Conversations in Context: A Twitter Case for Social Media Systems Design

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ABSTRACT

Conversations are the lifeblood of collaborative communities. Social media like microblogging tool Twitter have great potential for supporting these conversations. However, just studying the role of these media from a tool perspective is not sufficient. To fully unlock their power, they need to examined from a socio-technical perspective. We introduce a socio-technical context framework which can be used to analyze the role of systems of tools supporting goal-oriented conversations. Central to this framework is the communicative workflow loop, which is grounded in the Language/Action Perspective. We show how socio-technical conversation contexts can be used to match the communicative requirements of collaborative communities with enabling tool functionalities. This social media systems design process is illustrated with a case on Twitter.

Categories and Subject Descriptors

D.2.10 [**Design**]: Methodologies

D.2.11 [**Software Architectures**]: Patterns

H.5.3 [**Group and Organization Interfaces**]: Computer-supported cooperative work, organizational design, Web-based interaction

General Terms

Management, Design, Human Factors.

Keywords

Social media, collaborative communities, socio-technical systems, design

1. INTRODUCTION

Collaboration is ever more distributed across time, space, and organizations. Old organizational hierarchies and stable ways of working are disappearing. Instead, collaborative communities of many different kinds and flavours are forming to make things work. An example in the business domain are innovation communities, in which the ultimate goal is to have consortia develop that both conceive of innovative ideas and realize their implementation. In the educational domain, collaborative communities can, for instance, take the form of learning communities, where lecturers take a facilitating role in having students co-construct their learning process.

Key to communities are strong and lasting communicative interactions that bind community members and take place in a common space. Collaborative communities are communities in which there are not only shared practices, but also common goals [15]. Such communication typically takes place in interrelated webs of conversations, where we take a conversation to be a series of interrelated communicative acts aimed at defining and reaching a goal [5].

Communities need technologies as media to support their interactions. Technologies put to proper use can become real tools for effective communication [17]. Some of the first such tools were probably chats around the fireplace. The media mix has evolved ever since, now containing a bulging chest of often glittering communication tools. In this ever-expanding set of communication functionalities, newer technologies often do not fully replace, but complement, refine and reimplement existing communication concepts. A telling example is the (current) Internet, which in a way itself is re-implementation of the initial "Victorian Internet" prototype: the telegraph [26]. Still, this trend of expansion and refinement also contributes to a fragmentation of functionalities, which is an important complicating factor in community systems design.

Social media are the youngest branch of communication technologies, and are becoming a cornerstone of the community systems. Social media are tools (often hosted in "The Cloud") which facilitate the discovery, creation, and sharing of content. Their essence is that they are about dialog and conversation, two-way discussions that bring people together to discover and share information [25]. There are many classes of social media tools, offering a broad range of often overlapping functionalities. Examples are social network sites like Facebook, MySpace and

LinkedIn, content sharing sites such as YouTube and Flickr, social bookmarking sites like Delicious, and microblogging sites like Twitter. Applications of social media in communities comprise content co-creation, personalisation, and the facilitation of communication and collaboration.

Twitter is a very popular microblogging tool. These tools support light-weight, easy forms of communication that enable users to broadcast and share information about their activities, opinions, and status [9]. As we will see, it is a social medium with significant potential for supporting the core process of communities, conversation. In the practitioners literature, much has already been written about how to effectively use it for business purposes (e.g.[4]). The scientific literature is catching up. Initially, it focused on empirical analyses of Twitter users and usage patterns (e.g. [9,11]), but now it is also starting to explore which genres of communication it can best support, such as informal communication at work or news media [30,12].

Although these investigations are necessary, they are not sufficient for the design of effective support for collaborative communities. These studies stay *within the context of the tool*, assuming generic user/usage patterns, not the highly situated and socio-technically distributed context in which collaboration takes place in practice. The fundamental problem is that both the collaboration processes and the functionalities that enable them are increasingly fragmented, which leads to loss of focus, halting of communication, and lack of activation of work processes in collaborative communities [15]. These are examples of pragmatic errors, leading to the breakdown of the social and contextual components of a discourse [10]. In the current social media-supported distributed collaboration process landscape, such errors are bound to increase in type and frequency exponentially.

