptualizing one's own work in the context of existing, potential, or envisioned IT tools" (Pipek and Wulf 2009). Whether it is intentional or not, individuals select some of the ICT to be used while engaging with issues and thus while in the process of forming a public. Taking this development seriously, new possibilities for citizens to collaborate, self-organize and engage with issues have arisen from early forms of communication technology and are currently used widely. 'Members' (although not comparable to a formal membership) of active publics neither necessarily have to meet in person to recognize their common understanding, nor do they have to articulate their affiliation in person, as long as it is supported within the information space: "Computer systems meant to support cooperative work in real world settings must support cooperation through the joint construction of a common information space in such settings" (Schmidt and Bannon 1992).

The *scope of the infrastructure* (Star and Ruhleder 1996) is defined as "either [the] spatial or temporal" reach beyond a single event or one-site practice; information infrastructures are defined to be "typically stretched across space and time" (Monteiro et al. 2013); and collaborative work is "enacted in space as well as in time" (Bardram and Bossen 2005). Despite the fact that other dimensions are also of relevance and have to be bridged for successful collaboration (e.g. organization, language, technology (Reuter 2014)), the advances of ubiquitous computing (Weiser 1994) have discovered the fact that fundamentally, information is always accessible and therefore expands the infrastructure. Communication nowadays is not necessarily enacted in space and time as it was in 1927; infrastructures for communication have been improved, as required by Dewey, and now offer new opportunities for individuals to engage with issues and therefore to led active publics evolve into communities.

Technology has always been involved in the production of locality and community (Mynatt et al. 1998). In their prescient book "The network nation", Hiltz and Turoff (1978) argued – well before the emergence of the internet – that computer-supported communication could transform society. Contemporarily it is common to

distinguish between virtual and real communities. The later emergent term 'virtual communities' was coined by Howard Rheingold (1993), who defines them as "social aggregations that emerge from the [internet] when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace". An even richer definition covers both the virtual and the real world: Network communities are "robust and persistent communities based on a sense of locality that spans both the virtual and physical worlds of their users. They are a techno-social construct that requires understanding of both the technology and the sociality embodying them" (Mynatt et al. 1998).

2.4. The impact of technology and design on publics

In addition to studies that concentrate on analyzing the content of public discussions within several media, e.g. Pietilä (2001), the field of CSCW has yielded a number of studies which attempt to discover the relationship between ICT (design) itself and publics. At this point it is important to notice that ICT could enable, ease or even complicate the conversion of publics into communities. However, simply the existence of ICT alone neither forms a public, nor transforms a public into a community. Nonetheless, ICT can play a role and might be supportive.

According to Le Dantec and DiSalvo (2013), as well as other authors (e.g. Turner and Killian 1987), the term public has undergone numerous conceptual definitions and revisions. They criticize that there is "usually a reference to the public as the intended users or audience for a given design and a desire to either effect change upon the public or facilitate the public to effect change themselves" (DiSalvo et al. 2007). Based on two design studies, DiSalvo (2009) began an inquiry into the design and construction of publics and showed that processes and products of design can serve to articulate issues that force publics into being. On the other hand, the research of DiSalvo et al. (2014) that was conducted on a reflexive analysis of five design projects, showed how HCI artifacts and systems can express shared issues. Further, Le Dantec and DiSalvo (2013) explored and elucidated theoretical ways of examining how publics form in and through participatory design processes. They show that publics "form a perspective on the changing practices and potentials of PD [Participatory Design] that highlight the messy, often confrontational ways that people form communities around an issue and are supported in taking action to address that issue" (Le Dantec and DiSalvo 2013).

Le Dantec (2012) presents a design study on the impact of technology on the specific issues of homeless mothers and their children living in a shelter. The study entailed the deployment of a ubiquitous computing system over a period of 30 weeks. Their tool built "a stable medium for sharing information that helped the staff be more effective and helped the residents feel more connected, while providing the degrees of freedom necessary to foster and sustain a number of unique relationships within the shelter" (Le Dantec et al. 2011). Lindtner et al. (2011) outline a theoretical framework for new ways of understanding how people position themselves

collectively in relation to larger social groups and societal norms. Following a 2-month deployment of a mobile photo-sharing platform in a youth housing project, they suggest "that the notion of 'publics' provides useful insights into user-driven, social and cultural forms of technology use and digital content creation" (Lindtner et al. 2011). Based on longitudinal survey data, Kavanaugh et al. (2007) examined how individuals in various types of local groups can be driven by ICT to participate in pluralistic community life. They show that ICT "increases communication, interaction, and participation among members of voluntary associations" (Kavanaugh et al. 2007).

When it comes to understanding the formation of informed publics, one of the main challenges is to make the conditions and consequences of an issue apparent and known (DiSalvo 2009). The methodological issues we refer to show that researchers have turned to a number of intervention methods to understand how issues are formed and mediated by new technology and design. This, however, does come at a cost. Early intervention with provocative design may well shift communicative behaviors away from what would otherwise be normal. Most of the current work conducted in CSCW and HCI has understandably taken the view that this is a cost worth bearing when intervention is the goal – but often intervention itself creates publics who engage with the intervention. As we have shown, the current studies concerned with technologies and designs as well as publics, focus on how publics are *formed by* or *engage with* design or technology. However, none of the above approaches try to examine how the (trans-)formation of publics could be *captured by* modern ICT.

3. Research gap and approach

As Dewey (1927) stated, he wished for the transformation of the 'Great Society' into a 'Great Community' as a cohesive group of publics. It would be possible to achieve such a transformation by improving communication (Dewey 1927); otherwise people know little about shared issues and concerns (Stikkers 2010). Although the mass technologies distracted people from forming a public general will in the past (Dewey 1927), we argue that modern mass technologies – consisting of mobile devices and social media – can provide infrastructures which will support communication between people. In turn, this assists the symbolical expression of problems as well as uncovering common and shared issues.

