Collaborative Sensemaking: Bootstrapping a Pattern-Driven Participatory Community Mapping Methodology[1]

Aldo de Moor

CommunitySense, Tilburg, the Netherlands

Abstract: Participatory community mapping can support collaborative sensemaking within and across communities and their surrounding stakeholder networks. We list some observations from practice about using community mapping for making inter-communal sense. We outline how we are bootstrapping a methodology for pattern-driven participatory community mapping. We propose the need for a community collaboration pattern language, illustrating it with examples from the cross-case evolution of core community interaction patterns.

Keywords: Community mapping, participation, collaboration, sensemaking, pattern languages

Introduction

Society faces many wicked problems, such as environmental disasters, financial and economic crises, terrorism, and wars. Wicked problems - like climate change - can no longer be solved by organizations or communities on their own, but instead require a "movement of movements" to find solutions that scale and are sustainable (Klein, 2015). Having the required collective impact means getting the commitment of a group of relevant actors from different sectors to realize a common agenda, while working towards shared measurement, mutually reinforcing activities, continuous communication, and backbone support (Kania et al, 2014).

One way to achieve the required coordination is to develop official "backbone organizations" that align efforts of various initiatives (Irby and Boyle, 2014). However, such a resource-heavy approach is often not feasible. Moreover, finding solutions to wicked problems is complicated by their social complexity. Addressing the fragmenting force of wicked problems therefore calls for a process of collaborative sensemaking using new understandings, processes, and tools in which stakeholders across the board collaborate in the complex thinking and decision making processes (Conklin, 2006).

Communities are the building blocks of collaboration in today's networked world. They consist of people from often different organizations and backgrounds working together for mutual benefit, in the process developing strong relations, and weaving a web of vibrant interactions (De Moor, 2015). Communities of practice, communities of interest, innovation communities, and so on, help to bridge knowledge gaps and cross collaboration barriers within and between organizations. However, achieving collective impact at scale goes beyond the individual community, and involves aligning resources, practices, and initiatives of

[1] This paper was accepted for the Proc. of the 13th Prato CIRN Conference 2-4 November 2016, Monash Centre, Prato Italy. A revised version is to appear in the Journal of Community Informatics.

multiple communities in a subtle process of inter-communal sensemaking, which we called knowledge weaving (De Moor, 2015).

Participatory community mapping - visualizing and jointly making sense of the collaboration ecosystem of communities - is key to making communities work (together) better. Earlier, we presented initial work on a participatory community mapping methodology and showed how it was instrumental in helping the Tilburg urban farming community make sense of itself (De Moor, 2015b). In the current paper, we deepen our exploration of the emerging methodology. We extend our approach by focusing on inter-communal sensemaking, in particular focusing on discovering, validating, and using collaboration patterns that help to make sense across communities.

In the current paper, we first introduce what we mean by participatory community mapping for collaborative sensemaking. We next share some observations from practice when using this approach to make sense across communities. We then examine how participatory community mapping needs to be pattern-driven to make more inter-communal sense. We end with a discussion and conclusions.

Participatory community mapping for collaborative sensemaking

Communities can be defined as sets of relationships where people interact socially for mutual benefit (Andrews, 2002). It is important to realize that communities and (social) networks are not two completely different organizational forms. Instead, they are part of a continuum. The network aspects refer to the relationships, personal interactions, and connections among participants, providing affordances for learning and collaboration; the community aspect refers to the development of a shared identity around a topic or set of challenges (Wenger et al., 2011). We might therefore say that communities are "densifications" in a rich social network substrate.

The need for a methodology

To improve their collaboration, community members and network stakeholders need to continually make sense of it (De Moor, 2015). This collaborative sensemaking process involves developing a common process of reaching a shared understanding about the collaboration, including the various perspectives and interests of the community members and surrounding stakeholder networks. Collaborative sensemaking helps community members jointly find out what their collaboration is about, what relationships and interactions their community and its context consists of, what collaboration resources are available, and what concrete opportunities exist for better working communities.

Sensemaking is the process by which people give meaning to experience. Sensemaking is much more, however, than just a random process of reflection. Weick defined the following essential properties: sensemaking is grounded in identity construction, is retrospective, is about actively acting upon and creating the environment, is a social and ongoing process, revolves around extracting cues to help make sense, and is not so much about accuracy but plausibility (Weick, 1995).

Community mapping is a core communal sensemaking activity. We define it as the process of capturing, visualizing, analyzing, and applying community network relationships and interactions for community sensemaking, management, and accountability purposes. There are many variations of community mapping, including geographical community-mapping[2]; concept mapping to visualize the context of a concept from the lens of a focus question (Novak and Cañas, 2008), dialogue mapping to capture the issues, positions and arguments in meeting discussions (Conklin, 2006), and social network mapping, in which the structural properties of social networks are analyzed, for example to detect emerging community roles (Smith, 2014).

Although the community mapping approaches mentioned all have their merits, they are lacking methodology-wise, from the point of view of (1) supporting *sustained* and *scalable* participatory community network building along the lines of (Wenger et al, 2011). Moreover, our methodology should (2) integrate insights from the emerging field of knowledge cartography: how to improve our capacity to create and use high-level meaningful (digital) knowledge visualizations (Selvin and Shum, 2014), thus leveraging the sensemaking capacity needed for collective intelligence and impact.

