# Spontaneous emergence of Community OR: self-initiating, self-organising problem structuring mediated by social media

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**Abstract**—We develop a new constitutive definition of Community OR as a self-initiating, self-organising community actor network emerging spontaneously in response to a triggering event and showing evidence of non-codified OR behaviours leading to action to improve the problem situation. From this new definition we have re-conceptualised Community OR as a construct that can be empirically observed emerging from suitable behavioural data. Social media play an instrumental role, acting as both the source of data and the enabling mechanism through which this form of Community OR occurs. Social media afford new possibilities for community empowerment and participation, with consequences for social enterprise and citizenship. We use Actor Network Theory, and specifically the language of translations, hybrid forums, and Callon's Co-production of Knowledge Model (CKM), as the methodological basis for our definition and analysis. The appearance of hybrid forums as a self-organising response to community needs after an event would seem to be a natural milieu for a range of OR competencies. However, unlike traditional practitioner-led engagements, here the OR practitioner's competency enters in a supportive rather than leading role. We support our argument through the analysis of social media data arising from the community response to a devastating flooding event – the Carlisle floods of December 2015.

*Keywords*— Community OR; Soft OR; Actor Network Theory; Co-production of Knowledge Model; Hybrid Forums

# 1. INTRODUCTION

What is Community OR? The literature does not easily characterise what it is, leading to a range of distinct claims (Midgley & Ochoa-Arias, 1999; Parry & Mingers, 1991). It seems that its origin lies in the space between developing an enhanced OR that serves to improve society and a practice that serves to support the community (Cook, 1973; Jackson, 1987, 1988; Rosenhead, 1986). Pioneering work can be seen from Ackoff's work with leaders in the black community in Mantua, USA (Ackoff, 1970), Cook's work in Aston, Birmingham, UK (Cook, 1984), Eden et al's work with charities (Jones & Eden, 1981), and Beer's work with the Allende government of Chile (Beer, 1974). After an explosion of interest, a number of clusters of applications have sprung up (Jones & Eden, 1981), including work in housing (Johnson, 2007, 2012; Midgley, Munlo, & Brown, 1998; Rosenhead & White, 1996; Thunhurst & Ritchie, 1992; Thunhurst, Ritchie, Friend, & Booker, 1992), health (White, 1999, 2003), poverty (Taket & White, 1994), and sustainability (Waltner-Toews, Neudoerffer, Joshi, & Tamang, 2005). It seems that the extant literature on Community OR involves the application of methods in an enhanced way to problems in which interests of underrepresented or vulnerable populations in communities are the main concern, and for which solutions to these problems are difficult (Midgley & Ochoa-Arias, 1999). One of the main consequences of these projects has been to give voice to the communities' concerns (White & Bourne, 2007). Yet, over the last decade or so there has been a growth of online communities engaged in knowledge and information-sharing, largely through discussions and conversation on social media (Miller, Fabian, & Lin, 2009) that has become a dominant form of giving voice to community issues, yet these have been almost entirely ignored by Community OR scholars.

An online community is a community facilitated by social technology (currently known as social media), comprising a spectrum of forums, which include markets, auction sites, bulletin boards, social networking sites, blogs, gaming and shared interest sites (Plant, 2004). Some common features of these things are that participation is radically distributed and part or most of the activity is done online or through digital means (e.g. on-line communication, digital products). Technologies have been developed to offer alternative forms of collaborative engagement. Researchers and practitioners alike are keen to understand the emergence and implications of online communities (Choi & Park, 2014; Gutierrez, Ochoa, Baloian, Zurita, & Loyola, 2015; Hammond, 2017; Kaufhold & Reuter, 2016; Kavoura, 2014; Kavoura & Borges, 2016; Williamson & Ruming, 2015). Online, people have increasingly based their societal identities on their interactions through social media, and have developed fairly well-defined behaviours. These are non-geographically bound communities, based on a structured set of social relationships among communities of interest. Our labelling of these as 'communities' is rooted in the construct of a community as a network of social relations marked by mutuality, social bonds and social exchange (Ganley & Lampe, 2009; Scott, 2000). Thus, scholars have described online communities in terms of what citizens are seeking, such as networking with fellow enthusiasts, and finding solutions to problems; or interest, relationship, and transaction; or professional opportunities. However, OR has been slow in realizing the new capabilities arising from the novel ways

disadvantaged or excluded communities are actively coming together online to tackle problems of concern. Although there is a growing stream of research on the increasing importance of online communities in social life (Choi & Park, 2014; Gutierrez et al., 2015; Hammond, 2017; Kavoura, 2014; Kavoura & Borges, 2016; Preece, 2001; Williamson & Ruming, 2015), the problem is that it may be difficult to define "Community OR" in this online world.

It is hard to understand why Community OR has not addressed these new forms of working with citizens. It seems that this would be the sort of opportunity that its pioneers, such as (Cook, 1973) and Ackoff (1970), would have welcomed, where citizens become more actively involved as participants in their democracies, with the governance and decisions that emerge from this process being more democratic and more effective. This builds on the premise of OR as social science (Jackson, Keys, & Cropper, 1989; Lawrence, 1966), with a progressive aspect where it is claimed that engaged citizenry through OR practice is better than a passive citizenry (White & Taket, 1997) drawing on (Arnstein, 1969). The emphasis from a Community OR perspective is that the participation process is a transformative tool for social improvement.

In this paper, we aim to address this lack of attention to the new ways of working and broaden the notion of Community OR to include problems associated with communities identified by their online communications. However, there is a need to build on the foundational work on Community OR and make the case for studying online communities as a legitimate group to analyse in order to form a better understanding of the role of OR in this type of setting. In order to do this, we position our work theoretically in relation to social constructivism and social materiality. In doing so, we draw on Actor Network Theory (ANT) (Latour, 1987) and developments by Callon (1999) of the Co-production of Knowledge Model (CKM). These perspectives enable us to take a broader and nuanced view of community action. In particular, these perspectives provide the means to identify how, and in what way, we get a convergence of collective action in online communities.

Methodologically, our approach is built on important work in OR that has defined constitutive definitions for Soft Systems Methodology (Checkland & Scholes, 1999, pp. 284-290), for interpretive systems approaches (Jackson, 2003, pp. 307-311), and generically for Problem Structuring Methods (PSMs) (Yearworth & White, 2014). The role of a constitutive definition is to provide a behavioural or performative description of a methodology to substantiate epistemic claims for their use. To make sense of empirical data from on-line communities we set out a similarly constructed constitutive definition for claiming that the behaviours observed can be classified as Community OR.

For our empirical work, we are interested in the mobilisation of online citizens in response to risk and disaster. Such situations are highly dynamic and located specifically, both spatially and temporally, leading to a greater need for understanding relational coordination. We show, in relation to a specific disaster in 2015, how and in what way the collective commitment of an online community to the framing of the problem (Hammond, 2017)was built up and reinforced across episodes of socially constructed events and in the relationship between different forms of actors' expertise, characterised as either

traditional/technical or non-technical/'lay'. In particular, we use the findings to explore questions of how communications, decision-making and the self-organizing process operated during the disaster response and discuss implications for OR practitioners (Kaufhold & Reuter, 2016; Kavoura, 2014; Kavoura & Borges, 2016). Using social media data from a real situation, we analyse how individual actors framed their circumstances in communication with one another and how this affected their subsequent interpretation and decisions as the disaster unfolded. In particular, we aim to observe patterns of altruistic reinforcing behaviours in conjunction with the emergent problem solving approach of the online communities as a response to the disaster (Bui, 2016; Kaufhold & Reuter, 2016; Sebastian & Bui, 2009; Tim, Pan, Ractham, & Kaewkitipong, 2017).

It is the appeal to widening participation, the utility of online communication, and the limitations that expert facilitated participation entails, that prompted the idea that on-line communities might be a suitable way forward for (re-)conceptualising Community OR, and that the advantage of the massive reach of social media might be coupled with new affordances for active community action to achieve this. However, considerable issues arise with respect to facilitating and moderating asynchronous and distributed modes of interaction in these settings. Not least, the difficult question of the original motivation to use an online platform without the prompting action of attending a workshop and the efforts of the academic/practitioner/expert facilitator to *animate* the methodology; i.e. how is the problem mediated? This is a key research question, originally raised by Morton, Ackermann, and Belton (2007) on how the issues that arise in moderating such distributed interaction differ from the issues involved in facilitating a *traditional* PSM/Soft OR workshop, that we also address.

In sum, having set out a likely scenario of relevance to Community OR practice and our theoretical and methodological position, we set out to establish our contribution – that we can observe, through publicly available social media data, behaviours that can be classed as Community OR. We thus open up the field of Community OR to empirical study through a new route, which has implications for OR practice generally and how OR practitioners might engage with communities in the future, especially in response to events such as natural disasters.

## 2. THEORY DEVELOPMENT

The study of Community OR is no longer synonymous with a sole focus on specific organisational forms (Friend, 2004; Midgley & Ochoa-Arias, 2004b), and nor is it driven solely by a moral imperative (Wong and Mingers (1994) demonstrate a wide range of motivations for practitioner engagement). Instead, we think that we need to broaden the notion of Community OR to include online communities. However, these forms of community are not susceptible to the traditional or prevailing views of what Community OR involves. We feel these views do not explain well the drivers for forming online communities, and nor do they provide adequate prescriptions for the practice of OR. Below, we provide a brief review, starting with a stock-take of normative views of Community OR. We then build on recent work on the Generic Constitutive Definition (GCD) (Yearworth & White, 2014) and from the

sociology of science in order to develop a *constitutive* definition for Community OR. The logic for this development is summarised in a set-based viewpoint presented at the end of the section.

## 2.1.    *Normative Views*

Midgley and Ochoa-Arias (2004a) have edited together a useful selection of previously published and new work, and they draw specifically on *normative* visions of community (Midgley & Ochoa-Arias, 1999; Midgley & Ochoa-Arias, 2004c) and ideas of context and future development (Parry & Mingers, 1991, 2004). They debate a normative definition of community and present an in-depth analysis of what is meant by the label *community* and the social construction of the field of Community OR. They suggest that Community OR practice is defined by its orientation to an ideal that is itself defined politically. Their vision for Community OR sets out three political traditions against which Community OR can choose to align its practice – liberalism, Marxism and communitarianism. Their case for a normative definition is argued in order to set a boundary around what is considered as belonging to the Community OR discipline. Further, they point to possibilities for a broader definition of community than the received liberal/capitalist tradition, which they consider to be a dangerous default. Their argument is grounded in the need to make explicit how the practitioner's political orientation affects their approach to client selection, setting boundaries for inclusion and exclusion, and choice of methods. Whilst we agree that the political orientation of the practitioner does indeed affect these decisions, the arguments of Midgley and Ochoa-Arias do not help to place an emphasis on everyday exchanges with regard to social interactions as the focus of enquiry. Their account also sees actions as being based on rules or norms.

Instead, we suggest the basis for a definition of Community OR should be in theories that have an interest in understanding and exploring actors' activities, interactions, interventions and performances. Further, these theories should be based in a socially materialist view, in the sense that interventions must be understood and investigated as a material as well as a social reality (Keys, 1997; White, 2009; White, Burger, & Yearworth, 2016). We are also striving to understand interventions as structured, emergent and creative. For this, we locate our interest in a pragmatist account of action that focuses explicitly on the view that the experience of actors is produced by purposive socially mediated actions and emotions, and is tempered by the material arrangements that embed these activities (Adams, Murphy, & Clarke, 2009; Peirce, 1955). See also Taket and White (2000).