Current studies in the field of CSCW concerning the interplay of publics and design mainly focus on theoretical frameworks about the formation of publics around ICT artifacts and how design practices can yield such processes (DiSalvo 2009; Le Dantec and DiSalvo 2013; Le Dantec 2012). These studies, then, are primarily intended to consider the impact of design and technology on the formation of publics and how people engage with technology when facing specific issues. Within this paper, we want to break out in a new direction. As Warner (2002) highlighted, it is difficult to carry out empirical work in the area of publics. He

argued that "some social scientists think that their method is a way to define a public as a group that could be studied empirically, independently from its own discourse about itself".

We are therefore interested in how emerging issues or shared problems can be uncovered as precursors. These precursors describe the issue itself, its consequences and its surrounding conditions as well as the formations of individuals around it. We were highly conscious of the fact that modern ICT – consisting of mobile devices as well as social media services – constantly accompany the majority of the population. Further, the research fields of CSCW and HCI in particular already provide methodological choices. A number of approaches and methods related to how to study people's behavior 'in the wild' have arisen, e.g. (Böhmer et al. 2011; Do et al. 2011). These could help to detect emerging issues and in turn trace how publics (trans-)form. Building upon those approaches we try to trace the way publics (trans-)form by researching the issues directly from their arising. We believe that investigating real and everyday occurrences as well as the daily experiences of individuals (at micro-level) provides us with a richer corpus of potential issues directly at their emergence. This results in a better understanding of how (and which) publics (at macro-level) are (trans-)formed around issues.

While building on this existing corpus of research, our interests are based on what we see as a current research gap in this area. This gap, we argue, exists because we still know relatively little about the issues around which publics are formed and how publics may evolve into communities. With our proposed direction as a complementary approach to explore the formation of publics and their evolution into communities, our aim is to use modern ICT to detect and uncover emerging shared issues right from their beginnings. The first step of capturing the formation of publics at an early stage is – from our perspective – to record which shared issues can be identified. To do this, we first need to capture the contextual information of the people involved to find out which similarities (and therefore shared issues) within the crowd might be emerging. In the following we will present potential methodologies for detecting shared issues as early indicators for publics from HCI and CSCW (section 4). Based on this, we present an operational model of the transformation from publics into communities and interpret the HCI and CSCW methods in the light of this model (section 5). We further derive implications for researching this transformation process (section 6).

4. Potential methodologies for detecting shared issues as early indicators for publics

Our approach follows the assumption that modern ICT infrastructures and information spaces (which result in individual mobile device data as well as social media information at micro-level) could be, if accumulated, indicative of potential shared issues at macro-level. The concept of publics reveals that they are heterogeneous. They do not flatly consist of how individuals engage, how individuals continue to

engage, or how individuals engage differently. It is not only the public which is heterogeneous; indeed, the relevance of the issue itself is negotiated by individuals. It is important to notice that of course not all shared issues and therefore potential publics are detectable using existing ICT-based methodologies; however we assume that it is at least a good starting point as long as ICT such as modern web technologies – often summarized as Web 2.0 – are used more and more. The so-called Web 2.0 tries to describe the innovations of the internet after the crash of the new economy in 2000. So-called web 2.0 platforms are "becoming something similar to traditional third places where conversations take place as much on private issues as on socio-political concerns" (Schäfer 2011). The term Web 2.0 has to contend with shifting definitions as well as being popularized, which limits public media discourse (Scholz 2008). However, in recent years, the development of the internet has been geared towards citizen involvement as well as community engagement, which mainly comprises support for greater participation and the integration of citizens into professional tasks or activities (Brabham 2013).

As a form of citizen integration, *crowdsourcing* can be defined as a "type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals via a flexible open call, the voluntary undertaking of a task" (Estelles-Arolas and Gonzalez-Ladron-de-Guevara 2012). We are aware of the fact that crowdsourcing is not always positively connoted and, for example, some types of initial public offerings (IPOs) might also be understood as crowdsourcing activities. However, a specific subset of crowdsourcing, which emerged with the ubiquity of smart mobile devices, is *participatory sensing* (Burke et al. 2006) in which individuals are asked to gather, analyze and share data and information using the integrated sensor capabilities of their mobile devices. The key factor of participatory sensing is that people are perceived to be involved in active engagement with issues and in generating knowledge (De Cristofaro and Soriente 2012; Gao et al. 2015). Participatory sensing focuses on the inclusion of as many people as possible in a networked environment to collect the most accurate and comprehensive information (Burke et al. 2006). Based on participatory sensing, types of aware and active publics have already arisen, e.g. within non-political contexts such as gathering GPS or speed data from cyclists to infer route and traffic noise (Reddy et al. 2010); when conducting empirical research (Ludwig and Scholl 2014); or when gathering audio data from microphones to discover biodiversity or the quality of earth (Kuznetsov et al. 2014; Moran et al. 2014). The presence of such multimodal sensors unleashes a wide range of possibilities for the collection of individual data. On the other hand, collective sensing focuses on an analysis of different actions and processes within several mass media (mainly social) networks (Resch 2013).

In the following, we outline approaches and schools of thought from the field of CSCW and HCI to uncover and detect emerging issues by using the physical gathering of contextual information with modern mobile technology (participatory sensing, section 4.1) as well as by using the virtual gathering of citizen-generated

content via modern social media mass technology (collective sensing, section 4.2). Based on both these concepts, we outline how physically-gathered data and also virtually-gathered information could be brought together not only to detect shared issues but also to define the role modern ICT could play in their discussion processes.