A methodology includes a description of the process to be performed and of the roles involved in the process, assigns responsibilities to activities and people and gives recommendations in form of best practices and guidelines (IEEE Computer Society, 1990 in Simperl & Luczak-Rösch, 2014). The overall purpose of the methodology under construction is to help community members map their own community network on an ongoing basis by (1) visualizing and connecting the many pieces of their collaborative puzzle into relevant maps and views that help them (2) better make sense of their common ground (within and across communities). This is a prerequisite to (3) co-defining the right community interventions needed to make their collaboration grow. Subsequently, (4) the effects of these interventions are to be monitored and evaluated to provide the data for the next round of mapping. This process is to be repeated continuously, resulting in ever richer maps, a deeper joint sense and ownership of the collaboration ecosystem, and increasingly effective community building steps.

Earlier work on the methodology: intra-communal sensemaking

We developed an initial version of our methodology as part of a project to stimulate urban farming in the Dutch province of Noord-Brabant, focusing on an emerging community of urban farmers around the city of Tilburg. To this purpose, we developed an online map using the network visualization tool Kumu[3]. By its very nature, such community mapping is participatory, meaning that relevant stakeholders need to be involved in providing and interpreting map data.

In (De Moor, 2015b), we showed how participatory community mapping requires an appropriate *language* (what types of elements and connections, what layout?), *tools* (how particular functionalities of online tools can help in the storytelling and visualization, analysis,

---

[2] E.g. tribal communities mapping their local rainforest resources: http://www.mappingforrights.org

[3] https://kumu.io/ademoor/tilburgse-stadse-boeren

and sharing of maps, how physical tools like plenary meetups can help to develop ownership), and *processes* (e.g. how best to capture, analyze, and use maps in community practice?)

Lessons learnt about map data capturing in practice include that it helps to distinguish between a *master map maker* (the architect designing the template and configuring and creating the initial map) and *domain map makers* from the community (who can add elements and connections to the initial map). It is also important to balance completeness and feasibility: trade-offs are needed in frequency & granularity as only limited map making resources are generally available (e.g. making only quarterly official updates, modeling just organizational participants instead of individuals, as this would make the map unmaintainable when many hundreds of persons are involved). We have also observed a "friendly peer pressure" arising, which led community members to contribute data since they saw others represented on the map and they wanted to be seen as well. However, it is important to avoid participants gaming the system by, for example, providing data about the same activity in different formats, while suggesting they are different activities. In this way, participants may artifically inflate their perceived involvement in the community, so that get more recognition than justified. One way to deal with this is by making the criteria for link inclusion explicit.

As to interpreting and using the maps, we learnt that community members are particularly interested in map views that focus on the direct context of their own organization or activity, whereas community managers are particularly interested in using the broader, bird’s eye views for community management (e.g. informing them which activities/participants act as hubs to which new activities can be linked, or becoming aware of the need to intervene when key activities or participants are "dangling" on the periphery of the map whereas they should play a central role).

It is important that communities start making sense of themselves through co-creating their own maps, using them in practice, and thus developing an active sense of ownership and identity. Still, throughout the process of mapping the urban farming and other communities, we observed that there are always connections being made to larger stakeholder networks and other communities. To scale for collective impact, sensemaking must extend beyond the individual community maps. If, as Etzioni (1993) says, society consists of a supra-community, a "community of communities" (or more precisely: a network of social networks and community networks), then the maps embodying their essence should also be linked. How to do this, is still very much an open question. To extend our methodology so that it explicitly supports inter-communal sensemaking, we start with some observations from practice.

Making Sense Across Communities: Some Observations from Practice

Next,we present four observations with respect to inter-communal sensemaking that we made while involved in collaborative sensemaking practice: linking maps across communities; meta-communication matters; tweaking the typologies; and sharing community network patterns.

Linking maps across communities

An interesting anecdote from practice shows there may be significant potential to link maps across communities. A local dairy farmer not involved in the Tilburg urban farming community is interested in develop new business models for traditional farms that want to start working more sustainably. Instead of developing yet another "mega-barn", he wants to reinvent and share farm practices in a process of social innovation, in an "open source farm lab[4]". Inspired by the Tilburg urban farming community map, the farmer started to develop a stakeholder network map of the community network forming around his own initiative[5]. The next step is aligning the two maps, seeing how they can be used by professional farmers moving towards sustainability to build alliances with urban farmers rooted in the city, thereby strengthening both communities. One supporting role there could be played by public librarians, acting as social innovation catalysts (De Moor, 2015).

Meta-communication matters

Often, producing the map is seen as the ultimate goal of the community mapping process. However, this initial sensemaking artefact is only a reference point to a community and its surrounding stakeholder network, showing the current or desired state of affairs. Especially when trying to build bridges across communities, members from other communities often need to be made aware of its existence through other communication channels than used by the producing community itself. Generic bridging media such as Twitter are useful for this purpose (Savage, 2011). For example, the map maker announced the release of the final version of the Tilburg urban farming community map on Twitter. It was not only retweeted by the community manager, but also by an unknown urban farmer from a different geographical location, and by the local dairy farmer mentioned above. What (social) media channels (including mailings and newsletters) to use increase cross-community awareness, how to use them effectively and who should play the linking pin roles is still ill-understood.