## 2.2.    *Actor Network Theory*

In order to do this, and also to widen the scope to include analysis of how a problematic situation and stakeholder group coalesce and develop a participant-led process to intervene, we draw on the language of translations and the concepts of problematisation, interessement and enrolment derived from Actor Network Theory (ANT) (Callon, 1986). ANT was first brought into use in understanding Soft OR interventions by White (2009, p. 825), and in OR more generally by Keys (1997). Our definitions follow (Callon, 1986):

- Problematisation – the initial co-creational process of linking a problematic situation with relevant stakeholders into an actor network consisting of both human and non-human actants. Questions emerge from the problematisation that become the goals that the actor network seeks to resolve through taking action.
- Interessement – negotiating the self-interests of the actors so that they are "*locked into place*" in addressing the problematic situation.
- Enrolment – defining and coordinating roles as worked out during interessement, such that actors accept them. Interessement is thus successful if this is achieved.

Scholars have already acknowledged the central role of the concepts drawn from ANT in understanding behaviours in actor networks in the complexities of vulnerability and resilience of communities in disasters (Brewer, McVeigh, & von Meding, 2013), and we here show how further developments in the ANT field can contribute to the examination of a definition of Community OR. In order to do this, we also draw on 'The Co-production of Knowledge Model' (CKM) defined by Callon (1999). This model arises from his critique of the ways that the scientific community have engaged with publics in the "*production and dissemination of scientific knowledge.*" According to Callon,

> "*Technoscience is pervasive; it invades daily life and consequently becomes the subject of heated debates and controversies.*" (*ibid*, p.81)

He asserts that failure to manage the process of engagement, and in particular deal with the unintended consequences of technoscience developments, has led to a "*great divide between specialists and non-specialists*" and thus to a crisis in *trust*. Callon identifies three modelsof the participation of non-specialists in "*scientific and technological debates*" (*ibid*, p.82):

- The Public Engagement Model (PEM): Scientific knowledge is viewed as objective and universal, lay knowledge is considered worthless, and specialists must teach non-specialists everything and have nothing to learn from them. Publics do not participate in knowledge production and only control it indirectly. Emerging technoscience is seen as a "*source of progress*" (*ibid*, p.83). Mistrust, arising from unintended side effects of this progress and subjective perceptions of risk, lead to resistances. Public engagement is thus directed towards overcoming these (irrational) resistances.
- The Public Debate Model (PDM): Scientific knowledge is still seen as objective and universal. However, unlike the case of the PEM, this knowledge is now seen as incomplete due to its "*abstraction*" from reality and its location purely in the laboratory. The process of "*broadening the circle of actors addressing the issue of technoscience and its applications*" (*ibid*, p.86) leads to the formation of differentiated publics, employing a range of methods such as inquiries and focus groups to manage the relationships. These processes "*muddle the usual boundaries between specialists and non-specialists*" (*ibid*, p.87) but do not remove them. In fact, they provide forums in which the earlier-mentioned resistances can now be voiced. However, whilst apparently

legitimising the inclusion of non-specialists, the PDM falls short of full representation due to the divided nature of the publics created by the process.

- The Coproduction of Knowledge Model (CKM): Here, the role of the non-specialist is essential, as the specialist forums of divided publics and specialists are replaced by *hybrid forums* of *concerned groups* (Callon, Lascoumes, & Barthe, 2009b). Knowledge is now dynamically produced by the close cooperation of specialists and *lay expertise*. Callon specifically uses the notion of the concerned group as engaged in a process of "*collective learning*" (Callon, 1999, p. 91).

- Specialist knowledge is still required, but now it is framed in a way that makes it "*particularly rich and relevant*" (*ibid*, p.91).

Callon et al. (2009b) recognise that the knowledge of experts is not the only knowledge possible, and in relation to the three models above make the distinction between the traditional laboratory-based research of the scientist (what they refer to as *secluded research*) and what they call research *"in the wild"* (Callon & Rabeharisoa, 2003). The latter involves, not just the co-production of new knowledge, but also, and simultaneously, the co-production of new "*social identities*" where "*new knowledge must be acquired and shared, and new ways of thinking, seeing, and acting must be developed, pooled and made available*" (Callon et al., 2009b, p. 33). Thus, it is likely to be the case that evidence of the CKM in operation in hybrid forums is where we will see examples of translation from problematisation into action through interessement and enrolment. Observing such translations empirically in an actor network requires a means of looking at the *behaviours* of the actors.

## 2.3.    *Behavioural, Performative Views*

We now develop an action-oriented approach to our definition from a behavioural, performative perspective to define Community OR in situ before we provide the empirical lens we have chosen to use to verify our approach. Following the approach of Yearworth and White (2014) in the construction of a Generic Constitutive Definition (GCD) for Problem Structuring Methods (PSMs), we have set out to adopt the same process to produce a similar constitutive definition for Community OR. In sum, the GCD was constructed *behaviourally*, in that it sought to provide a classification schema for labelling problem structuring behaviours in action. It is thus also *performative* in nature (Pickering, 1993, 1995); a researcher seeking to establish that problem structuring is being enacted need only establish empirical evidence for a set of behaviours for confirmation. This removes any requirement for self-identification or self-labelling with any known PSM by the actors enacting those behaviours (which would principally be the academic OR practitioner doing the labelling). It therefore becomes solely a concern of the researcher observing those behaviours to supply the label.

The performative viewpoint is constructed around the simple question of what it is that people are *doing* when an academic practitioner has labelled a group activity 'Community OR'. The derivation of our constitutive definition of Community OR starts with a thought experiment. For any of the examples of

Community OR in the literature, what would have been the behaviours exhibited by the participants that, if we had been able to observe and classify them, would furnish a data-driven definition of Community OR that could be married-up to the declarative labelling by the academic practitioner publishing the work? This is a reasonable existential question that mirrors Checkland and Scholes (1999, p. 285) reflection on the existence of Soft Systems Methodology[1] and the Yearworth and White (2014) derivation of the Generic Constitutive Definition for PSMs. It is generally the case that we lack access to the empirical *behavioural* data that has informed the classification of an intervention as specifically Community OR by an academic practitioner (and we will continue to lack access to the sort of data we need for performative, behavioural, (re-)analyses of OR engagements whilst narrative accounts are deprecated by OR journals (Ormerod, 2014)), so we have concentrated on the performative aspects of community as discussed by Parry and Mingers (1991) in order to construct ours. We have skimmed over the OR component of the definitions. The question of whether an activity labelled Community OR *is OR* seems a less important point. The planning case cited by Parry and Mingers was readily classified by them as Community OR, and the key expertise afforded to the target group was provided by a physicist challenging the environmental impact models that the developer was using to justify the planning application that the target group objected to. We have assumed that a Community OR engagement is almost certainly dealing with a mess and thus it is a reasonable assumption that PSM-like behaviours would be in evidence. We acknowledge that we could have chosen some other set of behaviours with which to define a recognisable OR activity taking place, perhaps associated with quantitative methods, although these are myriad and less easy to categorise behaviourally.

The performative idiom, itself emerging from ANT, recognises agency as residing in both human and non-human actants. However, White et al. (2016) point out that human actants are imbued with the property of conscious intentions such as motivation, unlike non-human actants whose purpose is manifest purely through their physical nature e.g. flood waters acting according to their (labelled) nature to damage homes and property, whilst human actors are motivated to prevent that from happening. Any definition of Community implies *collective* human agency (Preece, 2000), even if the action manifest by that human agency is only sharing an understanding or belief in something, possibly mediated through the agency of non-human actants. We argue that the community becomes observable as a phenomenon once that shared belief or understanding is translated into actions (i.e. a target group in the sense of (Parry & Mingers, 1991) exists in the minds of its members and they start to act as a group), which give rise to empirical data. As researchers interested in group activity phenomena, we should be able to observe and theorise over these empirical data. Therefore, our constitutive definition of community is broad and covers any group activity of human actants with a shared understanding or belief in something, who then take actions that are observable in response to that belief or

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[1] ''*It is the Constitutive Rules which are of greater interest since they answer the stark question: What is SSM? If there are no such rules then in what sense can SSM be said to exist?*''

understanding. We bring this definition into the realm of OR and narrow the scope of observable actions by invoking the specific notion of *action to improve* a problematic situation. This provides us with the first test of whether a phenomenon is considered in or out of membership of OR practice – are the actions we observe empirically recognisable as OR in practice? Yearworth and White (2014) have argued for a behavioural answer to this question around the practice of Soft OR, and we believe that we have shown that the extant Community OR literature illustrates that the *something* causing the formation of a community wanting action to take place is invariably a messy problem. Therefore, in response to the messiness of the problem context, we would expect to see evidence of problem structuring behaviours as characterised by the 9 elements of the Generic Constitutive Definition (GCD) for PSMs (Yearworth & White, 2014, p. 939). The element definitions of the GCD are summarised in Table 1 and the element labels are used later in the coding of data in Table 3.

| | Element Label | Element Definition |
|---|---|---|
| 1 | Action to Improve | Problem structuring is intervention oriented and leading to improvements in a problematic real-world situation through a set of purposeful activities |
| 2 | Systemic Approach | Use of systems ideas (including boundary, hierarchy, communication and control), which are i) appropriate to context, ii) theoretically adequate, and iii) supported by appropriate systems modelling |
| 3 | Adaptation/ Creativity | The approach taken was adapted or elements combined for the particular problem situation, requiring human creativity |
| 4 | Methodological Lessons | Given that any problematic situation is unique, learning from the intervention is focussed on methodological lessons arising from conscious reflection |
| 5 | Worldviews | The process of problematisation recognises that problems are construct of an individual's mind and defined by their worldview, they do not exist independently of human thought. |
| 6 | Messiness | The problem context in which the approach is used has been recognised as messy, wicked or swampy. |
| 7 | Interactive/ Iterative/ Therapeutic | The intervention in the problem situation has come about through sharing of *perceptions, persuasion and debate* in a participative group setting using an approach that is iterative and "*interactive/therapeutic,* and *not expert* |
| 8 | Subjectivity | In the approach taken it has been recognised that the stakeholders of the problem situation are part of it, and cannot be objective. |
| 9 | Limits | Conceptual limitations have been recognised in the approach taken, including building expertise in the use of problem structuring |

**Table 1. The 9 element labels and element definitions of the Generic Constitutive Definition (GCD) for Problem Structuring Methods (Yearworth & White, 2014).**

## 2.4.    *Motivations and Self Organisation*

There is a need for a further theoretical positioning so that we can begin to question the *centrality* of the role of the OR practitioner's interventions. We do this because there is still a need to stress the importance of focusing on power relations, conflicts, and interest (Fox, 2000; Law, 1986). The focus is on a field where actors produce and reproduce differences and inequalities. Our aim, therefore, is not to focus on the individual practitioners and their norms, but to imagine the field as relational and dynamic, which embodies the complexity of real-life interventions.