4.1. Physically gathering contextual information with mobile technology

To detect the conditions and consequences of potential issues at a physical level, we require methods for capturing contextual and situated information pertaining both to an individual and to the environment, as Grunig (1983) already outlined. A set of approaches already exists in which contextual information gathering is currently performed. This will be presented along with corresponding potentials but also together with some of the associated difficulties.

Proportional to the rapid dissemination of mobile devices and the ever-increasing role they play in people's everyday lives is the need for methods that allow an appropriate study of mobile behavior 'in the wild' (Brown et al. 2000). Modern ICT provides new approaches to capture media perception and media actions in situ by observing the use of mobile devices and therefore potential information about how individuals engage with issues. Based on a brief description of past approaches, we present a range of these mobile methods for capturing contextual and situated information. Our aim in presenting these methods is not to provide concrete design implications on how to detect potential issues from their beginning by capturing people's mobile device data. It is rather to afford a brief overview of existing methods. The objective is to motivate researchers to examine potential links between mobile methods and the detection of shared issues at an early stage, thus engaging with them as starting points of publics.

For detecting issues, *life logging* seems to be a concept that aims to automatically record people's behavior and consists of "the continuous capture of personal data: such as photos from one's field-of-view, location, audio, biometric signal and others, with the aim of supporting the later recall and reflection over one's life events and experiences" (Gouveia and Karapanos 2013). Logging an individual's life can make potential engagements with issues become apparent. As mobile devices have become highly personalized tools for individuals, they are more or less present and at hand at any time and place (Fortunati 2005). Thus *mobile data logging* represents a significant part of life logging. Mobile data logging means that a device automatically collects various context and usage data which would otherwise be very hard and time-consuming to capture without any user interaction at all (Froehlich et al. 2007). However, one complication which arose is that any logging of people's mobile behaviors entails taking into account a number of possible different devices and applications. There is a whole ecology at work. Analyzing people's behaviors by studying mobile devices, then, is not straightforward (Rahmati and Zhong 2013). While some studies focus on quantitative measurements, such as download frequency, to obtain a picture of the general popularity of mobile applications and therefore

general usage patterns (Do and Gatica-Perez 2010), others focus on the use of mobile devices and applications in specific terms of context (Böhmer et al. 2011; Demumieux and Losquin 2005; Do et al. 2011; Verkasalo 2008).

Verkasalo (2008) and Do et al. (2011) show that context has an enormous impact on the use of certain types of mobile applications by continuously and automatically analyzing phone sensors (application logs, location logs and Bluetooth logs) over a 9-month period. A similar approach with the focus on large-scale studies and more than 4.100 users without previously prepared devices is presented by Böhmer et al. (2011). Although context-related approaches provide insights into the impact of locations or social contexts on smartphone use, they also have limitations such as not capturing people's intentions with regard to use patterns and situations. To highlight such a major problem, Kujula and Miron-Shatz's (2013) user study demonstrates the relevance of detailed descriptions by using the example of an actor who looked at just one specific photo on his mobile device several times a day. Only in the course of further interviews was it revealed that this was a photo of a family member. Although automatic logging procedures are immensely valuable for providing gross data, on their own they are of less value when attempting to uncover user behavior or rationales for engagement.

Liu et al. (2010) argued that mixed methods are required to gather appropriate information about people's real behaviors. These, we suggest, are needed because the evolution of a public can take place over a long period of time and around non-specified issues (Dewey 1927). Approaches already exist which try to overcome these limitations by combining automatic data logging with self-reporting mechanisms. Froehlich et al. (2007) present a system that combines the logging of phone data through more than 140 types of events with mobile experience sampling (Consolvo and Walker 2003) as well as targeting questionnaires towards specific moments of interest. They have shown that the acceptance of such a mobile system in everyday life requires both robust performance and non-intrusive data collection.

The methods as described in the above-mentioned selection help to capture contextual and situated information pertaining both to the environment and to individuals themselves. Combining these with concepts of participatory sensing (whereby people are involved in the active generation of knowledge) could help in the application of existing approaches from the fields of CSCW and HCI, aiming at both the detection of shared issues and also at facilitating awareness of publics at an early stage.

4.2. Virtually gathering citizen-generated content via social media

While participatory sensing focuses on gathering contextual and environmental information at an individual level, there are also concepts that focus on more collective macro levels and therefore on another potential direction of uncovering publics at a later evolution stage. Currently, social media has become a popular venue for the discussion of diverse aspects of civil life (Schäfer 2014). As such, social

media can presently be seen as an instrument which is capable of rendering shared and common issues and (the affectedness of individuals as parts of) a public more accessible (Weller et al. 2013). However, the use of social media at the present time is frequently unstructured; information is not always comprehensible and different groups have different spaces for participation (van Es et al. 2014). Several studies remark on the "chaotic use of social media", e.g. Kaewkitipong et al. (2012). Some of the studies are based on the considerations of the actors related to their purpose – different social media entail different forms of communication (Hughes et al. 2014). Twitter, for instance, is used broadly just now as a platform for posts of up to 140 characters, while Facebook pages provide a situational overview and Facebook groups coordinate activities (Reuter et al. 2015). Based on these perceptions of current use, various approaches have arisen that may help to detect shared issues and trace how publics (trans-)form. They may be summarized as the term 'collective sensing'.