Analyzing and resolving such problems is what the Pragmatic Web perspective is about, as it examines "how communicative actions with a pragmatic context are performed via Web media and illuminates how mutual understanding and commitments to actions can evolve in conversations.[1]" More precisely, we will address the question how social (and other) media can be best put to use in the goal-driven, distributed conversation context typical of professional communities.

To answer this question, we examine the conversational context from a socio-technical perspective. To close the gap between what the community wants and what the technology does, we need to design the architecture of social interaction to support social goals [28].To this purpose, we define a conceptual model of socio-technical conversation contexts in Sect. 2. In Sect. 3, we examine the communicative affordances and constraints of Twitter in more detail. Sect. 4 explores how we should start thinking more in terms of social media systems design instead of from the current intra-tool perspective. We end the paper with a discussion and conclusions.

2. SOCIO-TECHNICAL CONVERSATION CONTEXTS

From a conversation-based perspective, the development of the Internet broadly seems to have had three stages. Initially, it was all about conversation. The Internet in its embryonic stage started out with e-mail and mailing lists in the 1960/70s. In the 1980s, new conversation technologies like bulletin board systems and Usenet newgroups became very popular. Usenet was/is not a specific bulletin board system, but a "network-scale computer conferencing system" that manages multiple public conversations about specific topics [22]. It is good to keep in mind that both mailing lists and newsgroups already had many qualities of what are now claimed to be revolutionary social media. Social media without the permanence of hyperlinked content and all the current multimedia bells and whistles, but still, the seeds were there. However, with the advent of the World Wide Web, in the 1990s, the focus seemed to shift from conversation to content: the development of HTML, CSS, web browsers, creating websites about everything and everyone took up a lot of the available attention and resources. Now, with the Web 2.0 and social media, conversations are back with a vengeance. The key difference with the initial stage of the Internet, however, is that conversation is now intricately interlinked with content, providing many new communicative affordances. Now, how to put these affordance to good use in collaborative communities?

Communities are formed by conversations building common ground between their members. All collective actions are built on common ground, which is accumulated in a process called grounding, the collective process by which participants try to reach mutual beliefs, essential for coordination. Grounding can consist of many conversations over time and is shaped by purpose (what is to be accomplished in the communication) and the medium (the techniques available for accomplishing the purpose [3]).

Key to efficient grounding is the *principle of least collaborative effort* which says that participants try to minimize their collaborative work in the sense of the work that they both need to do from the initiation of each contribution to its mutual acceptance. This minimum collaborative effort depends on both the purpose and the (costs of using the) medium [3]. A purpose of developing a plan of action would require a medium that allows for convergence in communication, so that agreements and commitments can be made explicit. On the other hand, in a community formation stage, getting-to-know and brainstorming conversations may be better served with a much more open-ended medium like an informal social networking site[2].

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[1] http://www.pragmaticweb.info/

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[2] Note that not all social networking sites are equal in this respect. For example, a "professional social medium" like LinkedIn often has quite focused conversations, aimed at answering specific requests for help (and showing off expertise). Facebook, on the other hand, is much more a "social social medium" where people often comment on rich content for bonding and relaxation purposes.

Fig. 1 presents our conceptualization of the socio-technical conversation context, which will be explained in the following subsections.

2.1 The Communicative Workflow Loop

We have seen that in the emerging social media landscape combined with new ways of working and organization, conversations become ever more fragmented across content, tools, people, and organizations. We next present a socio-technical conversation context model which can be used to model the larger context of conversations in collaborative communities, from both a purpose and a medium perspective. This model can be used for analytical purposes, such as the diagnosis of breakdowns in work, but also for design and configuration purposes of the tool systems supporting complex forms of collaboration. The model is a combination and extension of earlier strands of research. The reader is referred to [18,20,14,16] for their origin and motivation.
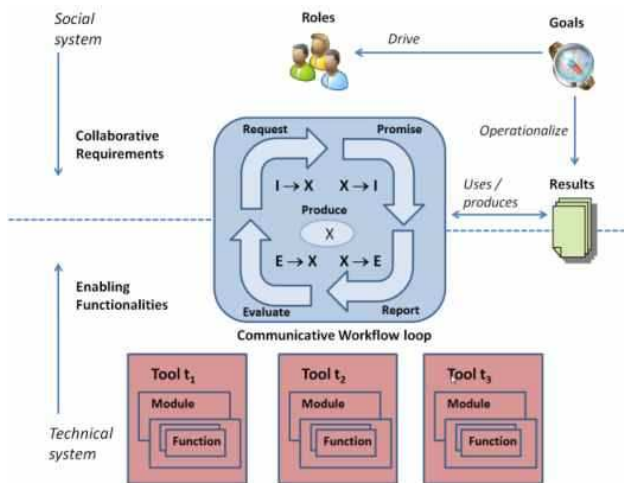