Therefore, the next aspect of our constitutive definition concerns the question of motivation. What is motivating a group of people to take action? Midgley and Ochoa-Arias (1999) identify the motivation of the facilitator as a significant force in Community OR. Whilst criticising the default and implicit "*political, moral and religious*" drivers behind this motivation, they seem less concerned with the *self-organising* nature of a target group and how it might be considered as a community of interest. For us, the latter is of central importance, as it is to Herron and Mendiwelso-Bendek (2018). Self-organisation appears to us to transcend formal political motivations as a more fundamental principle, although we accept that groups emerging from a process of self-organisation in response to a shared need will inevitably acquire a "*political, moral and religious*" complexion, either as part of that emergence, or from the need itself, or indeed imported through the agency of, for example, a community leader or the Community OR practitioner. However, that does not detract from the focus on self-organisation in our definition.

Our constitutive definition thus questions the centrality of the OR practitioner in a Community OR process by placing emphasis on the activities within an emerging target group. The origins of the intervention, in an OR sense, start from the target group rather than the instigation of an OR practitioner. In the case described by Parry and Mingers (1991, p. 579), a pre-existing target group is augmented by the assistance of an expert modeller, leading to the increased effectiveness of the group activity, which involved objecting to a planning application. We return to the simple ideas of 'vulgar competence' in OR practice and the 'science of better' (Mingers, 2007) and advance the case that the meaning of better and what is competent are a property of, and emerge solely from, the behaviours within the target group (Parry & Mingers, 1991, p. 579). We thus replace the need for a normative view with a constitutive view. This view is necessarily pragmatic (Adams et al., 2009; Peirce, 1955), focussing on the immediate needs of the target group rather than political ideals; and it is performative (Pickering, 1993, 1995) in concentrating on the behaviours and processes involved in the group activity that emerges to meet those needs.

By introducing the principle of self-organisation into a definition of Community OR, we can turn the problem of labelling on its head and return to some of the egalitarian and emancipatory goals of the origins of Community OR (Ackoff, 1970; Rosenhead, 1986) and ask a new question: should we find evidence of Community OR taking place as self-organising problem structuring, would it not be of value for OR practitioners to offer their services to help? The marrying-up of the OR practitioner and a community in this situation then becomes a peer-oriented activity more in keeping with the idea of Callon's CKM. We return to this question in the later discussion, where we consider this from an ethical perspective.

## 2.5.    *Decentring Facilitation*

We now draw attention to the role of the facilitator in our definition of Community OR. Is a facilitator necessary for Community OR to be taking place? This is a difficult question to answer since,

for the majority of Soft and Community OR practice that we know about, it is the role of the practitioner as a facilitator that has brought to light the interventions through academic publishing. Here we make use of the idea of decentring.

In their analysis of the use of an online Group Support System (GSS) for problem structuring, Yearworth and White (2016) *de-centre* the role of the facilitator and comment on the possibility of facilitator-less GSS and self-organising problem structuring behaviours. They conclude that there is no particular technical reason that would prevent such a group activity taking place. Therefore, it is the GSS itself that provides the *scaffolding* (Jordan, 2014) for problem structuring behaviours. In the same way, we argue that the digital platform for online communities thus now becomes an important actant in its own right as part of an actor network. It follows from this that the possibility of facilitator-less Community OR, scaffolded by a digital platform, is plausible.

We bring these strands together and present a novel solution to the conceptualisation of a Community OR engagement and approach to the collection of empirical data – *we shift our entire empirical focus into the domain of the study*: i.e. the intersection of social media and community needs. We reframe our research questions in a way that is open to empirical investigation by the collection of data from social media to look for possible instances of Community OR emerging in accordance with our constitutive definition.

Thus we arrive at the notion of a Community OR engagement as purely a construct derived from observational data, rather than one of expertise coming into a community in the form of an academic practitioner/expert facilitator *bringing about* an engagement (White & Taket, 1994). In making this leap, we do not need the action of the academic/practitioner/expert facilitator for problematisation, interessement and enrolment to occur for our community; there is no actual Community OR *engagement* as defined through the eyes of an academic practitioner/expert facilitator, although the scenario may be labelled as Community OR ex post, as we are setting out to show in this paper. The crucial step is that the translation from problematisation through interessement and enrolment is viewed as *self-initiating* and *self-organising* steps in the creation of an actor network. We consider that the activities of such emerging target groups on social media should be considered as part of the domain of Community OR and a legitimate object for our study – and, crucially, an object for our support as OR practitioners.

## 2.6. Summary

We can summarise our argument for a constitutive definition of Community OR observable in social media by the use of a set-based view similar to the approach of Yearworth and White (2014) and shown in Figure 1.

We define the superset of all collective behaviours arising from a problematisation and leading to action ($B$). We regard this superset as containing all OR practice generally ($R$), which in turn contains the subsets of Soft OR ($P$), and Community OR ($C$). Yearworth and White (2014) clearly established that non-codified PSMs ($N$) are a subset of ($P$), and our argument above thus reduces to the assertion

that $C \cap N \neq \emptyset$. We then introduce our empirical claim that a subset of ($B$) can be mediated by digital platforms (D)[2] and, furthermore, that a subset of this activity is conducted on social media and is publicly observable ($O$). This leads us to a restatement of our theoretical and methodological position that $C \cap N \cap O \neq \emptyset$. For the rest of the paper, we make use of this set notion as shorthand, both to indicate our constitutive definition for Community OR and our assertion that this is not an empty set.

-- Figure 1 here –

**Figure 1. The logical relationship between Community OR ($C$), non-codified PSM behaviours ($N$) and their mediation via social media ($O$) in the superset of all collective behaviours arising from a problematisation and leading to action ($B$).**

This section has established the theoretical and methodological bases for our constitutive definition of Community OR, defined the logical relationship between Community OR, non-codified PSM behaviours and their mediation via social media, and set out our analytical framework in the sociology of translations and CKM. In the next section we present our empirical work based on a major event that occurred at the end of 2015.

## 3. METHOD AND DATA

Our empirical work is centred on the devastating impact of an Extratropical Cyclone on communities in the Northwest of England and the Scottish Borders in December 2015. The storm formed on the 3rd of December over the Atlantic Ocean, traversing in a North-Easterly direction. The UK Meteorological Office (henceforth referred to colloquially as the Met Office) named the storm on the 4th of December, and at 2pm on the 5th of December issued the following 'Red' weather warning:

"*Storm Desmond, the fourth named storm of the season, is bringing potentially damaging gusts of wind across northern England in particular at times today (Saturday), while the frontal systems associated with the storm are bringing heavy rain to some parts of northern Britain. The heaviest rain is expected on west facing hills and mountains from north Wales northwards and a Red 'take action' warning for rain is now in force for parts of Cumbria and the Scottish Borders. Rainfall totals of 150 to 200mm are expected in places across Cumbria today, especially over exposed mountains, whilst parts of the Scottish Borders can expect to see in excess of 60mm. In addition significant impacts are likely across a broad area of northern England, western Scotland and Northern Ireland.*"

This warning, which includes the specific phrases "*Red 'take action' warning*" and "*significant impacts*", signal the initial temporal boundary for our data collection.

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[2] We explicitly identify this subset because we refer to the example of using Group Explorer (JourneyMaking/SODA) by Yearworth & White (2016) later in the Discussion, which is characterised by the region $P \cap \sim N \cap \sim C \cap D \cap \sim O$ as shown by the crosshatching in Figure 1.

## 3.1. Approach

Our approach set out to i) establish the existence of a target group for analysis consistent with our constitutive definition for Community OR, and ii) provide the empirical data to support the analysis through the theoretical lens of translations and the CKM. It is based on the use of publicly available data from Facebook and Twitter, and is structured in four different phases reflecting the different affordances of the platforms (Weller, 2016) and motivations for participation (Baek, Holton, Harp, & Yaschur, 2011; Sweetser & Kelleher, 2011) as follows:

1. Quantitative analysis of Twitter data: to provide initial insight into the short-term dynamics of the problem context, network structure, and emergence of any target groups,

2. Qualitative analysis of Twitter and initial Facebook data: to provide an in-depth look into the dynamics of the problem context and target group formation,

3. Detailed qualitative analysis of Facebook data: to search for evidence of problem structuring behaviours and models of interaction between types of expertise, and

4. Quantitative analysis of Facebook data: the use of automated text analysis to support exploration of the actor network.

There was a certain amount of to-ing and fro-ing between collection and analysis of social media data, and this is an inherent feature of our methodology. Therefore, these phases *summarise* the exploratory nature of our investigation and do not prescribe a rigid, step-by-step procedure.

## 3.2. Ethics of Data Collection and Analysis

The data collected from Twitter and Facebook are available via the search terms shown below. Since we are looking for patterns of behaviour, we are not recruiting participants to a study and sampling is in effect completely determined by the queries used to search for data. By definition, as stated in §2.6, if the queries submitted to a platform return no data, then $O = \emptyset$. The availability of the data to searching is governed by the agreement between the users who post information and the platform providers, as specified in the terms and conditions of the respective End User Licence Agreements (EULA). Since publicly visible data are being analysed, and there is no specific recruitment of human subjects, we therefore conclude that this is not human subject research from a research ethics perspective (Wilson, Gosling, & Graham, 2012). Also, there is no prima facie case for any participant to expect privacy when posting information via these platforms, *unless* the user takes specific actions to restrict visibility of the information they are posting (Moreno, Goniu, Moreno, & Diekema, 2013). In the case of the event we analyse, the fact that the data is public is *essential* to the spontaneous creation of the target group we study. We return to ethical questions in the discussion.

## 3.3. Quantitative Analysis of Twitter Data

The Twitter data were used in the initial analysis due to the manageability of data produced, limited by the smaller number of Twitter users and the 140 characters limit in Tweets. The Twitter data were obtained using the Advanced Search facility on the twitter.com website, via the use of a client

application written in Python based on the use of the Tweepy package. The initial Twitter query looked at the volume distribution of Twitter data from the 3rd of December to the 3rd of February 2016 using the search phrase "Carlisle AND flood* since/2015-12-03 until/2016-02-04". This query generated 1641 tweets, of which 455 mentioned other twitter accounts and were therefore suitable for network analysis. Inspection of data from this initial search led to the generation of a further search after it was seen that the hashtags #spiritofcumbria and #spiritofcarlisle had emerged, on the 7th and 9th of December respectively, and were being used for communicating, in a more focused way, reactions to the needs generated by the flooding and storm damage. Searches on these two hashtags generated 2827 tweets combined, with 1357 suitable for network analysis.

The volume of tweets downloaded from the Twitter searches over the data collection period is shown in Figure 2. The initial Twitter query revealed a very sparse network, as shown in Figure 3. The network graph extracted from the Twitter query on the hashtags reveals a more developed morphology, and is shown in Figure 4.