Collective sensing "tries not to exploit a single person's measurements and data, but analyzes aggregated anonymized data coming from collective sources, such as Twitter, Flickr or the mobile phone network" (Resch 2013). In contrast to approaches of sensing individuals that analyze individual records (section 4.1), collective sensing focuses on the analysis of different actions and processes within several mass media (mainly social) networks (Resch 2013). For example, Flickr photos are used to make statements about the seasonal behavior of tourists (Sagl et al. 2012). As long as such data is based on individual records, members of publics remain identifiable. The great advantage of collective sensing is that no additional infrastructure is required, as it is based on already established ICT infrastructures.

When attempting to detect publics or evolving communities, various approaches based on locations, communication or topics can be applied. One prominent example is trend detection via the Twitter stream. This approach aims to identify emerging trends on Twitter in real time and "provides meaningful analytics that synthesize an accurate description of each topic" (Mathioudakis and Koudas 2010). First, keywords that suddenly appear at an unusually high rate are identified and then groups of keywords are built. Additional data is then extracted from these tweets to identify the topic. Other approaches describe topic detection on Twitter based on the evaluation of temporal and social terms to allow the real-time identification of the "most emergent topics expressed by the community" (Cataldi et al. 2010). These "hot topics" are often the first indication of shared issues on a macro-level.

Another approach focuses on community detection in the context of social media (Papadopoulos et al. 2012). This method has proven to be valuable in a series of domains, e.g. biology, social sciences, bibliometrics. However, there has only been limited discussion in social media. In contrast to the definition given above, the concept of a community is established here by people in a group who interact with each other more frequently than with those outside the group. A clear definition of community is rather subjective and depends on where to draw the line. Besides the focus on communication as the characteristic of a community, content-driven crowd

discovery algorithms can efficiently identify newly-formed communities of users from the real-time web (Kamath and Caverlee 2012).

In addition to these mining methods, Reuter et al. (2015) present various research-based or commercial applications that focus on the analysis of social media; however, their reports and visualizations focus on categories such as business performance, competitor benchmarking, and brand analytics. Cobb et al. (2014) suggests querying multiple social networks with filters. Thus, Reuter et al. (2015) implemented functionalities to render social media "more listenable" as suggested by Hughes et al. (2014) e.g. by showing related discussions in various social media and by using a cross-social-media functionality.

5. Following the issue: towards an operational model of the transformation from publics into communities

Many of the methodological choices described within section 4 elaborate on collecting digital traces of human activity delivered by the two main groups of technologies: First the mobile technologies that allow activities performed by an individual citizen to be traced and/or reconstructed; and social media technologies, that, in tracing the sharing behavior of individuals, allow the distribution of information and agency patterns in social networks (and consequently shared issues and discussions) to be followed. Both modern types of ICT have changed the breadth as well as the depth of possible inquiries on the emergence of issues and therefore the (trans-)formation of publics into communities. But they also carry the promise that the distance between an ongoing social process of a public's formation and its visibility for an observer can be shortened significantly, turning a retrospective perspective on analyzing publics into an ongoing effort to observe a public while it forms, with new connections to interventionist research methods like action research (Lewin 1958).

To uncover the process of emerging publics, both physically-gathered data (section 4.1) as well as virtually-gathered information (section 4.2) could be brought together to enable a comprehensive overview of shared issues as an early indicator of publics and later communities. Both key technologies allow the level of individual perceptions and activities to be connected to observable group phenomena in the (social) media. On a theoretical level, the concept of *mobile crowd sensing* (Zaslavsky et al. 2013) already combines the sensing of individuals with the collective sensing view by supplementing sensor data collected via mobile devices with citizen-generated content from social media, such as opinions or experiences (Guo et al. 2014). Such a mobile crowd sensing concept can already be found in different application fields, such as combining and presenting people's on-site movements together with social media activities to make informed decisions about their community actions (Ludwig et al. 2015a). To transform the technological concepts of mobile crowd sensing towards our research approach, it is necessary to develop an operational model of how the individual and the social perspectives are

intertwined in the process of forming a public/community and practical implications of how to manage such a model.

Our considerations were based on Grunig's (1983) situational model of publics and the distinctions and connections Stikkers (2010) sketched between publics and communities. As mentioned in section 2.1, we distinguish between nonpublics (the general crowd in ignorance of any issues that could be the basis of a public), latent publics (people potentially affected by an issue although unaware of it), aware publics (those who are aware of the relevance of a certain issue) and active publics (the segment of people who are both aware of an issue and act towards it).

Our operational model focuses especially on the process of detecting a public and on its turning into a community (Figure 3). The operational model allows us to develop both a perspective from within (based on sensor data, looking at how an individual becomes engaged with an issue that may have a public – section 5.1) as well as an external perspective (looking at collaborative formation activities that are centered on an issue – section 5.2). Both perspectives can be captured using the ICT streams mentioned above.