Tweaking the typologies

The basic concept and relationship typologies developed for the Tilburg urban farming community case were applied in several other community and network mapping projects, amongst others a university science hub, a regional social innovation network association, a provincial public library association, and a center of expertise. We observed that the element and connections types were generally reusable, but needed to be subtly adapted in different ways in the various cases. For example, core element types in the Tilburg case were *Participants, Activities, Results,* and *Tools*. In the Science Hub case, however, there was an additional need to distinguish between *Core activities* and (secondary) *Activities* (Figure 1). This because the mission of the science hub includes to develop a substantial network of secondary activities coordinated by a wide network of external stakeholders around its own core activities.

---

[4] http://www.pietvanmeintjeshoeve.nl/farmlab-ontspannen-werken-de-buitenlucht
[5] https://kumu.io/kenniscloud/kenniscloud#stakeholdernetwerk-open-source-boerderij

When communities start collaborating, it is important to make sense of what element and connection types can act as boundary spanners, so that a well-understood collaborative mesh can emerge across the communities. Well-selected, situated types can be important boundary objects. Such objects help broker translation, coordination and alignment among the perspectives of different communities coming together (Fischer and Shipman, 2011). Work on defining and aligning intra and inter-community typologies is still in its infancy, however.

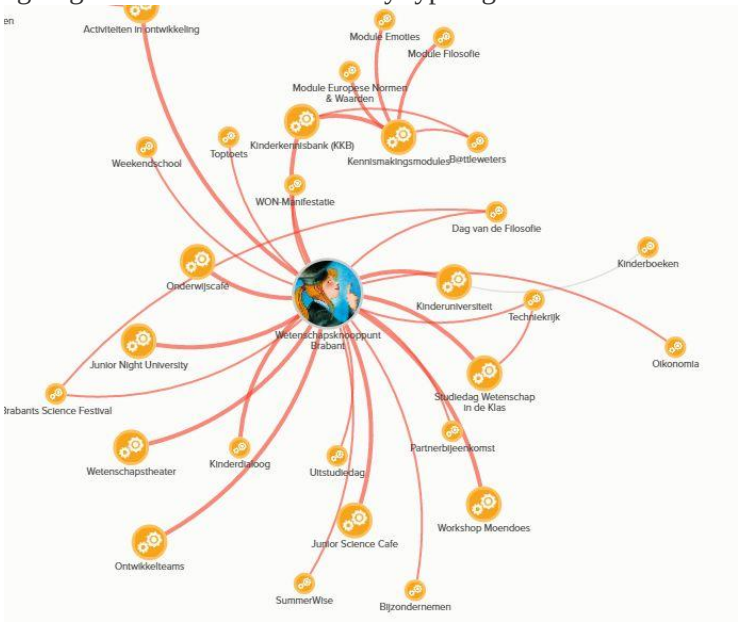

Figure. 1 Science Hub Brabant map excerpt showing networked primary (large) and secondary (smaller) activities[6]

Sharing community network patterns

Maps can serve different sensemaking purposes. Community maps at first sight are only descriptive of their own community network case: charting who is relating to and interacting with whom about what. However, we have also found that (generalized) map fragments can be reused within and across cases. For example, map fragments describing the generic types of roles and content involved in activities in the Tilburg urban farming community case were - with some tweaking - reusable in the map of the Science Hub Brabant. Another example of how multiple communities of practice can be linked through common project and domain-elements is presented in the next section. Such generalized fragments are in fact community collaboration patterns, outlining potential community relationships and interactions relevant to making the community more collaborative. These patterns are not rigid procedures to be followed literally. Instead, they are to be taken as sensemaking starters, to be interpreted and further detailed in an active process of reflection by community members. Such patterns are

[6] See for full current map https://kumu.io/wkbrabant/wetenschapsknooppunt-brabant

therefore not prescriptive, but *generative*, weakening barriers to or creating opportunities for thinking or acting that promote collective/civic intelligence (Schuler et al. 2011).

When taking a closer look at our inter-communal sensemaking observations, we see they are of two different types:

First of all, inter-communal sensemaking allows multiple communities to build bridges and work together more effectively by aligning their practices at the operational level, together forming a higher order networked community-system. Society itself being made of many interconnected communities makes this need clear. In (De Moor, 2015), we showed an example of sensemaking bridging the interests of a theater community and an environmental cafe community. Patterns are a useful instrument to inform the building of such bridges, as they, for instance, help identify potential social objects to which different communities can jointly relate.

Second, (meta-level) sense needs to be made across communities - sometimes even in different domains - by sharing their generalized lessons learnt. Often, communities find practical solutions for their collaboration problems that could be appropriated and reused in other communities. As communities are situated, these solutions cannot be blueprints, but need to be in a form that can fit the "collaboration ecosystem" of the receiving community. In other words, lessons learnt need to be abstracted to the right extent, sufficiently specific so that they are still useful, but generic enough to remain usable across often widely different cases.