-- Figure 2 here --

**Figure 2.** Volume of tweets acquired from the Twitter searches over the data collection period.

-- Figure 3 here --

**Figure 3.** Network graph extracted from the "Carlisle Flood" Twitter query.

-- Figure 4 here --

**Figure 4.** Network graph extracted from the hashtags #spiritofcumbria and #spiritofcarlisle Twitter query.

A number of network parameters were extracted from both graphs (using the Gephi package) and are summarised in Table 2. Although this shows a more *cohesive* social network emerging from the use of the *spirit* hashtags (as defined by degree and density), as is clearly shown in Figure 2, the volume of tweets dies down to almost zero by the 3rd February 2016. At this point in time, the network as identified by both the search term and the hashtags has ceased to exist in any meaningful sense. It is clear that, whilst the Twitter data provide some limited view into the actor network around problematisation, for this problem context we were not able to follow the translation through interessement and enrolment to self-organisation and to problem structuring behaviours, reflecting the findings of (Sweetser & Kelleher, 2011) on motivations for participation. However, we should not be surprised because the triggering event associated with the search term has ceased to be the problem at hand.

| Network Metric | "Carlisle Flood" data | *Spirit* hashtag data |
|---|---|---|
| Average degree | 1.288 | 2.347 |
| Average weighted degree | 0.689 | 1.509 |
| Network diameter (Brandes, 2001) | 4 | 9 |
| Graph density | 0.002 | 0.003 |
| Modularity (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008) | 0.983 | 0.768 |
| Average path length (Brandes, 2001) | 1.135 | 3.422 |

**Table 2.** Network parameters for the graphs shown in Figure 3 and Figure 4.

*3.4.     Qualitative Analysis of Twitter and Facebook Data*

Facebook data were collected from simple search queries entered in the Facebook website as follows:

https://www.facebook.com/search/top/?q=carlisle%20flood&filters_rp_creation_time=%7B%22start_month%22%3A%222015-12%22%2C%22end_year%22%3A%222015%22%7D – for December 2015, and

https://www.facebook.com/search/top/?q=carlisle%20flood&filters_rp_creation_time=%7B%22start_year%22%3A%222016%22%2C%22end_month%22%3A%222016-01%22%7D    – for January 2016.

Data were saved to PDF files (46 pages/9.4Mbytes and 107 pages/27.2Mbytes respectively) for analysis. The analysis focused on three distinct phases in the period of data collection, which we have labelled as follows:

1.   *Preparation*, which starts from the original 'red' warning at 2pm on the 5th of December and ends when the Carlisle flood defences begin to fail towards midnight – much earlier than expected by the Environment Agency,

2.   *Emergency Response*, which starts as soon as the flooding begins, and

3.   *The Rally*, which has no fixed starting point, but is where we identify the beginnings of community-organised responses to the flooding, rather than responses being led by the Emergency services, Government agencies, or Not For Profit (NFP) organisations.

4.3.1   Preparation

The initial tweets on the 5th December were mostly passing-on general area flood warning messages: e.g. "*People at risk in Carlisle should have been warned about flood threat if they are registered on the @EnvAgency system*". However, some tweets were targeted at very specific locations: e.g. "*Residents in the Warwick Road area of Carlisle have been issued with a severe flood warning*" at 17:37. Residents were commenting on being prepared: "*What a way to spend a Saturday... Moving stuff upstairs to protect from a flood. Brings back memories from 2005 #greatflood #carlisleflood*". There were also concerns, based on experiences of the 2005 flooding, that the flood defences built by the Environment Agency in Carlisle were likely to fail: "*Hoping and praying that the flood defenses hold in #Carlisle tonight*" and, using stronger language, "*Really fucking hope these £38million flood defences in Carlisle do their job tonight for the sake of my fam*". Indeed, by 20:21, the Environment Agency itself was predicting that the defences would fail around midday on the 6th. Variations in this 'severe' warning were being passed around in the following hour, although, in fact, the first reported breach was at 21:43: "*Flood defences breached at Etterby Lea Terrace, #Carlisle . Stanwix at risk of flooding during high tide tomorrow. #CumbriaFloods*". At 23:09, we have the first image on Twitter of the unfolding crisis: "*Flood defences BREACHED in Carlisle, Cumbria. And the water's still coming in from the mountains! #StormDesmond pic.twitter.com/1ivmitDK0n*". By around midnight, it was clear that the original predictions of failure of defences at midday on the 6th were too conservative. At 00:09

on the 6th we see "*Flood defences in Carlisle now expected to be topped from 1am. Alerts in Warwick Road, Botcherby, Willowholme, Caldewgate and Shaddongate*"; and at 00:27, "*Looks like #Carlisle flood defences will breach in the next hour. Lights flickering, hearing helicopters flying over. Scary. #CumbriaFloods*". Expressions of anger and frustration were beginning to emerge at this point: "*All that money on flood defences a total waste of time and money #Carlisle*"; "*The waters in #Carlisle are rising. Those super-duper flood defences after 2005 are failing*"; "*There was a 'Great Flood' in Carlisle, Cumbria, in 2005... but millions were spent on flood defences, that have now failed. #StormDesmond*"; and "*Thoughts with people of #Carlisle. Flooded out again. Brand new flood defenses failed. How much money wasted*". By the morning of the 6th, we were waking up in the UK to widespread media reports that major flooding was underway in Carlisle.

4.3.2    Emergency Response

Most of this phase of the disaster corresponds to three main groups of expertise mobilising to deal with the immediate threat of the flooding to human life. We would not expect there to be much traffic on social media except where citizens, and particularly news media, are observing them in action. In the first group, the normal UK emergency services (police, ambulance and fire brigade) were being augmented by specialist organisations with requisite equipment, such as Army troops for infrastructure defence: "*Critical that flood defences around electricity sub stations in Carlisle / Kendal not breached. Army brought in to help. #CumbriaFloods*". Also, rescue efforts were being augmented via the Royal National Lifeboat Institution (RNLI): "*@PwllheliRNLI volunteer and @RNLI Flood Rescue volunteer Bryn Ellis in the thick of the action in Carlisle pic.twitter.com/I7xKbc8O9f*".

The second group, Government Agencies, such as Carlisle City Council, are less in evidence. At this critical time, we would expect them to be providing assistance and coordination to the first group, but for these actions to be largely unobservable through social media. A check of the @CarlisleCC Twitter account activity on the 6th December revealed mainly replies to tweets rather than originating messages. This check also uncovered the fact that their website was down due to the impact of the flooding on their own infrastructure: "*@allaboutclait Hi Andrea, apologies for the delay in responding, yes, the website is offline Due to the flooding of the Civic Centre*". A critical member of this group, The Environment Agency, only appears in the Preparation phase as a source of warnings derived from their flood prediction models, and they were an object of anger and frustration as already noted. In this phase, their expertise is not being called for.

Concerning the third group, Not For Profit (NFP) Organisations, we would not expect to find them assisting directly in this phase, although on the 7th we find reference on Twitter to the local Rotary Club coordinating what they call "*Flood Relief*" activities. The link from the tweet to the post on Facebook provides a segue into our analysis of The Rally phase:

"*Once again Rotarians from the club have been assisting with the flood relief in Carlisle. This time we have been at the Greystone Community centre where there have been literally hundreds of people in need of assistance. The people of Cumbria have been amazing with so many donations of*

*food, clothes, baby supplies and toys that the centre has now run out of room. They will still need donations but would appreciate that help being given over the next few days rather than now. I've also seen some amazing generosity from local businesses including a coffee van and this pizza van from over the border in Gretna. Who both donated their goods free of charge to the volunteers and those needing help. A distressing day but a rewarding one too knowing that you can give assistance.*" http://fb.me/4lgtrnu9s

### 4.3.3   The Rally

The qualitative analysis here is focussed on the emergence of truly community-led activities. The data show that the Emergency Response activities were still active, as the volume of water flowing in the River Eden remained at a dangerous level (>400M$^3$/s; see (Environment Agency, 2016, p. 14) until the morning of the 7$^{th}$. However, the role of the rescue services is diminishing as the flood waters recede.

Carlisle United's ground was a highly visible symbol of the scale of the flooding when the water levels "*nearly reached the crossbars on the pitch*" at Brunton Park (Taylor, 2015). The "Blues" were quick in organising community action, and there were many media reports on Facebook as early as the 6th December publicising their offer of help to the community. For example, this on the Guardian website:

"*A lot of concern from the lads about all those affected by this weekend's events up in Cumbria and the Borders. Every member of the squad has agreed that they want to help … It has been agreed that we will all be available, after training on Tuesday to help out in any way possible. Clearing furniture, cleaning, tidying – anything that is needed and that will help. Contact us if you think the lads can help you with your situation*".

However, despite the publicity via news outlets, there is no evidence in either the Facebook or Twitter data to indicate that this offer grew into self-organising and on-going activity. The necessary translation did not take place: problematisation was nebulous and interessement and enrolment apparently did not happen.

There is evidence in the data for two further self-initiating activities. On the 3$^{rd}$ January 2016, there is a post on Facebook referring to an open meeting organised by the Lions Club International:

"*Carlisle – are you missing out? Flood hit communities across Cumbria are benefiting from the support of Lions Clubs International - Carlisle is missing out and we would like to do something about this with your help. For those interested, there will be an open meeting on 12th January, 7pm*".

The post is invitational and promises an "*open*" meeting. However, there is no further data that indicates what happened at the meeting or after. On the 4$^{th}$ of January, there is a post referring to "*Floods HQ Milton Hilltop*" and a link to a blog post (McQueen, 2016) with reflections of a volunteer starting on the 21$^{st}$ December with the initial task of packing Christmas hampers for families affected by the flood with items donated by local supermarkets. Again, this seemed self-limiting to the specific task of

distributing Christmas hampers without any further sign in the data of self-organising activity. For both cases, again, the necessary translation did not occur.

On the 7th January, a brief post on Facebook by the "Carlisle Flood Action Group" referred to a meeting apparently to be held that evening: "*Thanks to Roy and team @CrownMitre for gifting their Ballroom for tonight's Carlisle Floods Residents' & Businesses' Action Group #support*". Further searching on Google reveals a news report on the meeting from the local Carlisle newspaper, the News and Star, dated 6th February: "*Aiming to turn anger into action after the floods: Two months on from the devastating floods, Pamela McGowan finds out how a community is fighting back*" (McGowan, 2016). Her report states the following:

> "*TWO months ago Stephen Gibbs was at rock bottom. Forced out of his Carlisle home by floods for the second time, the thought of having to go through it all again left him both heartbroken and angry. And he wasn't the only one. Yet it was while seeking refuge at the Crown & Mitre, alongside about 100 fellow flood victims, that he helped lead the city's residents to unite in a way they never had before. The Carlisle Floods Residents' and Businesses' Action Group was born to demand answers, but also to channel the anger of a community into what has become a new movement for positive change. Stephen, of Eldred Street, is a lecturer in global leadership and change at the University of Huddersfield. Everyone had genuinely believed that the flood barriers would do their job. I thought we can't just do nothing. His background, combined with his own personal experience of flooding, prompted him to lay the foundations for the group and help local people find their voice.*"

Here we see the beginnings of a self-organising activity where non-time-bounded *action to improve* the situation is seen as a guiding purpose. The creation of an action-oriented identity on Facebook reflects this translation. The socio-materiality of the situation is also acknowledged in that the target group recognises that the situation has been caused by inadequate flood defences and that this inadequacy arises from decision-making processes and interpretation. The process of finding a voice seems bound to a translation from being passive victims needing help to active citizens seeking not just answers – presumably from suitable experts – but more importantly, *change* in how things are to be done in the future.