Figure 1 The Socio-Technical Conversation Context

Our view on conversations is grounded in the Language/Action Perspective (LAP), as exemplified in Austin and Searle's speech act theory, Habermas's theory of communicative action, and Winograd and Flores's work on LAP-based IS design [2,23,8,29]. We consider a conversation to be a self-contained unit of communication for accomplishing certain purposes (see Sect. 2.3 for a typology). A conversation can be seen as a set of communicative acts grounded in social relationships and focused on organizational coordination. A conversation is only partially structured in the sense that its main process and contextual entities are known, but that as many degrees of freedom as possible are given. This as collaborative communities operate in a situated way, where some structure helps focus collaborative interactions, while too much can stifle the community's emergent and creative ways of working.

The basic communicative workflow loop is conceptually quite simple, although the devil is in the implementation detail. Each workflow loop is carried out by three *conversational roles*: the

initiator (I), executor (X), and evaluator (E) of the workflow. Each of these conversational roles can be played by one or more *domain roles,* these could for instance be members or facilitators, and all kinds of stakeholders in the community. Each workflow loop itself consists of four subsequent *communicative acts*, with in the middle one *production act:* (1) the initiator *requests* the exector to do something, (2) the executor *promises* to do so, (3) the executor *produces* the requested result, (4) the executor *reports* to the evaluator that the result has been produced, and (5) the evaluator *evaluates* the result and, if satisfied, approves it.

Although this basic workflow model is a good starting point, it is not sufficient for addressing the complexities of real-world collaboration. We defined a Transaction Process Model model which presents all the possible conversational moves by actors playing a range of roles in a business communication process [18]. This model, based on [27], distinguishes not only a success layer where the complete workflow loop is performed in one go according the four stages outlined above. It also has a discussion and discourse layer, in case communication breaks down. In [20], we presented an extended workflow loop taking into account the service and delegation relationships necessary for delegating responsibilities. We will not delve into these complications here, nor expand on other complexities such as the analysis of embedded workflow loops, where one communicative act can spawn one or more new workflow loops.Instead, we will let the basic framework guide us in the analysis of social media systems design.

2.2 The Socio-Technical Context

Each workflow loop is surrounded by a socio-technical context. The social system produces a set of collaborative requirements. A set of goals (the "purpose" in [3]) both drives community members in their roles and is translated in a set of (intermediate) results. For example, a goal could be to produce a report at a certain date, aimed at a specific audience, and satisfying certain quality criteria like cost, readability, etc. This goal would on the one hand serve as a compass for the community members to assess to what extent their mission has been accomplished, and whether, for instance, corrective action is needed. On the other hand, these goals will need to be operationalized into concrete results, from the complex end results very close to the goals to all the intermediate results needed to accomplish the goals. Each workflow can both use one or more intermediate results and produce one or more end results.