Towards Pattern-Driven Participatory Community Mapping

Many community mapping projects start from conceptual scratch. We believe, however, that distilling, sharing, combining and re-configuring good practice-patterns may be an important step in increasing the efficacy and impact of participatory community mapping, especially in the context of goal-oriented collaborative communities. To this purpose, we propose the development of a community collaboration pattern language.

Towards a community collaboration pattern language

Collaboration patterns capture socio-technical lessons learnt in optimizing the effectiveness and efficiency of collaboration processes (De Moor, 2009). In a community setting, these patterns help discover and build the collaborative context in which the community interactions take place (e.g the goals, roles, content, and tools associated with the interactions).

Pattern languages are networks of patterns that call upon one another. Pattern languages can help promote creativity, collaborative and critical thinking, while acting as a meta-language that enables people with different roles to communicate and share experiences with each other (Pan and Stolterman, 2013). In particular for building bridges across communities, pattern languages are useful, as there are often few existing inter-communal links yet, with community builders from across the communal divide unsure about potential common ground. A particularly good example in this respect is the Liberating Voices pattern language

(Schuler, 2008), with its strong focus on societal empowerment and civic intelligence. Common sense can be made by representatives from various communities following a suggested path between multiple patterns, in the meantime interpreting their joint context through the lens of these patterns. For example, a group of stakeholders could start with interpreting the *Collective Decision Making*[7]-pattern, then together select one of the suggested pathways from that pattern, such as the *Multi-Party Negotiation for Conflict Resolution*-pattern[8].

Good pattern language take time to develop, as they need to transcend particular situations or problems (Pan and Stolterman, 2013). Developing a pattern language is a form of ongoing, cross-case grounded theory development. Classic grounded theory develops conceptualized theory from the ground up by coding observations, organizing codes, comparing them, selectively coding for identified core variables, and examining the emerging relationships between categories identified (Chametzky, 2016), thus inductively building a conceptual model. It is along similar lines – but absorbing insights from many cases rather than a single in-depth analysis - that community collaboration patterns can be constructed, and further evolve across cases.

We next illustrate how such a community collaboration pattern language could evolve, by outlining the actual emergence of an important class of community collaboration patterns in our community mapping practice: core community interaction patterns - which form the conceptual backbone of the pattern language. Note that for lack of space we leave out many of the details. Important here is to get an overall sense of the evolutionary process.

Case: The cross-case evolution of core community interaction patterns

At the heart of collaboration patterns are community interactions. In this section, we show how a core community interaction pattern evolved across several cases.

The initial Core Community Interaction Pattern

Our quest for identifying collaboration patterns started by framing an initial core interaction pattern grounded in earlier work on socio-technical community collaboration patterns (De Moor, 2009) and Carrol and Rosson's conceptual model of community (in Carroll, 2012, p.15). In this paper, we will use a simplified version, outlining only the core conceptual elements and connections of this pattern (Figure 2).

What this community network building block says, is that each *Interaction* may Contribute To *Goals*, may be Part Of, Trigger, or be Involved in[9] other *Interactions*, Using or Producing various types of *Content*, Involve various types of *Participants*, and be Supported by - sometimes a whole ecosystem of - *Tools*. Furthermore, all of these elements can be Part Of other elements of the same type (e.g. . an *Organization Department* can be Part Of an *Organization*).

[7] http://publicsphereproject.org/node/209

[8] http://www.publicsphereproject.org/node/278

[9] We found out in practice that being Part Of or Triggers is often too specific at an early stage of specification, hence the more generic Involved

Figures 3 and 4 shows two subsequent adaptations of this basic pattern in subsequent cases. They were decided upon after in-depth discussions about map language, tools, and processes and presentations of the draft maps to community managers and selected core community members, going through various iterations. We take their thinking these patterns to be understandable and useful to be a promising measure for the validity of these patterns, tentative as they are.