*3.5.    Qualitative Analysis of Initial Facebook Data*

To follow the emergence of this group, our analysis – from the point of view of questions about problem structuring behaviours – is based on the Facebook postings from the Carlisle Flood Action Group from December 12th 2015 onwards, as only 3 further posts were found in the original Facebook data through to the 3rd February 2016. A new PDF file of 173 pages/22.2Mbytes was generated, which was simply the download of all data from the Facebook page https://www.facebook.com/CFRBAG/. We also draw attention in the data to the problem context and the nature of assemblage of actors,

interpreted as an example of a hybrid forum and CKM in action. The analysis of this data set is presented in Table 3.

| Date | Data | Concept |
|---|---|---|
| 14/12/15 | *"Tying blue ribbon to trees and lampposts at the highest point the water reached.*<br>*Blue ribbons will remain until the government does something positive about the flood defences in Carlisle."*<br>*"Tie a Blue Ribbon - thanks to Emma Maskell of Warwick Road* https://www.facebook.com/spottedcarlisle/photos/pb.2693176398 70713.-2207520000.1450116261./720816561387483/?type=3&theater *"* | Data from lay expertise. |
| 19/12/15 | *"Interesting reading* http://www.geography.org.uk/resources/flooding/carlisle/currentr isks*"*<br>*"Interesting group - have phoned them this morning and invited to 7th Jan meeting."* | Expert opinion.<br>Hybrid forum.<br>CKM. |
| 23/12/15 | *"Had one of many interesting chats with David, this time about land management, including "river keepers", and the range of similar artisans and skilled craftsmen and women who once worked the land to husband it, keep weeds away, protecting marsh land…"* | Lay expertise.<br>Historical involvement of laypersons. |
| 28/12/15 | *"Flooding cause that the Government would rather keep to itself"* http://www.chroniclelive.co.uk/news/north-east-news/flooding-cause-government-would-keep-10580092#ICID=sharebar_twitter<br><br>8/1/16    *"This is not true - read the European Water Framework Directive for yourself - it's a public document. We should not be spreading inflammatory stories that have no basis"* | Contested knowledge.<br>Messiness.<br>Worldviews.<br>Subjectivity.<br>Seriousness of voice. |
| 28/12/15 | **FLOODS MEETING**<br>**WHEN**: 7:30PM, THURSDAY 7TH JANUARY 2016<br>**WHERE**: CROWN & MITRE HOTEL, CARLISLE CITY CENTRE<br>**FOR**: EVERYONE AFFECTED BY THE CARLISLE & AREA 2015 FLOODS<br>**PURPOSE**: TO CREATE A UNITED RESPONSE TO THE DEVASTATING FLOODS OF DECEMBER 2015 & AGREE OUR MESSAGES/ACTIONS<br>**Attending**: John Stevenson MP, and other representatives<br>Organised by:<br>Carlisle Floods Residents' & Businesses' Action Group<br>For further information:<br>email: carlislefloodsaction@gmail.com<br>mobile: 07544 581601<br><br>1/1/16    *""We are in the business of managing risk and not preventing floods" (reported on Channel 4 News this evening) So said the top official in the EA. In this context "risk" means "possibility of flooding". So there you are, from the horse's mouth"* | Action to improve.<br>Workshop.<br>Hybrid forum.<br>Managing risk.<br>Interactive/<br>Iterative/<br>Therapeutic. |
| 4/1/16 | *"IMPORTANT: Bring pen and paper to this Thursday's meeting. Children are welcome."* | Inclusivity.<br>Record keeping. |

| 7/1/16 |  "Carlisle and Area residents and businesses unite to agree what we will do as a community to protect the City and region. 1) … Visioning Group …(gathering evidence statements/photographs of flood defence failure, and visioning for the future) 2) … Blue Ribbon Campaign (tie a blue ribbon – will help ensure an effective defence to restore house values) 3) Protest/Petition/Facebook Group https://www.facebook.com/CFRBAG/?ref=hl (debate and protest, sharing knowledge and support) 4) … Business Support Group (sharing knowledge together, and putting business back on the road) | | Action to improve. Messiness Data from lay expertise. Self identification as a community. Protest. Interactive/ Iterative/ Therapeutic. |
|---|---|---|---|
| 7/1/16 | "Thank you to so many people who have attended this evening this just shows the power of social media in today's society. A petition for a public enquiry into the floods and help from the solidarity fund will be created shortly." | | Action to improve. Power of social media. Continuity of voice. |
| 7/1/16 | "Which activist sub-group are you joining?" | | Action to improve. Enrolment. Non-expert facilitation. Messiness. Power of social media. Interactive/ Iterative/ Therapeutic. |
| | 7/1/16 | "A well conducted meeting and attendance was amazing but it's a shame we have had to go through the floods again after 11 years so let's work together with an action plan to stop a repeat in the future" | |
| | 7/1/16 | "Yes the attendance was great to see. The difference is 11 years ago there was little social media and this time the power of social media is working" | |
| 17/1/16 | "You won't like this, but the DEFRA budget sees the EA's ability to focus on high risk areas as part of its revenue generation. The EA, as you say, has a remit far from our expectation. It is single project focused and if you or I chose to build on a flood plain…" | | Contested knowledge. Messiness. Worldviews. Subjectivity. |
| | 18/1/16 | "The gap between perception and reality. Most assumed the EA had a wide remit, but on closer inspection it is quite narrow. Having said this the govt will let it, and the EA will allow itself, to be the Front Rank during the opening shots of this particular skirmish/battlefront." | |
| 8/1/16 | ""The EA was created with the explicit purpose of providing "Integrated Pollution Control". Yet because of the political and departmental squabbles at the time of its creation, it ended up being a merger of the NRA, HMIP and various waste bodies. Because the NRA at the time had over 6000 staff, and HMIP much less, and because of the sheer scale of the operational demands of the NRA activities, it ended up being a conglomerate dominated by water and floods. The widely recognised result has been an often poorly managed and poorly focussed organisation." Professor Dieter Helm CBE http://www.dieterhelm.co.uk/" | | Expert opinion. |
| 10/1/16 | "GO BLUE FOR FLOODS. In empathy for the flood victims people are joining a visible campaign to ensure Cumbria the North of England and the Borders are not forgotten. Some have already started to tie a knot in a blue ribbon outside their homes, | | Social media. Data from lay expertise. Subjectivity. |

| | | | |
|---|---|---|---|
| | | *and community spaces. Lets us all extend this movement to our social media pages."* | |
| 10/1/16 | | *"Curious that DEFRA vision is "flood protection" (2) which isn't shared by EA. Also, this vision, from Liz Truss, includes "The Secretary of State told us that opening up flood defence projects to other organisations such as local authorities potentially increased access to funds since flood-protection spend unlocked land that could be of massive benefit to the local economy. 20 Installing flood defences in areas at risk of flooding can allow developments to proceed which would..."* http://www.publications.parliament.uk/pa/cm201516/cmselect/cm envfru/443/44305.htm#_idTextAnchor009 | Contested knowledge. Expertise. Messiness. Worldviews. |
| 11/1/16 | | *""Mark Hoban... former Tory minister... chairing Flood Re... whose starting salary was... £150,000 for one day a week... The implementation [of Flood Re] relies entirely on government, which by authorising insurance companies to levy £10-£50 on everyone's home insurance creates an industry-managed fund to subsidise the hard-to-insure in flood-prone areas. This structure has a major failing: while the government authorises the fund, the money comes from households countrywide and not the Treasury. It thus creates no incentive to prevent flooding, instead passes the cost and responsibilities to householders with no way of changing water management." Private Eye 8-21 Jan 2016 page 3"* | Contested knowledge. Expertise. Messiness. |
| 11/1/16 | | *"Environment Agency chairman Sir Philip Dilley, who faced criticism during recent floods, resigns* http://bbc.in/1Rxg9d6 *"* | Contested knowledge. Expertise. |
| 11/1/16 | | *""Yes, we use the word "overtopping", and it graphically describes what happens. The defences have not failed; it is just that the flood we have experienced is greater than the structure was designed to cope with." David Rooke, Deputy CEO, Environment Agency* http://data.parliament.uk/writtenevidence/committeeevidence.svc/ evidencedocument/environment-food-and-rural-affairs- committee/winter-floods-201516/oral/26721.html*"* | Contested knowledge. Expertise. Subjectivity. |
| 11/1/16 | | *"After the 2005 floods, a major project to construct comprehensive flood defences within the city was undertaken. This project took around five years from initial planning stages through to delivery on the ground. It is unlikely that such a major scheme will be required within the city for a considerable amount of time."* http://www.carlisle.gov.uk/Portals/24/Documents/Examination_Li brary/Core%20Documents/SD%20006%20Carlisle%20District% 20Local%20Plan%20Proposed%20Submission%20Draft%20201 5- 2030%20Infrastructure%20Delivery%20Plan.pdf?timestamp=14 47419830594 *""* | Action to improve. Expertise. |
| 15/1/16 | | *"IMPORTANT: Ali is starting the Flood Resilience Group examining at first hand what, if anything, can be done to protect the home from flooding. We know this is something like the Holy Grail of flooding but with concerted effort intelligence gathering might surface ideas of significance. The danger is that without this something quite ingenious or surprising could be overlooked"* | Lay Expertise. PDM not CKM? Hybrid forum. Interactive/ Iterative/ Therapeutic. |
| | 17/1/16 | *"Without stretching the point, Flood "Resilience" is a misnomer. The EA have said they are focused currently on "risk management" not Flood Prevention. This is* | |

| | | *largely because they are only one agency amongst many who have a role in the 'whole catchment area'. DEFRA might be our focus of attention"* | |
|---|---|---|---|
| 17/1/16 | | *"UPDATE: Having not received a response to the Group's 8th January communication to Rory Stewart's office, a message has been sent to Neil Parish, Chair of the DEFRA Select Committee requesting his urgent attention to Carlisle and area's situation."* | Power of social media. Reluctant Expertise. |
| 18/1/16 | | *"Extracted from earlier debate: The CEO of Flood Re is, according to reports, earning £150,000 per annum for one day's work per week. ...If there is a London-centric blindness, with people who have experienced 'gold-taps' and have a sense of entitlement to fabulous sums, then the Carlisle community has to make its voice heard. Silence has cost Northern communities dearly".* | Interessement. Subjectivity. |
| 18/1/16 | | *"We have received an acknowledgement from Neil Parish, Chair, DEFRA Select Committee, via his office, acknowledging our desire to input into any enquiry or investigation."* | Expertise. Hybrid forum. PDM not CKM? |
| 1/2/16 | | *"UPDATE: A small group of volunteers met on Saturday, following our invite for folks to step forward and form a small executive committee to take the Group's objectives forward. This went well and we are meeting again later in the month to plan more formally. Creation of website, gathering evidence and outlining the vision of what the community wants to put to govt, Public Relations, well-being and many other topics were covered. Do we form a charity, expand vision..."* | Taking action. Adaptation/creativity. Interactive/iterative. |
| 2/2/16 | | *"Call for evidence https://consult.defra.gov.uk/water-and-flood-risk-management/national-flood-resilience-review-call-for-evidence"* | Expertise. Lay expertise. PDM. |
| 10/2/16 | | *"Update: The Action Group has invited representatives from National Farmers Union to join its exec group this week. It's critical the Action Group engage farmers so a combined approach is formed"* | Action to improve. Expertise. Lay expertise. Hybrid forum. |
| 12/2/16 | | *"First 'proper' Action Group Exec meeting tonight friends, and we've got all your inputs to process, and plan next meeting and actions etc. Much to consider about next moves. Wish us well!"* | Adaptation/creativity. Interactive/iterative. |
| 14/2/16 | | *"Great first formal meeting of exec team on Friday, brilliantly workshopped by Diane. Concerns ranged from co-ordination of emergency response, communication from agencies, protest strategy, to group website, and getting your voices across smartly but forcefully. I think we have something special here which we will communicate more fully soon. Passionate concern to represent the victims! We are YOUR group and will speak for you fearlessly! Plans coming together for next meeting."* | Action to improve. Subjectivity. Workshop. Facilitation. |
| 15/2/16 | | *"Update: The Group following their meeting felt it wise to change the name to "Carlisle Flood Action Group" but are at pains to say this is focused fully on representing Carlisle and its districts, residents and businesses. Hope that is OK friends."* | Adaptation/creativity. Interactive/ Iterative/ Therapeutic. |

**Table 3.** Concept mapping of the data covering the formation of the Carlisle Flood Action Group

The data and concept mapping presented in Table 3 cover the formation of the Carlisle Flood Action Group in its first two months of existence. Problematisation, interessement and enrolment are clearly established, indicating the necessary translation into self-organising and self-sustaining activity. As can be seen in the data, certain aspects of the GCD can be seen, although it is missing evidence of taking a

systemic approach and the data clearly cover a period much too early for any thoughts of methodological learning. However, the group is being reflective and showing a willingness to listen and adapt. It is clearly making use of 'conventional' workshops and meetings, and recognises the role, and power, of social media in supporting its activities. Unfortunately, there are no available data from the workshops, although there is reference to audio recordings from the 7th January meeting being available in Dropbox these were 'Not Found' (HTTP 404 error) when an attempt was made to access them.