To enable the workflows (the "medium" in [3]), there is not one, customized information system, like many large corporate transaction processing systems. These are often made-to-order in very complex and expensive information systems development projects. Rather, collaborative communities are generally supported by *systems* of tools, many of them hosted. A mistake often made is that community managers and facilitators want to have a single, silver bullet piece of "communityware". Some platforms claiming to be such systems exist, but in practice they mostly turn out to be too constraining and in no time community members start using additional tools, such as their own Gmail and Google Docs accounts to write project reports instead of the often arcane, very user-unfriendly and limited-size corporate e-mail systems. Rather than trying to prevent this, community managers should welcome the idea of having an "ecosystem of tools", which can evolve and adapt to the exact – momentary – needs of their

members. Another misconception is that one should always strive for technical interoperability between these tools. This often very hard, expensive, or even impossible. Rather, "socio-technical interoperability" often suffices where through the clever use of APIs, mashups, permanent urls, and simple checklists or procedures a feasible interoperability can be realized. For example, collaborators could tag their contributions on a social networking site with work-related topics from a growing list. A "tag cloud" within that site would show (by the size of the tag in the cloud) which emerging topics are used as tags most frequently. A procedure could be agreed upon that if a tag gets used more than a certain threshold number the community member with the most expertise on that topic becomes a "topic steward" and starts maintaining a content page on that topic on a wiki, which is part of the tool system of the community. On the home page of that wiki, the tag cloud from the social networking site can be embedded through a mashup.

The tools themselves sometimes only need to be considered black boxes from a functionality point of view. For example, it is often sufficient to know that "an e-mail tool" should be used for person-to-person push communication, as this tool is so widely known and comes in so many different implementations. On the other hand, many tools have very complex, nested levels of functionality, often containing *modules* of logically grouped *functions,* which are the "atomic units of functionality". Often, it is necessary to indicate which particular module of a tool to use in a conversation, sometimes this even needs to be defined at the function level. For example, Skype has three very different main modules: a Chat module supporting text-based synchronous chatting between two or more users, an (audio) Call module, and a Video Call module. Depending on the purpose, each of these modules will be more or less suitable. Finally, a good example where the function level is relevant is Twitter, as we will see. Twitter is extremely simple in its basic functionality, and each of its functions has very different applications, so the function level is relevant here.

2.3 Conversation Purposes

In the preceding subsections we have looked at the structure of the communicative workflow loop as well as its context. We have not yet explored the different purposes these conversations can be used for, however. This is important in order to better match requirements with functionalities.

LAP takes the view that language not only describes the world by *exchanging information*, but is also used to create and *coordinate actions* in the world. In doing so, the interests of both the speaker and the hearer need to be taken into account.

However, information exchange and coordination is not all that conversations are about. In [18], we defined *conversations for action* as the conversations in which the actual work (i.e. information exchange, coordination) gets done in a community. *Conversations for specification*, on the other hand, are the core process for generating legitimate and acceptable changes in the socio-technical system of communities. They make explicit some of the key choices to be made by the community for their collaboration to be productive. Such collaborative sensemaking should take seriously the diverse perspectives and the processes of communal meaning negotiation [24]. In other words, such (meta)-level conversations are about the collaborative sensemaking by the community of its context: why are we collaborating (*goals*), what needs to come out of it (*results*), who should be involved (*roles*) and how should the conversations for action be defined (*workflows*) and supported (*tools*)?

What we have not yet sufficiently taken into account in previous work is the role that conversations play in relationship and community building. Over time, conversations between community members help develop common ground, trust, and motivations for participation that are indispensable for communities to operate, grow, and become productive [3,28,21]. Summing up, we distinguish four different types of *conversation purposes* in collaborative communities:

- Information exchange

- Coordination of (inter)actions

- Collaborative sensemaking

- Relationship building

All of these types need to be supported in any collaborative community, however, to what extent depends on the purpose and media used. Also, some conversations within a community can focus on only a subset of these objectives.

3. TWITTER: A CONVERSATIONAL SWISS ARMY KNIFE?

3.1 Twitter Functionalities

Twitter is a microblogging service that enables its users to send and read "tweets", which are text-based posts of up to 140 characters that are displayed on the author's profile page and delivered to the author's subscribers, who are known as followers. Tweets can visible only to a specified circle of friends, or, by default, be visible to everybody. Twitter can be accessed through many different interfaces, and is easy to access from mobile devices. Although the Twitter features themselves are exceedingly simple, it provides a wide range of add on-functionalities through externally developed services that access its API.

We describe some core functions of Twitter, all of them different versions of posting a tweet, but with very different uses.

- Posting a *self-contained tweet*: this contains a general statement without external reference.

- *Replying* to another tweet: by adding the username of another user, preceded by '@', this other user will see the update in her "Tweets mentioning @user" list.