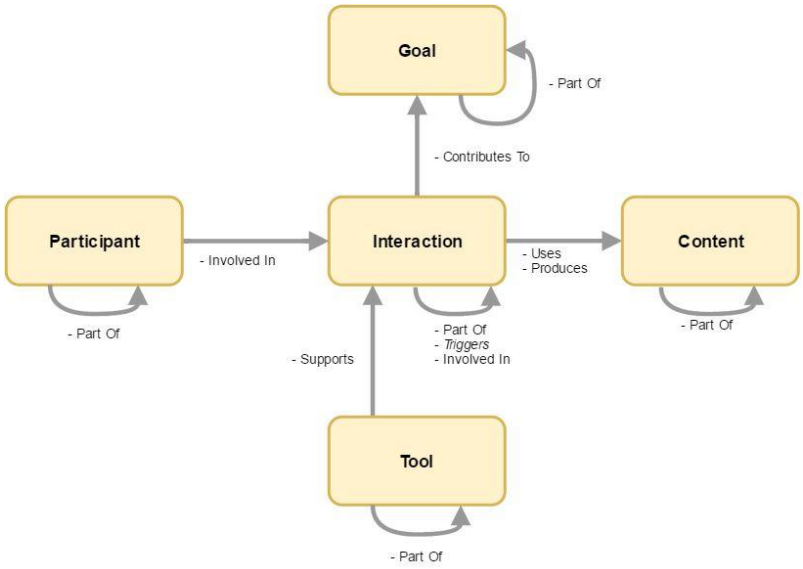

Figure 2: The initial core community interaction pattern

The Tilburg Urban Farming Community case

Figure 3 shows an initial adaptation of the core community interaction pattern driving the mapping process in the Tilburg urban farming community case. We see that key *Interactions* in this community were called *Activities*. Three different types of *Participants* were distinguished: *Individuals*, *Organizations*, and *Communities*. The type of *Content* of special interest to this community were *Results* Produced in the *Activities* (Used *Content* was not visualized as it was not key to the current sensemaking effort how the activities were organized). As the *Results* were official project deliverables, they also acted as *Goals.* In addition to being Involved, *Participants* could be related to *Activities* by just being kept Informed about them. Note that, although according to the initial core community interaction pattern, *Results* can be Part Of other *Results*, modeling these was not of interest to this community, at least in this stage of its development, as the main focus was on outlining the network of *Activities*. Note that the concept and relation types of the generic core community interaction pattern that were created for this case are indicated in red and those not used in this case are represented in italics. For example, Contributes To and Produces were not used in the mapping discussions, as their relation subtype in common - Has Result - was more relevant to the (initial) sensemaking purpose of this community.

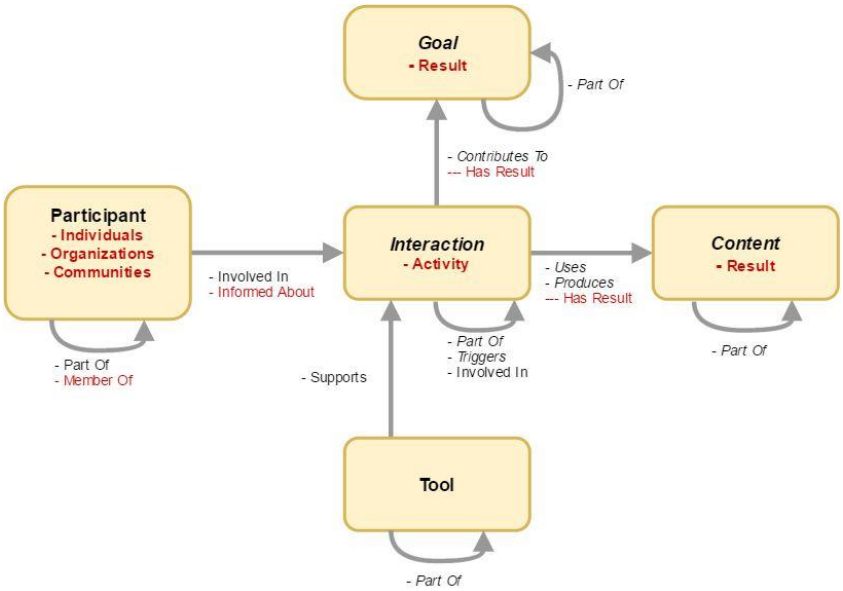

Figure 3: The core Tilburg urban farming community interaction pattern

The RDM Center of Expertise case

Figure 4 is another variation of the initial core community interaction pattern. It was at the heart of a mapping exercise to support community building in the RDM Centre of Expertise (CoE) in Rotterdam, coordinated by the Rotterdam University of Applied Sciences. The CoE has as its mission to develop better technical education, as well as new knowledge and sustainable innovations required by the Port and City of Rotterdam. It does so by supporting collaboration between educational institutes, research centres and corporations in a range of projects, also involving university lecturers and students. This collaboration takes place in a network of currently seven communities of practice (CoPs).

Community mapping was considered to have potential to visualize the collaboration ecosystem not only within but especially across the various communities. To explore this potential, a pilot was conducted with two of the communities of practice: CoP Logistics and the CoP Future Mobility. These communities were selected as the community managers were already exploring cross-overs between the projects associated with their communities. In several iterations, a pilot map was produced[10]. This map is now being extended by the community managers and researchers of the CoE to make it cover increasingly more common ground.