Social media are clearly instrumental in on-going problematisation, interessement and enrolment. They also serve as the *glue* to bind the group together in on-going exploration of the problem context, and they provide a rich source of worldviews (simply because commenting on Facebook posts is an open, public act). This glue also generates a rich narrative structure reminiscent of the sort of OR case data called for by Ormerod (2014); we are seeing evidence of iteration and adaptation in approach, perhaps in far more detail than we would normally have access to in OR engagements.

There are also signs of the CKM emerging in the data. It seems clear that the relation between traditional expertise and lay expertise is still in the mode of Public Engagement and Debate Models (PEM and PDM) rather than full CKM (Callon, 1999). However, the group clearly see themselves as a source of expertise that needs to engage in dialogue with traditional expertise as represented by bodies such as DEFRA and the Environment Agency.

In summary, we believe we have established that the activity described in this case can be viewed as Community OR in action, as set out by our constitutive definition established in the Theory Development section.

### 3.6.    *Quantitative Analysis of Facebook Data*

The Text Analytics module from IBM SPSS Modeler v18.0 was used to analyse the Facebook data from the Carlisle Flood Action Group Facebook page at https://www.facebook.com/CFRBAG/. The data were extracted and transformed using the Facebook Graph API (Facebook, ND) and a custom Python script coded using the urllib2 and json (JavaScript Object Notation) modules. The 'message' part of the post and the date were extracted from the downloaded json data structure and written to an MS-Excel spreadsheet as an intermediate format for use with SPSS Modeler. There were 379 messages to the Carlisle Flood Action Group page in the data structures returned from the Graph API query during the year after the initial post made on the 12th December 2015. Category models were built interactively (category model nugget mode) with the 'Basic Resources (English)' loaded and using the extracted results to build categories. However, the process was not completely automatic and required manual 'cleaning' to override the automatic category assignment. Given the exploratory nature of the analysis

performed, and the relatively small size of the data set[3], the global frequency of concepts chosen was set equal to one. Due to the prevalence, and importance to the problem situation, of the use of EA or E-A in the posts in reference to the 'Environment Agency', a global substitution was made in the data before loading into SPSS Modeler.

Running the SPSS Modeler stream (the schema in SPSS Modeler for conducting an analysis) found 3,296 concepts in the data. The category builder in the interactive workbench was then used to build a category tree. Whilst this is nothing more than a taxonomy of the concepts found in the data, SPSS Modeler preserves the link to the location within the source data, which in this case is bounded by the message data structure in the post. This co-occurrence mapping is similar to coding in Computer Aided Qualitative Data Analysis Software (CAQDAS) such as NVivo with the coding boundary set to paragraph and using a matrix query over the codes (Yearworth & White, 2013).

. The 'category web' that can be extracted from any one particular category can be interpreted as a view of the actor network for categories corresponding to specific actors, or actor classes, when the lowest level categories are chosen for display. As an example, the actor network for the actor class 'flood barriers' is shown in Figure 5, and for 'flood victims' in Figure 6. In the key to both figures, the quantity "# docs" refers to the number of messages (i.e. rows in the Excel spreadsheet after extraction and transformation of data) in which the categories appear.

-- Figure 5 here --

**Figure 5.** Interpretation of the actor network relating to the actor category 'flood barriers'.

-- Figure 6 here --

**Figure 6.** Interpretation of the actor network relating to the actor category 'flood victims'.

This approach opens up innovative angles for exploring the actor network as the category web presents the graph of category relations bounded by a single message posted by someone to the Carlisle Flood Action Group Facebook page: i.e. it is the human actor that posts the message who is implying that a relationship exists between categories, as labelled by SPSS Modeler, by the fact that they *co-occur* within a particular posted message.

However, whilst providing a novel approach to the visual exploration of the actor network, there is no apparent solution to the problem of labelling behaviours according to categories that exist outside the data themselves; nor is there available a pre-built 'Resource Template' suitable for the task. Best practice seems to indicate that the typical starting point for automated text analytics are data that have already been behaviourally labelled, most likely through the process of capturing the data (Baddar, 2015). A Resource Template could have been built, ironically, starting from the manual behavioural coding already carried out in the qualitative analysis of the Facebook data shown in §3.5. This would be useful for analyses of further data sets in the future, but not for the existing data i.e. all the data we

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[3] The size of the raw text message data in the 379 messages generated by the query was only 184Kbytes; which is tiny in comparison to the size of datasets these tools are designed to work with.

have extracted and analysed in this paper could have been used as a training data set. We envisage the possibility of qualitative analysis for particular types of behaviour in ever larger data sets used to build a 'Resource Template' that could then be used in SPSS Modeler for the automated behavioural analyses of new data sets.

## 4. DISCUSSION

The data are rich with images that graphically convey how the community was actually created by this devastating flood (the idea that a community was created assumes that a 'community' is not merely a passive aggregate of residents in a geographical area, but a self-organising, interacting collective). The event was both highly dynamic in time and highly specific in terms of location. This could be seen in the Twitter data shown in Figure 2, where there was an initial sharp delineating time boundary on the 5th December followed by a decay to under 50 tweets a day by the 19th December, and then a fairly steady decline to almost zero by the 3rd February 2016. However, the consequences of the flood continue to unfold in the affected community, as evidenced by the volume of messages posted to the Carlisle Flood Action Group Facebook page.

Dealing with flooding is undoubtedly a wicked problem (Rittel & Webber, 1973), and the immediate post-event response in this case, whilst involving a wide range of expertise, was not dependent on the deployment of intellectual capability in the form of an academic/practitioner/expert facilitator from the OR community. However, we believe that we have convincingly demonstrated through our analysis that Community OR was in action despite this absence. We have charted the emergence of one new community organisation in our qualitative analysis – the Carlisle Flood Action Group – that represents the translation of the original problematisation, interessement and enrolment of actors into a group that was to all intents and purposes engaged in problem structuring, even though those actors would probably not have heard of the term. There was (and still is) wide engagement and participation from citizens, and that has been evident despite the presence of existing, and the emergence of new, organisations. We view this *self-initiating* and *self-organising* behaviour amongst actors as the very embodiment of what is meant by a community. However, our concern here is less about definition and more with the question of community empowerment. Have social media empowered the community and helped them structure the problem as created by the event? In answer, we have mainly focussed our analysis of the degree to which we have seen evidence of (Soft) OR behaviours and the CKM emerge in the empirical data. We find support for our observations in the work of Tim et al. (2017), who describe the emergence of social media as boundary objects in their analysis of a disaster response. Their qualitative case study research describes how social media were used in the 2011 Thailand flooding disaster and demonstrate the "*enactment of social media as a boundary object-in-use*" (*ibid*, p.217). They present data that clearly shows communities problem structuring their response to the event. Although their research is oriented towards promoting the practical application of social media platforms in disaster response situations, their findings nonetheless

lend further support to our argument that $C \cap N \cap O \neq \emptyset$. In addition to the idea of social media *scaffolding* OR behaviours, discussed in §2, the findings of Tim et al. (2017) and our analysis in §3 lead us to the strong conclusion that social media platforms are actants in their own right in actor networks.

*4.1.    The Relationship Between Soft OR and Hybrid Forums*

Once the immediate community needs had been addressed, focus naturally started to switch towards the mitigation of future events, which cues the entrance of other expertise in the form of expert modellers such as those skilled in providing predictive models of flooding. Examples of hybrid forums grounded in notions CKM already exist (Lane et al., 2011).  In the example provided by Lane et al., the establishment of the Ryedale Flood Research Group to address recurrent flooding in Pickering in Yorkshire seems to presage the formation of the Carlisle Flood Action Group. Whilst the work of Lane et al. (2011) has emerged from a theoretical underpinning purely in ANT and the CKM, the close relationship between the process enacted within the Ryedale Flood Research Group and the Generic Constitutive Definition for PSMs has already been noted by Yearworth (2016), who draws attention to possible equivalence of purpose and form between a problem structuring workshop and the hybrid forum (Callon et al., 2009b; Callon, Lascoumes, & Barthe, 2009c).

In our analysis in §3, we focus specifically on the *translations* evident in the case data from the perspective of both hybrid forums and CKM. Here we are particularly interested in how the CKM applies to decision-making situations, where scientific knowledge and technology capabilities cannot completely 'solve' a problem due to limitations such as restrictive budgets and imperfect knowledge of local conditions. Responses to flooding and the construction of flood defences fall into this hinterland of messiness.

We can illustrate the divide between traditional and lay expertise with the observation that, in our data, the non-specialists regarded the Carlisle flood defences as having failed, but to the expert, they had merely 'overtopped' - the word 'failure' was reserved for the case of actual physical collapse. To bridge this gap, the CKM lens helps us to see the role of non-specialists as essential: publics are now part of a "*concerned group*", and the problem of trust is finessed by the fact that know-how in the problem situation is now on an equal footing, so the concerned group can "*gain recognition for their actions*". The non-specialist as a member of a community affected by a disaster and emerging new social identities (Callon & Rabeharisoa, 2003) – such as the Carlisle Flood Action Group (and the Ryedale Flood Research Group previously) – can be seen as part of a wider group acting to improve the problematic situation. The Carlisle Flood Action Group amply fulfils the definition of a hybrid forum. In this "*space of organized hybrid forums*" Callon et al. (2009b) regard controversy as the causal mechanism that

> "*...allows the design and testing of projects and solutions that integrate a plurality of points of view, demands, and expectations. This 'taking into account', which takes place through negotiations and successive compromises, unleashes a process of learning*" (*ibid*, p.32).

The parallels with problem structuring behaviours in bridging between different worldviews and subjectivities are apparent and striking.