- *Linking* to external resources: tweets can contain links, often abbreviated through services like tinyurl.com and bit.ly, to other resources, such as a web page or blog post.

- Contributing to a *topic conversation*. By preceding a term with a hashtag '#', users can contribute to a conversation about a topic by searching on this term. Twitter then shows all contributions by users from the total Twitter user base that use this term. Provided the term is specific enough, it is one of Twitter's most powerful features, as this allows users to tap into a giant expertise the moment it is needed.

- Twitter *lists* provide a way to group together Twitter users, for example those sharing a similar interest. Each list then shows the tweets from its combined members.

3.2 Conversational Twitter Practices

Microblogs like Twitter are a special case of weblogs. Compared to ordinary blogs, microblogging allows for faster communication and more frequent updates [9]. Twitter is used for many different purposes, such as information sharing, information seeking and maintaining friendship-wise relationship [9]. Another perspective is that people use Twitter for keeping in touch with friends and colleagues, raising visibility of interesting things, gathering useful information, seeking help and opinions, and releasing emotional stress [30].

Based on their usage patterns, different types of Twitter users can be distinguished. One classification is broadcasters, acquaintances, and miscreants/evangelists [11]. Broadcasters are users who have a much larger number of followers than they are following themselves. Acquaintances show reciprocity in their relationships. Miscreants/evangelists follow many more than that they have followers themselves, often acting as spammers. Another distinction is between information sources, friends, and information seekers [9]. An information source is a hub with a large number of followers. Friends have various kinds of more or less reciprocal relations. Information seekers post rarely, but follow other users regularly.

What is clear from the previous is that Twitter provides a very rich conversational medium, that generates a wide range of usage behaviors, most still only partially understood. In [7], we did a socio-technical analysis of conversational blogging practices, which we use to inform our initial Twitter analysis. We found that open-ended conversations mediated by blogs result in a number of technical problems: (1) the distributed and fragmented nature of blog conversations, (2) the lack of bi-directional links, and (3) the lack of tracking technologies. These problems are not encountered in, say, conversations mediated by mailing lists, where the community membership is better defined through mailing list subscription and messages are actively delivered to the members and presented to them via their inbox, instead of the initiative having to come from the readers themselves.

In Twitter, these problems are partially remedied: (1) conversations are still widely fragmented and distributed. However, in the general blogosphere, many different blogs are used, whereas Twitter is centrally hosted. This makes searching for related tweets, such as replies and topic conversations, much easier and faster. (2) Bidirectional links are still cumbersome, but in a different way. Whereas a comment in a blog very clearly belongs to a specific post, it is up to the Twitter user to find out

which particular tweet another tweet is a reply to[3]. On the other hand, whereas blogs require complex and error-prone "trackbacks" to find out which other blog posts comment on a source post, through, for instance, the Twitter reply function it is very easy to find out which replies have been generated on a user. (3) Tracking the tweets involved in conversations is relatively easy through searching on both replies and hash tagged-topics. However, the resulting linear list of contributions is sometimes difficult to interpret due to the immediacy, sheer number, and lack of thread structure.

Typical conversational practices have developed around blogs which at least partially address their technical problems [7]: (1) an abundant use of linking to previous posts and comments as "conversational glue", (2) the emergence of tangential conversations (conversations that touch, but move in a different direction), and (3) conversation with self (organizing one's own thinking) versus conversation with others (leading to discussion).

Around Twitter, similar conversational practices have developed. (1) Replies and topic hashtags are used abundantly to weave sometimes very complex discussion webs. One very powerful feature of Twitter, compared to for example closed social network sites like Facebook, is that it is very easy to join a conversation with complete strangers purely based on interest, instead of being limited to talking to people currently in one's circle of friends. As the effort of reading and replying is minimal, over time a deep conversation web with strands to a large group of relevant people can develop, both on an ad hoc basis (joining conversations based on a search) and permanently (by being their followers and joining in when an interesting topic passes by). (2) Tangential conversations are almost a necessity in Twitter, much more so than in blogs. As each tweet contains an essential thought or piece of information, not a full story like a blog, new ideas get triggered and expressed all the time. (3) Although both ordinary and microblogs enable conversations with both self and others, Twitter due to its strong conversational properties may be more geared towards conversations with others than blogs, which are often used by their authors to draft ideas they are exploring more or less by themselves.