[10] https://kumu.io/rdm-coe/rdm-coe

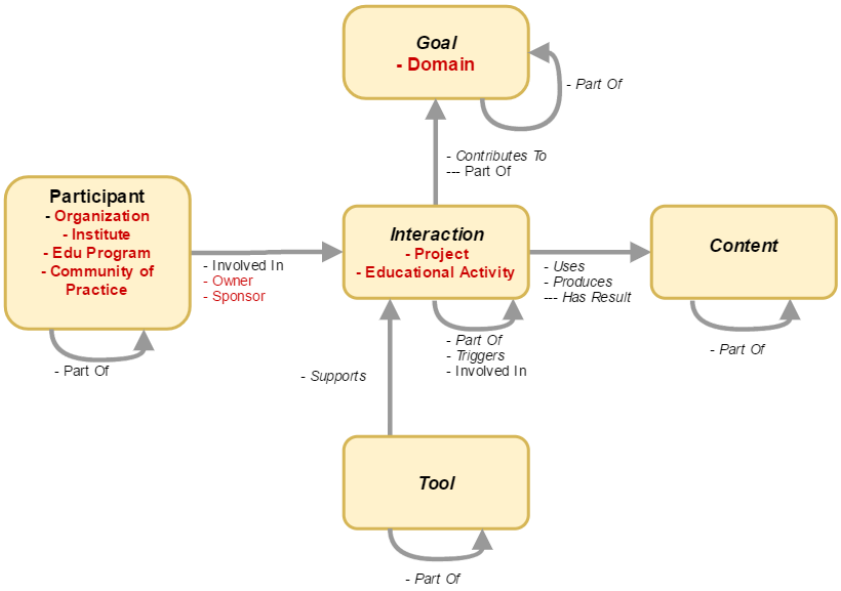

Figure 4: The core RDM Centre of Expertise community interaction pattern

The basic unit of *Interaction* in the CoE are *Projects*. An auxiliary *Interaction* concerns *Educational Activity*, which itself is associated with a special type of *Participant*: *Educational Program* (as an organizational structure). This relationship is considered essential for successful operations of the CoE, as much of the research capacity comes from university lecturers and students. Having this relationship modeled in the map will make discovery of relevant *Projects* by, say a student enrolled in a particular *Educational Activity* much easier. A key *Goal* context of those *Projects* are one of four *Domains* the CoE is working on. Key *Participants* to be modeled are - next to the *Communities of Practice* the *Organizations* involved as participants, sponsors or owners of the *Projects*. Individual persons are important, for example, as project contacts, but are modeled as attributes of the project instead of separate map elements. This to keep the maps maintainable and focused on the (project) essence of the collaboration structure of the CoE. Two special types of relation between Projects and *Participants* are Sponsors and Owners, as this is key resource information for further network building. No *Tools* and *Content* were modeled, as - so far - the map is especially used for communicating the overall collaboration network structure, not to zoom in on the project level.

Figure 5 shows an implementation of this pattern in the RDM CoE pilot map. It is a submap that zooms in on one of the projects, INTRALOG. The red lines indicate involvement-relations, the blue ones membership-relations, the dashed orange and brown lines ownership and sponsorship relations, respectively.

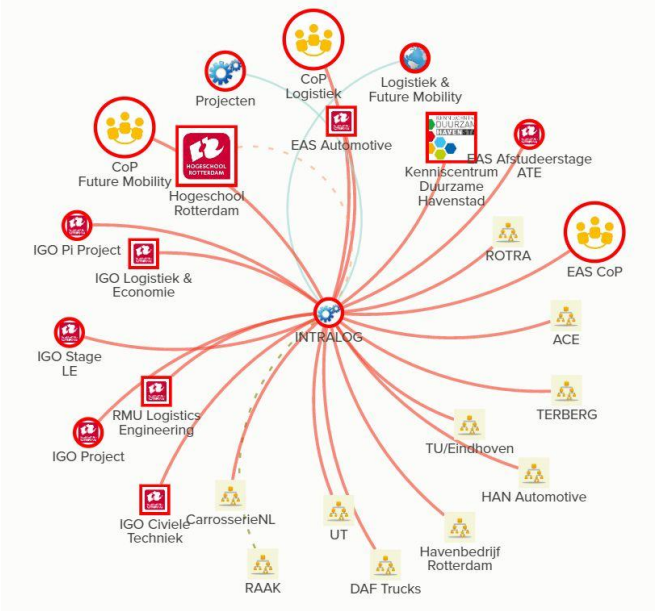

Figure 5: Implementation of the core RDM CoE community interaction pattern in a project-sub map

Discussion

We have examined the role that participatory community mapping can play in making sense not only within, but also across communities. We identified first order inter-communal sensemaking, where actual connections are made between different communities in a particular case, and second-order inter-communal sensemaking, in which generalized lessons learnt are drawn and shared across cases.

Key is the participatory nature of the community mapping. This plays out in several ways. First of all, community representatives are strongly involved in defining the language to be used, in particular what types of elements and connections are key to their community. They also define what views on the map matter to them, so that attention of their members is directed most effectively to what matters most in – literally – their view. In terms of process, data for the maps is largely provided by the community members themselves, for example in the form of surveys, spreadsheets, and interviews. Especially the level of participation in the maintenance and use of the maps can still be improved. Right now, the consultant, as "master map maker" is designing the architecture and making the seed map. Community members have been trained in several instances to do basic maintenance (adding new elements and connections of the same type), but more complex map maintenance tasks such as changing the structure and layout of the map and adding new features is still too complex for most. Furthermore, ways to put the maps to community use, for example by weaving them into regular community sensemaking activities, such as community workshops, and primary processes (such as research and education in the RDM case), still need to be further developed.

Patterns help improve both types of inter-communal sensemaking. We described how we are bootstrapping a pattern-driven methodology, with the ultimate aim of developing a community collaboration pattern language that can drive this process. We illustrated the role patterns play by examining the evolution of core community interaction patterns across several cases. The patterns are only tentative and need further specification to meet formal knowledge representation standards. Still, they show proof of concept of how such patterns can adapt and become re-usable, forming the "collaboration genome" as it were. Although both methodology and pattern language are still in an early stage, they continue to develop rapidly.