5.1. The internal perspective on the formation of publics and communities

If our aim is to trace the path of a public (towards a community) from an *internal* perspective, we argue in favor of observing how an *individual* engages with and relates to an issue (and its communication) that may have a public. As presented in section 4.1 there are already numerous approaches that try to reconstruct and sense an individual's life in-situ. By sensing mobile device data such as the speed or locations and the opportunity to combine different types of sensor data (e.g. the speed at a
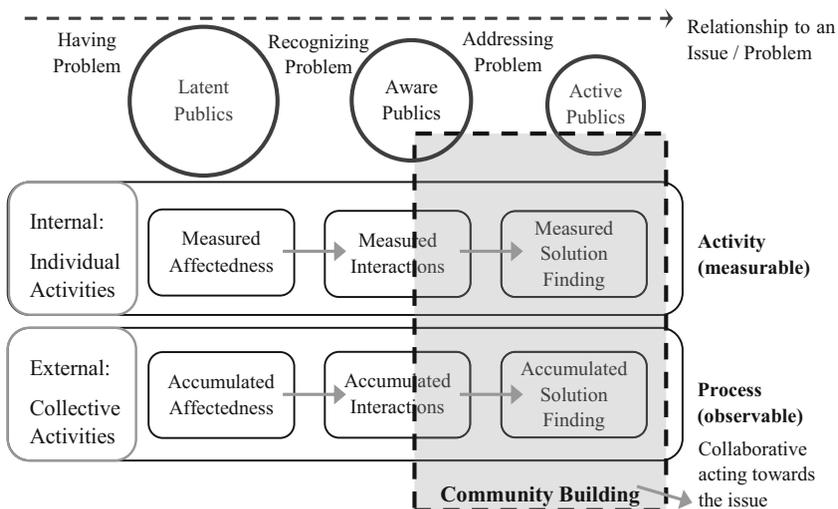

Figure 3. From Publics to Communities: An Operational Model

specific location), it may be possible to detect issues and to measure the affectedness of an individual – even though the individual is not yet aware of being affected. Measuring the affectedness of an individual does not mean the individual is aware of being affected. For example, sensing a smartphone's microphone can give some indication of how it is affected by noise – although the noise is perhaps not an issue for the individual right now. S/he is possibly unaware of the noise and consequently is not aware of being affected by the noise.

By further sensing and measuring the individual interventions on a mobile device, such as search behavior, chat log or social media usage, it may be possible to draw inferences from the measured data about the affectedness of an individual to its awareness of an issue. As previously mentioned, by sensing smartphones an external observer can become aware of individual affectedness, but the individual him/herself does not. Only if an individual undertakes an action on a mobile device with regard to the current situation do we assume that an individual is engaged with the issue and is aware of his/her problem. The combination of different data and user interactions in particular offers a rich set of potential indicators of the awareness of an individual. Referring to the example we previously mentioned about noisiness, it would be possible for an individual to search for the permitted noisiness level. In combination with detected affectedness, we could now assume that an individual is aware. In this case, privacy and data protection aspects especially need to be taken into consideration. Either the entire sensing process must gather anonymized data or it must be elaborated which information an individual is willing to provide (we will expand on this aspect in section 6.4).

The line between aware and active publics is always blurred. For example the activity 'seeking for information about noisiness' could on the one hand be an activity to gain awareness of a problem; however, on the other hand it could already be categorized to the solution finding process itself. Again, by sensing individual interactions with the mobile device and the sensor data as well as contextual information, it may be possible to detect individual awareness of an issue. However, mobile technologies could also be used to detect or measure the solution finding process of an individual. Considering the relation of sensed data and information may provide insights into the continuous development of an individual towards an issue and its relation.

5.2. The external perspective on the formation of publics and communities

If our aim is to trace the path of a public (towards a community) from an *external* perspective, we argue in favor of looking at how people engage with and relate to issues that may 'have' a public. In accordance with the emergence of the so-called Web 2.0 (O'Reilly 2005) as an architecture for participation, new possibilities for social interaction arose. Correcting his initial definition, O'Reilly (2006) argued: "Web 2.0 is the business revolution in the computer industry caused by the move to the internet as platform, and an attempt to understand the rules for success on that

new platform. […]". Accordingly, data does not only represent content that has been provided by an individual for the purpose of distribution; it also represents interaction among people. Of course, many of these data sources are not available for capturing the external perspective on the formation of publics and communities. Potential sources for such data are chat protocols and personal messages as well as closed groups within social networks. However, other information is available and might help to capture the formation in varying extents (Rogers 2015). Section 4.2 presents various approaches available for collective sensing which may help, and our operational model is designed to distinguish between the different stages of detection.

Aware publics might be detected or captured by looking at accumulated interventions, such as activities on the web which show that people are aware of an issue as a collective (Bruns and Burgess 2011). For example, the trend in Twitter is already used to identify tendencies (Mathioudakis and Koudas 2010). These trends are of course not necessarily a sign of the formation of publics and communities; however, as long as Tweets and retweets, which demonstrate communication about issues, are detected, these technologies might help to capture the emergence of a public. Topic detection (Cataldi et al. 2010) could also help to evaluate real-time identification of the most emergent topics showing the engagement with issues. Community-driven crowd discovery based on content might also help to identify the formation of communities from the web (Kamath and Caverlee 2012) in the early stages of becoming aware of the issue.

Having identified the issue and people's engagement with it, the next step is to trace the potential transformation of an active public. The formation of active publics might be captured by looking at accumulated solution finding, i.e. activities which render it possible to distinguish solution finding from pure awareness. Community detection in the context of social media is one approach which can be applied not only to potentially detect issues but also to discern connections among people around some issues (Papadopoulos et al. 2012). Such a community detection show people have already connected around it to do something about it. It is, however, interesting to detect collaboration not just within one type of social media but also in publics among different media. These might show accumulated solution finding, using e.g. Twitter for actively creating situational awareness and for recruiting new members to the public; or Facebook groups for internal communication about the issue, including pictures from Flickr to demonstrate evidence of some issues of interest. Simple observation of one type of media might therefore not be necessarily sufficient to really capture collective behavior.

6. Practical implications for researching the formation of publics and their transformation into communities

In the last sections we described how new, ICT-driven ways of 'following the issues' could help to trace the (trans-)formation of publics and their potentially evolving into communities. Although we consider the issues as the defining part of the processes

we want to look at (as they shape a public and are shaped through a public), it is the activities that individuals perform (targeting themselves, e.g. information seeking, or targeting others, e.g. communication and cooperation around the issue) that we are be able to capture (as part of engagement) and therefore to trace with modern ICT infrastructures. Although we are aware that there are new digital traces of human agency we can now follow, it does not mean that we can claim to be able to capture every community with the full complexity of the social interactions they consist of. But with our approach we can be more optimistic of being able to produce valid statements.