In our data, this controversy is focussed on the technical role of the flood defences, the expert-informed decision-making leading to their construction after the 2005 floods, and the aftermath of their failure (lay view) or "overtopping" (expert view). In fact, dealing with contested terminology and the modification of vocabulary in hybrid forums allows "*laypersons to enter into the scientific and technical content of projects in order to propose solutions*" (Callon et al., 2009b, p. 33). They observe that "*Relations between specialists and non-specialists usually bear the stamp of asymmetry*" (*ibid*, p.33) and one of the ways in which expert groups maintain their power is through their specialist language.

The language of hybrid forums and specifically the concept of *dialogical democracy* (Callon et al., 2009c) now provides us with a link – in effect a restatement and continuation – to the original goals of Community OR as set out in the Theory Development section. Here, in contrast with familiar 'representational' democratic processes, the focus is on mechanisms that enable dialogue between traditional and lay expertise characterised by the *intensity*, *openness* and *quality* of the debate (Callon et al., 2009c, pp. 158-161). We can thus bolster the motivational argument for our constitutive definition of Community OR by aligning the self-initiating and self-organising behaviours observed in the data with this concept of dialogical democracy (also see Franco (2006), and Cronin, Midgley, and Skuba Jackson (2014), for discussions of the importance of dialogue to problem structuring).

## 4.2. *The Development of Digital Platforms*

The analysis of the data we presented in §3 has shown that translation through problematisation, interessement and enrolment are taking place, mediated by the use of social media, so the preconditions for Community OR activity have been established: i.e. $C \cap N \cap O \neq \emptyset$, and the use of distributed interaction through an online platform is already central to the behaviour of the actor network (which is also supported by observations by Tim et al. (2017). Further examples from Sebastian and Bui (2009), the 2013 floods in Germany (Kaufhold & Reuter, 2016), and the Queensland Police Service (2011) demonstrate how social media platforms are being used in disaster scenarios and clearly show problem structuring by participants. There is no question that social media can be treated as an actant in the emerging actor networks resulting from such scenarios. We expect to see social media platforms playing a greater role in the future, leading to further sources of empirical data in the region $C \cap N \cap O$.

This leads us towards new research questions relating to problem structuring behaviours mediated by social media:

1. To what extent do social media *scaffold* problem structuring?
2. What is missing from current social media that, if were they to be incorporated, might improve problem structuring?
3. What is required from social media to enable OR practitioners to engage with a concerned group?

The automated text analysis of Facebook data presented in §3.6 shows the beginnings of the sort of automated analytical tools that might be deployed to explore these three questions further, although they fall short of the quality of analysis presented in Callon's original work (Callon, 1986, p. 217 Fig 5) or the work of Brewer et al. (2013); lacking both the capability to generate abstract concepts from the data and, crucially, to show the role of the social media platform itself as an actant in the actor network (Tim et al., 2017). However, our questions are practically oriented and, in answering them, we can dispense with the theoretical constructs employed in this paper to establish the existence of Community OR. Therefore, from the examples we have seen so far, we can advance tentative answers to these questions.

On the questions of scaffolding and what is missing, there seems to be enough evidence that the capabilities of Facebook in its current form are already sufficient to *afford* problem structuring behaviours. The experience of Morton et al. (2007) on implementing PSM workshops online, i.e. working in the region $P \cap \sim N \cap \sim C \cap D \cap \sim O$, shows that there is nothing intrinsically flawed in the idea that social-media platforms could act in the same way as specialist software such as Group Explorer if they were suitably modified; i.e. widening scope to the region $P \cap \sim N \cap \sim C \cap D$. Recent work by Yearworth and White (2016) demonstrates the practical decentring of the role of facilitation and suggest that it is not unreasonable to see the "*rise of a participant-led group decision support process model*" (*ibid*, p.69). However, this sort of extension might not be required. The findings from (Tim et al., 2017), that social media can act as a boundary object, suggest that actors are actually already sharing mental models as might be expected in a PSM workshop. In the on-going posts of the Carlisle Flood Action Group we did find a link to a 'forum' (Carlisle Flood Action Group, ND), that includes reference to the use of models (amongst other things) in a process of debating and learning:

> "*Use this forum to post topics about the technical aspects of the rivers and flooding. This could involve historical information, recommendations, statistics, models. Please note this is an opportunity to debate and learn. Whilst we may put forward recommendations to the appropriate authorities we are not expecting to fully solve such a complex issue*" (*ibid*).

However, judging by the lack of activity on this forum and its demise, it appears that the main activities of the Carlisle Flood Action Group, that are mediated digitally, are actually taking place on the social media platform itself. Taken together with the findings of Tim et al. (2017), this suggests that enhancements to existing social media platforms are perhaps unnecessary and might be ignored even if they are provided.

The answer to the third question is simple. In constructing the argument for the claim that $C \cap N \cap O \neq \emptyset$, we required that problem structuring behaviours mediated by social media were publicly observable, and that these were resulting from a collective problematisation and leading to action: i.e. $O \subseteq B$. In §3.2, we made the observation that the public nature of the interactions between actors was *necessary* to achieve a translation from problematisation through interessement and enrolment. We therefore suggest that *nothing more* is required from existing social media platforms to enable OR

practitioners to engage with a concerned group. Although not included in our original treatment of Callon's work, we introduce here his notion of the "*mobilisation of allies*" and remark that it is up to OR practitioners whether they become part of the translation from problematisation through interessement to their enrolment in the actor network. The negotiation of their role would proceed through becoming aware of concerned groups coming into existence in response to a triggering event, and then engaging with the group through the social media platform. This sits very well with the ambitions for OR expressed by Ackoff (1970) and Rosenhead (1986), discussed in §2.4, as well as the desire to serve 'non-traditional' target groups that are participatively organised and led (Parry & Mingers, 1991).

## 4.3.    *Summary*

In our Theory Development section, we reviewed the Community OR literature and touched on many of the same concerns as expressed in the CKM/hybrid forums work, although these clearly come from two separate academic communities. The link between them appears in the concept of dialogical democracy (Callon, Lascoumes, & Barthe, 2009a, p. 10). Its characterisation is theorising at a sociological level and largely descriptive (Callon et al., 2009c, pp. 158-161). However, we need more than this for a contribution to Community OR of practical importance. Therefore, we see the implications of our findings for practice having three strands;

1.  The OR community generally, not just Community OR, has work to do in catching up with the rapid pace of developments in online communities that are already exhibiting distributed problem structuring behaviours and the de-emphasis (decentring) of expert facilitation. We have clearly shown that social media already support self-organising and self-supporting "*concerned groups*" of the CKM (which are the equivalent of 'target groups' from the point of view of Community OR analysis), able to translate from problematisation through interessement and enrolment, leading to practical action. *This catching-up is urgently required*.

2.  We have to accept that social media afford communities the freedom to engage and disengage with issues at will. Therefore, concerned groups can be very dynamic entities. Established ideas of power and emancipation in Community OR need to respond to this new dynamism and take into account a more nuanced understanding of power relationships and the role of the OR practitioner in an online setting. We refer to work on the relationship between Communities of Practice (COP) theory, Foucault's work, and ANT as an example of how achieving this understanding might be approached (Fox, 2000).

3.  Self-organising and self-sustaining online communities raise new ethical issues for all OR practice, and not just Community OR, especially in relation to the trust relationship between specialists and non-specialists. For specialists such as OR practitioners used to PEM/PDM-like public engagements and legitimisation of decision making, online communities that

enact CKM-like behaviours in hybrid forums could be unsettling and challenging places to work.

These implications for practice suggest a new direction for Community OR: an ethical reframing of practice that reflects the new and dynamic power relationships that social media afford online communities. Unlike designed Community OR interventions, where issues of stakeholder inclusivity and power are considered by the OR practitioner leading the intervention (Johnson, Midgley, & Chichirau, 2017; Johnson, Midgley, & Chichirau, 2018), here we are suggesting that the OR practitioner needs to *negotiate* entry into an emerging concerned group to achieve a satisfactory enrolment. Established OR competencies will either have to be re-packaged in new guises (e.g. augmenting social media platforms to enhance problem structuring behaviours) or practitioners will have to find new ways of working (e.g. Hard OR/Analytic capabilities delivered by specialists entering into new relationships with non-specialists in hybrid forums). The three strands, discussed above, suggest fruitful directions for future work.

## 5. CONCLUSIONS

We started out in this paper by implying that there remain difficulties in defining Community OR, where very few of the papers on the subject actually tackle directly the issue of where common ground lies. We have added a new definition of Community OR to the debate with two characteristics: i) a self-initiating, self-organising actor network showing spontaneous problematisation and enrolment in response to a triggering event, and ii) evidence of problem structuring behaviours leading to actions to improve the problematic situation consistent with the Generic Constitutive Definition of PSMs by Yearworth and White (2014). From this definition, we can thus re-conceptualise Community OR as a construct emerging from data, in addition to the conventional view of an OR engagement initiated by an academic practitioner or expert facilitator.

We see social media playing an instrumental role in two ways: providing both the source of empirical data to observe this new form of Community OR, and providing the scaffolding through which it occurs. Our analysis has shown that current social media platforms are not limiting problem structuring behaviours, and there is a certain amount of urgent catching-up required by the OR community, in general, to engage with concerned groups as they emerge. We therefore see social media providing new possibilities for community empowerment and participation, with consequences for social enterprise, democratic processes and citizenship. Actor Network Theory, and specifically hybrid forums and CKM, have been shown to present a new and encouraging theoretical basis for the analysis and development of OR engagements generally, but especially in the realms of Community OR and Soft OR/PSMs, where lay expertise is likely to be ever more present. The emergence of hybrid forums online would seem to be a natural milieu for a range of OR competencies, thus presenting the challenge to the OR practitioner of how and when to engage.