Ontologies are explicit (often formal) specifications of conceptualizations, necessary if patterns are to defined consistently and in a reusable and scalable way. There are many ways to represent ontologies. In (De Moor, 2009), for instance, we show how the ontologies underlying our collaboration patterns can be represented using the Conceptual Graphs formalism. However, formal knowledge representations are not enough, there needs to be a process to evolve and apply the pattern representations. One stream of relevant work we draw from is collaborative ontology engineering. Collaborative ontology engineering sees ontology engineering as a consensus-building process in which stakeholders/communities of practice agree upon a common view of a domain of interests, their shared knowledge being structured in terms of concepts, attributes, relationships and constraints (Simperl & Luczak-Rösch, 2014). This stream of research has developed many formal approaches to conceptual model distillation, alignment, and conflict resolution which could help us validate and organize the proto-patterns emerging from cases as discussed in the previous section. Vice versa, our work could inform this field in terms of the interplay between real-world community sensemaking and the often very abstract knowledge representations that make up formal ontologies. In

Another input for pattern language development are social network analysis approaches. For example, by analyzing social media conversation networks, community clusters can be discovered (Smith et al., 2014). Structural social network analysis and ontology engineering approaches merge in new research streams like semantic mining of social networks (Tang and Li, 2015), which could further help to expand pattern language construction.

A weakness of many pattern languages is that most efforts seem to go into creating the pattern language, rather than using it, leading to insufficient analysis and evaluation of pattern languages in action (Pan and Stolterman, 2013). To develop an effective pattern-driven participatory mapping methodology, creating, analyzing, and comparing pattern use cases is paramount. Through our approach of developing many hands-on mapping projects, examining what patterns are being used and can be distilled in each case, while simultaneously developing a reusable collection of community collaboration patterns, we hope to contribute to this still emerging body of knowledge.

Stimulating physical stakeholder interactions with the maps and their generating patterns seems essential to engender community ownership and adoption. We have conducted several experiments with different process formats, including plenary presentation of different map views to key stakeholders and having participants one-on-one talk to and then tag each other, followed by plenary group discussion. To further enrich the process of our methodology, we are inspired by related community-focused pattern language work, participatory representational practice, and the meta-design of socio-technical systems. For example, the Liberating Voices pattern language has developed a range of pattern-driven workshops and games (Schuler, 2011). Participatory representational practice focuses on the interplay between facilitators and participants, specifically how practitioners make participatory visual representations coherent, engaging, and useful (Selvin, 2011). Work on the meta-design of socio-technical systems provides us with more general process-oriented principles on which to build our methodology, such as cultures of participation, empowerment for adaptation and evolution, and seeding and evolutionary growth (Fischer and Herrman, 2011).

We also need to address the issue of how to use community mapping to evaluate the impact of the community networks. For collective impact, the relational is as important as the rational, and structure is as important as strategy (Kania et al, 2014). One direction to explore is how social capital evaluation frameworks such as by Marais (2012) can inform the analysis of what linkages matter. Social network analysis provides us with basic measures to capture essential structural properties of social networks, such as degree centrality, closeness and betweenness. Such measures are visualized by the Kumu network visualization tool we use in our community mapping projects. In participatory mapping sessions, this allows the facilitator to for example identify potential hubs and "movers and shakers" in the community, to be discussed with community representatives. Other Kumu tool features include visually indicating impact, for example, using layout to show weighted metrics (e.g. larger elements depending on the size of one of its attributes or the number/weight of connections it has). We

intend to experiment with these features in upcoming mapping projects. Developing sensible visualizations and mapping processes in which to create and interpret them can help prevent an overly quantitative approach to measuring community value, which runs the risk of not capturing the essence of what the community is really about (Wenger et al., 2011).

However, visualizing organizational structure and capacity is not enough. Equally important is to model the intentions, the goals of the evolving community network. So far, we have focused on charting the existing networks of participants and stakeholders. In forthcoming mapping cases, we will also bring those goals to aspire to more explicitly into the equation. We dub this "visualizing the *GAP*", the relationships between *Goals-Activities-Participants*.

Finally, most of our work so far has been on visualizing the community networks and making sense with participants of what these visualizations mean. However, to close the community network development loop, we also plan to more systematically work on the subsequent community building interventions that actually make the community network grow, and the monitoring activities that provide the inputs for the next round of community mapping efforts. Combining such participatory mapping-powered community-building processes with scalable collaboration platform development processes (White et al., 2014) should make working together for collective impact much more feasible.

Conclusion

To achieve global collective impact, we need to considerably grow and much better put to use civic intelligence and social innovation capacity. Top-down approaches led by governments and large corporations are insufficient. Networked communities are a core part of the societal fabric required. Pattern-driven participatory community mapping is an important process for making, growing, and applying the inter-communal sensemaking capacity essential to achieve sustainable global change. The methodological bootstrapping outlined in this paper provides some of the theoretical and practical scaffolding on which to build upcoming R&D, implementation, and adoption and use efforts.

References

Andrews, D. (2002). Audience-Specific Online Community Design. *Communications of the ACM*, 45(4), 64–68.