When we now turn to the dimensions that help us to derive practical implications for researching the (trans-)formation of publics into communities based on following the issue, we remain aware of the methodological tradition that has been used to follow the issues and look at the formation processes we are interested in. We have however chosen to focus on the new questions that arise when considering the new technological options available to researchers that try to examine publics and their engagement with issues. In the following we outline some practical implications for researching the formation of a public and its potential transformation into communities. By doing so, we aim to provide some ideas and circumstances of how to approach the researching of publics.

6.1. Timelines of publics vs. timelines of research

Usually when we focus on researchers and their agenda, we start by defining research goals. It may therefore seem strange to discuss timelines even before we discuss research goals. But operationalizing new opportunities for collecting digital data and researching publics requires researchers to position their research towards the processes they are interested in. In traditional empirical work, the usual time relation is a *retrospective*: The research took place when an issue had matured and the associated public was active and visible. The investigations aimed to reconstruct how the public had formed, e.g. by tracing its visibility in the (traditional) media or by interviewing or observing relevant actors within that public. With the new technological options of modern ICT, the visibility and traceability of issues have changed in such a way that we can aim to observe the (trans-)formation of a public earlier, creating an overlap between the ongoing formation process and the research process. We can maintain an *extrospective* view of this formation as an ongoing process, and we have the opportunity for an *introspective* view for the individuals involved.

As issues and publics can shape each other mutually (Dewey 1927), we may also have to look for issue formation, a process of maturation in which several pre-issues may be considered until a stable issue emerges. While collecting the data, we may need to be aware of the pre-maturity of issues we look at, and it may require an ongoing adjustment by the researchers to make sure that their research follows interesting and relevant traces throughout the formation, what we call 'open-heart empirics' (Dax et al. 2015). With this term we describe the (re)configuring of a study

frame and adjustment of research goals during the empirical phase. As an example of this formation process, we can look at the Sendai/Fukushima incident in Japan in 2011. Within the first 12 hours of the earthquake, it was being discussed as a natural disaster and was easily traceable as the Sendai or Tohoku earthquake both in social as well as classical media. Following the meltdown in the nuclear plant near Fukushima, the issue and its related public changed significantly, with this issue becoming traceable as the Fukushima Daiichi disaster. After understanding the timelines of publics and the timelines of research in general, we can now define our research goals.

6.2. Research goals and data collection

In general, we assume that the research goal associated with the new technological options is to find out about the process of (trans-)forming a public into a community. The fundamental rules for designing an empirical field study still apply. Researchers have to define *the who*, *what* (activity), *when*, *where* and *how* to interview or observe, which we will now discuss with regard to the new choices we currently have for following the digital traces of issue-related activities (Ludwig et al. 2015b).

The who and the what. For the external perspective on publics it is quite straightforward to use a set of terms connected to a (pre-)issue which help us to follow related public activities in the general social media based on keyword searches. With issues still in the process of maturation, from time to time it may be necessary to redefine the terms we use to follow the issue. But for the internal perspective as well as for capturing more intimate information in the potential forming of a community, we need to be able to follow individuals and their activities as well. The selection processes for keywords and which individuals to observe may influence each other, and at some point it might become necessary to drop certain keywords or individuals to stay focused on where the action is.

The when and the where. The first obvious choice in when to collect data is the question of continuous vs. discrete data collection. Reasons for restricting the data collection can be the computing/transmission performance of devices and internet connections, but also a strategy of data sparseness in connection with privacy concerns (see below). With new technologies, more complex choices exist: It is possible to make a data collection dependent on a location or a co-location of people and objects. The relation to an issue is not necessarily expressed verbally anymore; it may also become visible by visiting places (real, like the Tahir square in Cairo, or virtual, such as websites on cancer therapy), or relating to people (e.g. experts on tattoo removal).

The how. Following a 'big data' version, many approaches exploit data collected automatically from the sensors of mobile devices or from social media platforms.

This data is helpful in understanding *what* is going on, but rarely *why* things are happening. A few studies already address the epistemological challenges of big data. By outlining six provocations about the issues of big data, Boyd and Crawford (2012) argue in favor of "questioning the assumptions, values, and biases of this new wave of research". They raise questions like "What is the status of so-called 'public' data on social media sites? Can it simply be used, without requesting permission? What constitutes best ethical practice for researchers"? Or as Kitchin (2014) argues, "Big Data and new data analytics are disruptive innovations which are reconfiguring in many instances how research is conducted."

Traditionally, researchers choose between quantitative and qualitative empirical methods. But now we are able to make intermediary choices: We may automatically collect original raw data, or we can collect "reflected data"; data that has been further qualified or commented on by the observed person. This may be particularly helpful when observing communication behavior. We have new options for situation-dependent empirical measures, e.g. starting location-based questionnaires, or a questionnaire starting after a full hour of Facebook usage. Further securing or qualifying the data also involves traditional empirical work, e.g. confirmative inter-views (feeding back what has been captured and how it was interpreted and checking that this was in line with the intentions of the activities observed) to make sure that a stream of activities is connected to an issue researchers are interested in.

On a more technological level, it is possible to run into problems of synchronizing the variety of data sources from which we capture data (as happened in video-based ethnography). Securing a unanimous timeline is imperative, but location data may also present quality problems. This can be a challenging task which could conceivably require the cooperation of the individuals who themselves are under observation. In particular, the combination of internal and external perspectives on the formation of publics requires the collection of enough metadata to correlate events sensed at individual level and those visible in social media.