3.3 How (not) to Use Twitter

Given the previous characterization of Twitter, how to position it in the socio-technical conversation context framework? For supporting a wide range of conversational functions, Twitter looks like a generic, Swiss army knife-like functionality box. Twitter seems especially strong in the request and report stages of the communicative workflow loop. The cost of both posting and replying is minimal. The audience that sees the request is potentially huge, and given the low cost at least some part of the audience is likely to respond. However, this strength is also a weakness, as its support for the promise and evaluate stages are rather weak. In Twitterverse, ties are often much weaker than in other social networking sites in which there is a mutual friendship relation of sorts. In Twitter, there is no obligation for anybody to commit, nor a ground for the requester to evaluate his anonymous

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[3] Although theoretically one does not know to which particular tweet this reply refers, in practice this is mostly easy to find out due to the semantically matching content of the tweets.

audience. From the perspective of the conversation purposes listed, Twitter therefore seems especially good for information exchange and relationship building (for example, by over time really getting to know the ways of thinking and working of collaborators). Twitter is also important for collaborative sensemaking, in that it helps to make explicit the issues that matter through the webs of conversation between collaborators over time. It can also be used for brainstorming about the why, what, who, and how of the community. However, for making the decisions about where the community should go, and especially for the coordination of tasks it may be less suited, at least when used in isolation. Decision making and coordination requires making commitments and evaluating work performed, something not really promoted by the fleeting, semi-anonymous, and commitment-less nature of Twitter. Still, these relative weaknesses can be overcome or addressed by other tools, such as e-mail, provided a proper social media systems design view is taken into account.

4. TOWARDS SOCIAL MEDIA SYSTEMS DESIGN

Collaborative communities being such diverse, ever-evolving socio-technical systems, how to go about developing their tool systems effectively and efficiently? What is the role of social media like Twitter in these systems?

Social media systems design in collaborative communities is a process of collaborative sensemaking with and by the community. We follow the design interpretation of [1] who, from the Pragmatic Web perspective, sees technologies as hypotheses about solving interactional problems that are built on assumptions about how interaction works and ought to work. These intentional interventions aim to enable new or alternative forms of interaction, which are captured in "ontologies for interaction". Such ontologies describe how particular technologies applied to a particular purpose ground a preferred form of interaction. Our socio-technical conversation context model provides an upper ontology of interaction as it were that can be extended and refined in the direction of both the social and the technical system. Although in this paper we explore elements to include in such an ontology of interaction, it is too early to provide a full ontology of social media systems. Rather, we will illustrate the general idea with a – hypothetical – scenario of a realistic case.

4.1 Twitter within a Social Media System: a Scenario

Climate change is one of the greatest challenges facing humanity. Addressing it requires the concerted effort of scientists, governments, businesses, non-governmental organizations, and citizens from all across the globe. The Intergovernmental Panel on Climate Change (IPCC) has as its mission to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences.

One of the main results of the IPCC are its assessment reports. Producing these reports is a massive undertaking. To get an idea, for the fifth report (AR5), 831 highly qualified researchers have been selected to contribute[4]. Given the complexity of the theme and the numerous, often opposing points of view, the production process of these reports is extremely difficult and the results are often controversial, as is illustrated by the InterAcademy Council, a multinational organization of the world's science academies having been requested to conduct an independent review of the IPCC processes and procedures[5].

The goal is clear: doing an independent review of the procedures. Essential for the review to be trusted is to get enough and timely input from stakeholders from all over the world. However, how to do this given the very limited resources available?

To do so, the review committee decides to create a wiki with for each review topic a separate page. The page is visible to the whole world. Still, it can only be edited by the review committee members. Each topic and page gets at least one "topic steward" assigned. Each page gets its own, unique tag, like "IPCC_T11" designating topic #11 of the list of review topics.