Carroll, J. M. (2012). *The Neighborhood in the Internet: Design Research Projects in Community Informatics* (1st ed.). New York, NY, 10001: Routledge.

Chametzky, B. (2016). Coding in Classic Grounded Theory: I've Done an Interview; Now What? *Sociology Mind*, 6(4), 163–172.

Conklin, J. (2006). Wicked Problems and Social Complexity. In *Dialog Mapping: Building Shared Understanding of Wicked Problems* (pp. 3–40). Hoboken, N.J: John Wiley & Sons.R. E. Anderson.

de Moor, A. (2009). Collaboration Patterns as Building Blocks for Community Informatics. In *Proc. of the 6th Prato Community Informatics Research Network Conference, Prato, Italy, November 4-6, 2009*.

de Moor, A. (2015). Knowledge Weaving for Social Innovation: Laying the First Strand. In *Proc. of the 12th Prato Community Informatics Research Network Conference, November 9-11, 2015, Prato, Italy*. Centre for Social and Community Informatics, Monash University.

de Moor, A. (2015b). Towards a Participatory Community Mapping Method: The Tilburg Urban Farming Community Case. In G. Avram, F. De Cindio, & V. Pipek (Eds.), *Proceedings of the Work-In-Progress Track of the 7th International Conference on Communities and Technologies, Limerick, Ireland, 27-30 June, 2015*.

Etzioni, A. (1993). *The Spirit of Community: The Reinvention of American Society*. New York: Simon & Schuster.

Fischer, G., & Shipman, F. (2011). Collaborative Design Rationale and Social Creativity in Cultures of Participation. *Human Technology*, 7(2), 164–187.

Fischer, G., & Herrmann, T. (2011). Socio-Technical Systems: A Meta-Design Perspective. *International Journal of Sociotechnology and Knowledge Development (IJSKD)*, 3(1), 1–33.

Irby, M., & Boyle, P. (2014). Aligning Collective Impact Initiatives. *Stanford Social Innovation Review*, (Collective Insights on Collective Impact), Fall 2014, 15–16.

Kania, J., Hanleybrown, F., & Splansky Juster, J. (2014). Essential Mindset Shifts for Collective Impact. *Stanford Social Innovation Review*, (Collective Insights on Collective Impact), Fall 2014, 2–5.

Klein, N. (2015). *This Changes Everything: Capitalism Vs. The Climate*. Penguin Books, New York.

Marais, M. A. (2012). An Overview of the Role of Social Capital in Development Processes. In *Proceedings of CIRN 2012 Community Informatics Conference: Ideals meet Reality. 7-9 November, Prato, Italy*.

Novak, J. D., & Cañas, A. J. (2008). *The Theory Underlying Concept Maps and How to Construct and Use Them* (Technical Report IHMC CmapTools No. 2006-1-2008). Institute for Human and Machine Cognition.

Pan, Y., & Stolterman, E. (2013). Pattern Language and HCI: Expectations and Experiences. In *CHI'13, April 27-May 2, Paris France*.

Savage, N. (2011). Twitter as Medium and Message. *Commun. ACM*, 54(3), 18–20

Schuler, D. (2008). *Liberating Voices: A Pattern Language for Communication Revolution*. Cambridge, Mass.: MIT Press.

Schuler, D., Gillgren, K., & O'Neil, M. (2011). Pattern Workshops and Pattern Games Generating Civic Intelligence with the Liberating Voices Pattern Language. In *2011 PUARL International Conference, "Generative Processes, Patterns and the Urban Challenge*.

Selvin, A. (2011). *Making Representations Matter: Understanding Practitioner Experience in Participatory Sensemaking* (PhD thesis). The Open University, UK.

Selvin, A., & Buckingham Shum, S. (2014). *Constructing Knowledge Art: An Experiential Perspective on Crafting Participatory Representations*. (J. M. Carroll, Ed.) (Vol. 7). Morgan & Claypool.

Simperl, E., & Luczak-Rösch, M. (2014). Collaborative Ontology Engineering: A Survey. *The Knowledge Engineering Review*, 29(1), 101–131.

Smith, M. (2014). NodeXL: Simple Network Analysis for Social Media. In *Encyclopedia of Social Network Analysis and Mining* (pp. 1153–1170). New York: Springer.

Smith, M. A., Rainie, L., Himelboim, I., & Shneiderman, B. (2014). *Mapping Twitter Topic Networks: From Polarized Crowds to Community Clusters*. Washington, D.C.: Pew Research Center.

Tang, J., & Li, J. (2015). Semantic Mining of Social Networks. *Synthesis Lectures on the Semantic Web: Theory and Technology*, 5(2), 1–205.

Weick, K. (1995). Sensemaking in Organizations (Vol. 3). London: Sage.

Wenger, E., Trayner, B., & de Laat, M. (2011). *Promoting and Assessing Value Creation in Communities and Networks: A Conceptual Framework*. the Netherlands: Ruud de Moor Centrum, Open University.

N. White, R. Cardone and A. de Moor (2014). Learning 3.0: Collaborating for Impact in Large Development Organizations. *Knowledge Management for Development Journal*, 10(3):21-37