6.3. Immersiveness and distance of research

Depending on the methodological tradition of research disciplines, arguments with regard to the distance between the researcher and his/her field have been presented in favor of maintaining a certain distance (to warrant the field's authenticity) as well as in favor of 'going native' (to gain a really deep insight into the dynamics of the field). These issues have to be reconsidered especially as smartphones have become an intimate personal device. While it may be desirable to gain an intimate insight into a person's activities in relation to an issue – particularly for understanding the dynam-ics of community building – it can be difficult not to influence the individual's activities (aside from the further privacy concerns we discuss below).

With a technocentric focus on collecting data as discussed here, questions may also arise regarding the negative consequences of that remote/distant data collection for the analytical work following the data collection. Often, researchers benefit from

the personal impressions they glean from on-side visits, which reveal that certain dimensions of empirical work may be missing from these approaches; or it might be deemed necessary to add opportunities for encounters with the field to the research plan. Nevertheless this may remain problematic: in classical empirical work these experiences were collected in exactly those situations in which the data was collected; using ICT approaches, that would not be possible.

What remains a problem for an extrospective view (section 5.2) can be a benefit when addressing the internal perspective (section 5.1) with an introspective view. With the option of the ongoing collection of data, we can support the introspective view as a means to creating an individual's self-awareness and his/her engagement with pre-issues and publics in formation, and base an extrospective view solely on data collected in this reflection process. This potentially presents several advantages: It answers the privacy concerns discussed below, and it also helps to avoid a kind of Hawthorne effect of individuals changing their behavior because somebody external is looking after their affairs (literally…!).

6.4. Ethical, legal and social issues

Obviously, the technological implementation of the operational model, which enables us to research the formation of publics and communities, could clearly be regarded as a surveillance infrastructure. As researchers, this is definitely something to avoid; we strive to allow the recorded data only to have the necessary depth, but not more. This general strategy of *data sparseness* can be complemented with further methods of *privacy by design* which we can implement in the frameworks that are used for data collection.

Privacy concerns are always present within human-centered approaches of HCI and CSCW. There is a close connection between the methodological options discussed above and earlier discourses on ethical issues in the field of CSCW, like *virtual ethnography* (e.g. chatrooms). Aside from an individual's general consent to participate in the research, further issues which apply here are considerations of opt-in vs. opt-out choices with regard to observing online activities, e.g. when using a specific software tool, and issues regarding the intended audience (normally not the researchers) of communications. Regarding the latter aspect, social media presents the problem that even though one participant of a social network may have consented; all related people also become traceable to some extent. On the other hand, to observe how publics could turn into communities – and with regard to the intensified social ties associated with that change – it may be necessary to have such an option.

Another issue which is closely related is that of anonymization. Beyond the usual practices of separating personal information from the data collected, new digital means of collecting data present the option of distinguishing between captured data and recorded data, e.g. by the automatic translation of names into pseudonyms. This

could be a strategy for solving the issue of having a social network with 'friends' who never consented to have their data recorded.

There are many more options to consider how the interaction between the data recording framework, the observed individuals and the researchers is organized. The data may be collected locally on a smartphone, but only be transmitted to the researchers' server after explicit consent has been given; or data can be transmitted in a modified (but still authentic) version. When talking about the research of publics, we are talking about long-term observations. Reminder and notification systems could be in place throughout these observations which need to maintain a careful balance between keeping the observed aware of their participation in a study and not disturbing their practices inappropriately – especially when sensing the individual dimension. We can also experiment with 'withering' consents, or time- and/or location-dependent conditions to switch the collection of data on or off.

Although these issues will have a strong impact on the quality of research made possible by using these new technological options, we currently see no perfect way of finding an optimal design for following issues and individuals in the formation of publics. There are some activities that try to tackle these problems by outlining considerations for supporting and informing (mainly) the researchers responsible for making decisions about the ethics of internet research (Markham and Buchanan 2012; Prabhu 2015). Despite this, the right design of these considerations is left to further methodological experimentation.

7. Conclusion

Current citizens' movements show that groups of people – even loosely coupled – emerge whenever suffering perceived injustice. These groups, consisting of people who are confronted with the same particular issue, are divided in their ideas as to how the issue should be resolved and engage in discussion regarding the issue. Those people who are indirectly and seriously affected, whether for good or for evil (even non-active), form a group distinctive enough to require recognition and a name, which Dewey (1927) selected as *The Public*. Based on Dewey's theory, both technology and the 'numbing and distracting' media hamper the formation of a public and the step from a 'Great Society' towards a 'Great Community' (Dewey 1927). On the other hand, early adopters of the theory of publics hoped that someday society would be able to use such (distracting) technology to improve communication and thus improve the engagement of citizens and therefore the formation of publics (Dewey 1927; Stikkers 2010).

Modern ICT infrastructures such as mobile devices and social media are situated within this area of tension, which exists between distracting people, but yet also fostering their engagement. Within this paper we have attempted to combine CSCW interests with the concept of publics, their formation, maintenance and evolution, by outlining several design directions for rendering the formation of publics more accessible on their way from aware and active publics to a community.