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Figure 1

All collective behaviours arising from a problematisation and leading to action (B)
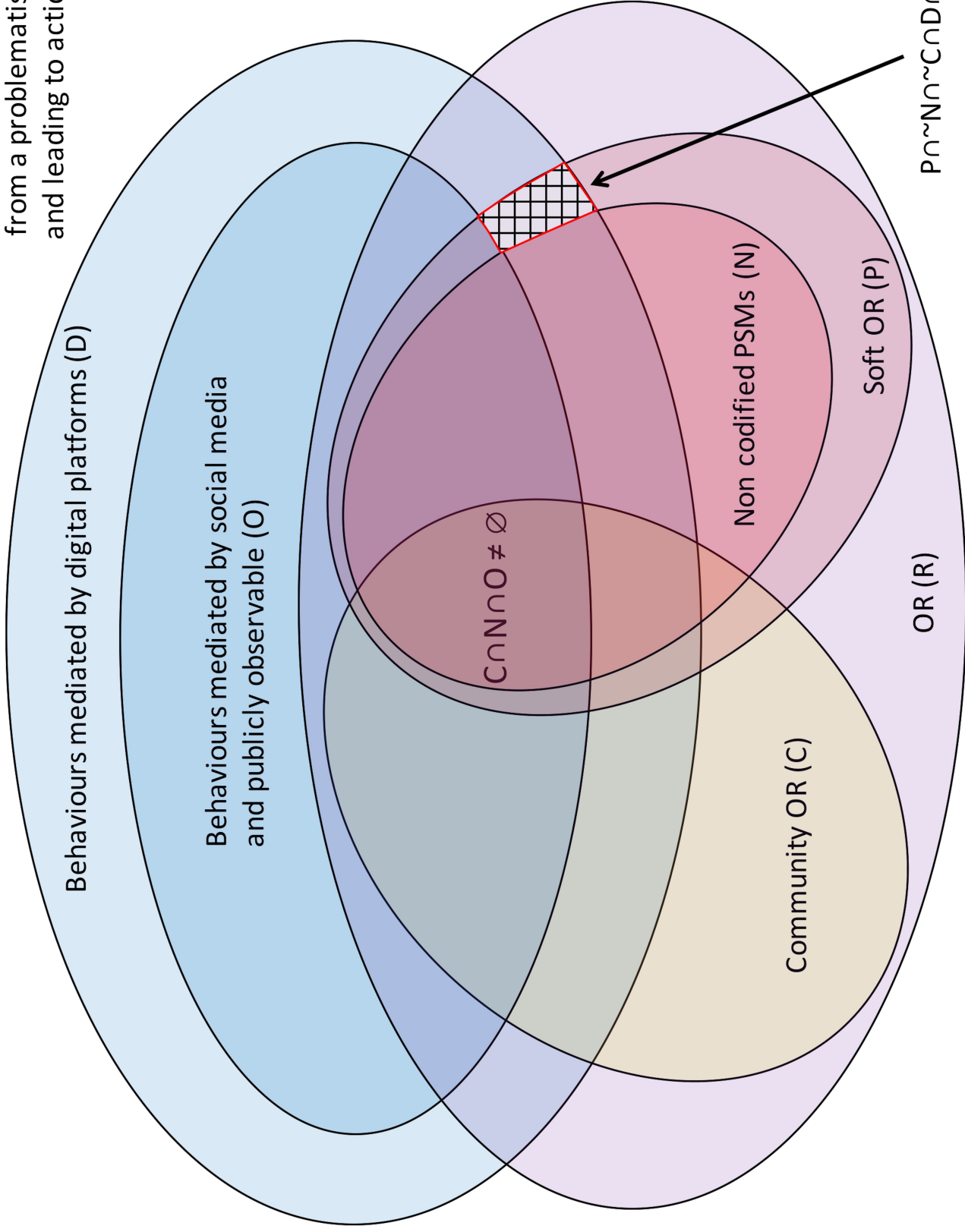
Behaviours mediated by digital platforms (D)

Behaviours mediated by social media and publicly observable (O)

Non codified PSMs (N)

Soft OR (P)

OR (R)

Community OR (C)

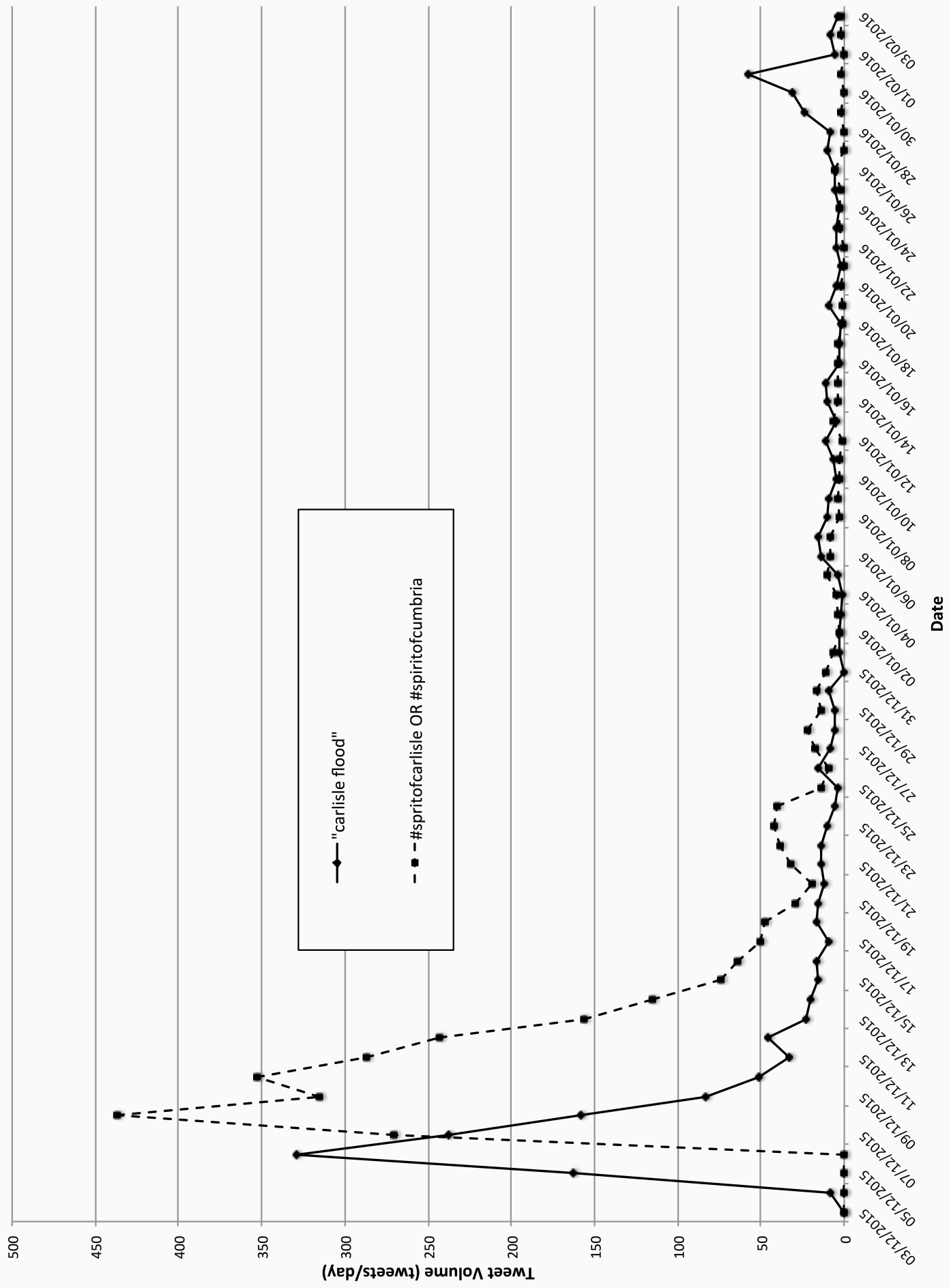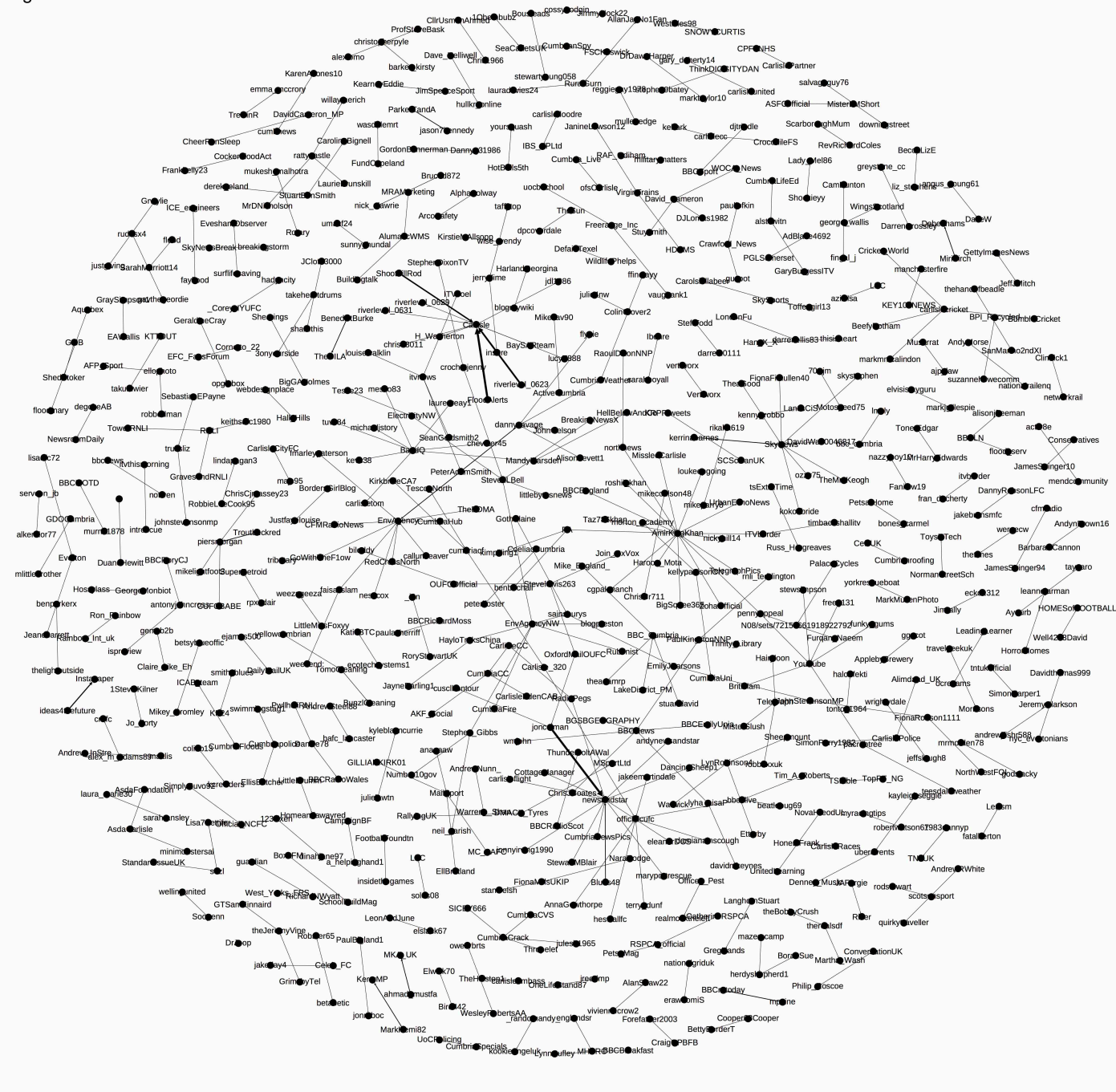$C \cap N \cap O \neq \emptyset$

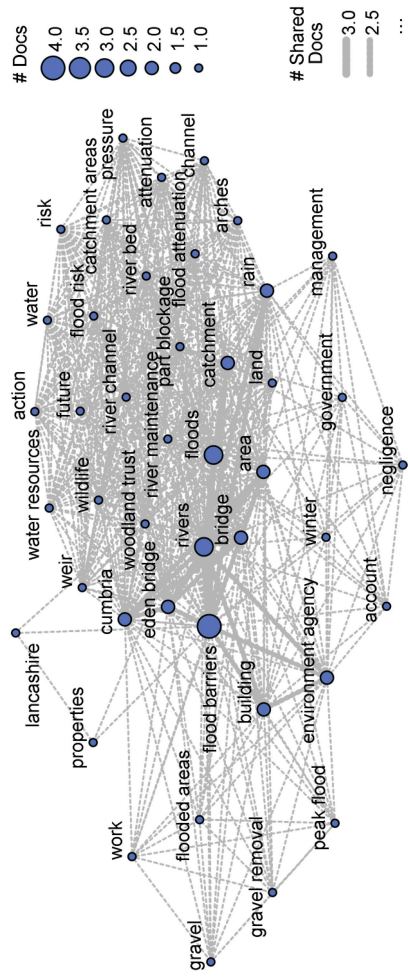$P \cap \sim N \cap \sim C \cap D \cap \sim O$

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6