We are aware that publics are socially constructed through their relations to issues and therefore it is not an obvious choice to carry out our empirical work within this field. Since our aim is to trace how publics form, we argue that the initial stage is to discover which issues are shared. This then leads to the social construction of those issues that form a public. We therefore take the first steps towards combining CSCW with publics not by focusing on how publics are *formed by* or *engage with* design or technology. Instead, the focus lies on how issues (i.e. early indicators for the formation of publics), which face emergent shared issues, and their transformation into communities can be *captured by* modern ICT infrastructures. By following the issues, we have outlined two main directions and starting points for the design of detecting shared issues as early indicators for publics and their (trans-)formation with ICT. We argue that to become aware of (shared) issues and socially constructed relations to those issues, CSCW approaches offer possibilities to sense physically-gathered contextual information with mobile technology as well as gather virtual citizen-generated content via social media technology. Physically-gathered contextual information can help to measure individual activities and virtual citizen-generated content can help to observe collective formation processes with regard to shared issues.

We do not aim to provide concrete design implications to research a public or its transformation process. Instead, we want to contribute with an operational model of the (trans-)formation of publics into communities, including potential practical challenges and implications for research. With our model and suggestions on how to manage it, we want to sensitize researchers to a different view on the interplay between publics and ICT. This view is based on the information gathered about people at an individual micro-level and potential communities at macro-level. We argue in favor of:

(1) Capturing contextual and situated information about physical conditions by using participatory sensing with mobile devices to measure the affectedness and interactions on an individual level. This helps to detect initial issues.

(2) Capturing emerging hot topics and discussions within social media by using collective sensing concepts to measure accumulated collective affectedness and interactions. This helps to detect early collective engagements and shared issues.

(3) Combining captured information about physical conditions and captured virtual topics and discussions by using mobile crowd sensing to obtain a detailed overview about aware and active publics on both a digital as well as a physical level.

(4) Opening up a new level of mediality by making shared issues more accessible and reflecting on the formation of a public by looking at other people's related private ICT media usage to provide support for community building.

Based on these four design directions and the developed operational model, we have outlined different practical implications for researchers on how to manage the

model and therefore provide the first step towards how to research the (trans-)formation of publics. On a theoretical level, we have outlined a number of issues in the process of researching and therefore managing the model for pursuing issues in the formation processes of publics and communities. We now take a step back from the research process as a whole. What becomes obvious is that the options we have for designing data-related interaction between practice and research domains have dramatically increased. More choices and possible adjustments within this paper present more problems in terms of transparency, documentation and tampering with the original practice processes. Descriptions of research work need to provide a detailed account of these choices and adjustments. As yet, there are no routines enabling this to be done at a sufficient level of depth as there are for traditional empirical work. It would be helpful if software environments for researchers prepared and supported this kind of documentation. The renewed call for 'good' documentation also requests descriptions of analytical work. We anticipate that the studies we are aiming for can only be handled by larger teams of collaborating researchers, in which the coordination of work and the appropriate documentation and description of these processes (also in publications) may become a relevant part of research methodologies.

The formation of a public is a process that often responds both to new and often varying challenges, and also to the framing conditions of our everyday lives at a societal level. As it may become interesting to start following (pre-)issues quite early, it may be plausible to work with a network of actors or social entities that form a kind of living lab (Eriksson et al. 2006) of publics, a set of longer lasting relations between researchers and society within a more general domain (e.g. crisis management). Within such a construct, it would be possible to come to event-driven or situation-dependent approaches for scheduling research work. In general, when conducting research on the transition between publics and communities, there are many societal arenas where such opportunity-driven research can be a valuable complement of traditional empirical research methods.

The combination of the introspective and extrospective view which we described in more detail above leads to research approaches that are more similar to action research (Lewin 1958) than to traditional analytical epistemological positions. The instruments for data collection could easily be enhanced to support this kind of research approach as well (e.g. by supporting the documentation of interventions in social media, and their results). Making pre-issues or other intermediary research results available for the self-reflection of practitioners already marks the first step in this direction. The visibility of potential issues and publics may also, if fed back to the users themselves, substantially change the way publics form, e.g. when awareness is raised that a potential issue – thought to be personal and irrelevant to others – is in fact also a potential issue for others one may connect to, this can help to create aware or active publics. By obtaining information about shared issues or common problems, individuals will become aware that they are part of a larger group of affected people. We can also expect that the easier it becomes to connect to others, the easier it

will become to manage the belonging to different publics (both potentials of the two technology streams mentioned above), and consequently the easier it becomes to form more sustainable communities that may even span several issues.

Presenting gathered information back to people themselves moves an internally-driven reflection of ongoing information exchanges and consumption. This reflection also extends to the related exploration of the phenomenon of the formation of a public closer to the actual practices of media technology usages. This is in contrast to a distant reflection based on post-observation reflections in traditional approaches. Furthermore, a new level of mediality is opened up by the ability to make shared issues more accessible and reflect on the formation of a public by looking at other people's related private ICT media usage which has become apparent. This mediality, together with new perception channels, not only helps to capture publics, but may also raise an individual's awareness of being bound in a public. This in turn may then pave the way for the evolution from active publics into a community. People may become aware of the entire process of the community's formation.

With our practical implications we focus on the different dimensions 'timeliness', 'research goal', 'immersiveness' as well as 'ethical and social issues'. While a problematization of the practical configuration of the operational model is a matter of style, method and epistemological position of researchers, the required digitalization of the production of empirical material and the associated development of research infrastructures enables as well as limits research practices here. The development of an operational framework for conducting research on the formation of publics, which is the ultimate goal of our considerations, becomes a process of infrastructuring (Pipek and Wulf 2009), and the project of a public that is created by the new and further development of technological options to capture human activity. It becomes an issue in itself to weigh the value of the services scientists can offer for reflections at societal level against the value of self-determination in the digital age.

Our next step will be an attempt to implement first prototypes for gathering physically-based data with mobile devices as well as virtually-based information from social media with the aim of detecting shared issues, thus potentially enabling us to trace the way publics (trans-)form.

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