The review report is written in several iterations. For its own coordination purposes, the review committee uses a private, archived mailing list. However, this tool is not suitable for soliciting input from the world, as such communication does not scale. A wiki scales much better [13], as revision histories ensure that there is no meta-communications needed about who changed what and changes can always be rolled back. However, these wiki editing rights cannot be given to the general public, given the strict report focus, the quality required, and fear of vandalism.

The committee considers Twitter a useful way to gather many relevant inputs without succumbing to their sheer number. An '@ipcc_review' user account is created. Any topic steward can use this account to request comments, find relevant experts, announce new updates of the wiki page etc. To ensure that interested people get only the Twitter updates of the pages they are interested in, each tweet includes a hashtag with the proper topic. Such a tweet could look like this:

"#ipcc_t11 Needed: expert on polar ice cap melting."

Now, some topics may attract thousands of replies. There is no need for the topic steward to get involved in a discussion of each reply or tweet containing the topic hashtag, as plenty of followers will discuss amongst themselves. To ensure that the steward sees all the replies of those people most relevant, she can create an ipcc_t11-list with a selection of Twitter users. This list could consist, for example, of the Twitter users who are her official collaborators plus those users whose replies over time she finds most insightful.

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[4] http://www.ipcc.ch, accessed June 29, 2010.

[5] http://www.interacademycouncil.net/?id=12852

Figure 2 A Focused Conversation Widget

To further connect the ongoing conversation with the emerging results in the review topic page, she decides to embed a widget in the wiki that shows the last 10 tweets containing the #ipcc_t11 topic hashtag. Such a widget contains a snippet of code that can be inserted into the HTML code of the embedding page[6] This powerful feature could be used in much more refined ways, however, by combining multiple search terms. For example, a separate widget could be included showing only the tweets within the scope of topic 11 that show the requests for help, by using the combined "#ipcc_t11 Needed:" search keywords when constructing the widget.

Fig.2 gives an idea of the power of such a widget as key "focused conversation" element of a tool system. The widget searches on the permanent Twitter "#climate channel" for all the tweets that contain the terms "melting" and "ice", in whichever order. If there were a wiki topic page on melting ice, this widget at the top of that page would immediately give the collaborators a sense of the current buzz around this highly specific topic, plus an immediate way to contact the relevant individuals or organizations. In this way, professional conversations can be made both more relevant and timely, and thus contribute to addressing the collaborative fragmentation problem mentioned throughout the paper.

5. DISCUSSION AND CONCLUSIONS

Conversations are literally what make collaborative communities work. Social media like microblogging tool Twitter have great potential for supporting these conversations. However, just studying the role of these media from a tool perspective is not sufficient. We introduced a socio-technical context framework to analyze the role of systems of social media supporting goal-oriented conversations. Central to this framework is the communicative workflow loop, which is grounded in the Language/Action Perspective. We showed how socio-technical conversation contexts can be used to match the communicative requirements of collaborative communities with enabling tool functionalities. This social media systems design process was illustrated with a case on Twitter.

We gave only a high-altitude tour of this vast systems design territory. It is extremely complex, not only by itself, but also as it

is fully dependent on the underlying levels of the HCI, software, and hardware systems [28]. Our focus, however, was the socio-technical systems level itself. At that level, entities should describe only in a broad way – at the application domain level – the complex nature of the interdependent socio-technical systems [6]. In this paper, we only very informally outlined some tool-mediated interaction patterns. In [16], we showed how collaboration patterns can be used to much more precisely describe the "ontologies of interaction" [1] needed for adequate socio-technical systems design for the community. Such patterns could be used in (formal) meaning negotiation processes between collaborative partners from different organizations and cultures, to establish common ground more efficiently [19].

Throughout the paper, we have advocated the socio-technical systems perspective. The approach proposed is much more of a perspective than a fixed methodology. Instead it should be considered as a kind of "pragmatic bus", which can connect many different existing conceptualizations, techniques, approaches, and methodologies. For instance, we use the anchoring concepts of goals, partially operationalized as results. Work done on intention broadcasting along the lines of [3] could be used to further investigate how these purposes mediated by technologies could be better achieved. Communication design and hypermedia discourse perspectives on sensemaking like proposed in [1,24] could refine the processes of eliciting and analyzing the socio-technical requirements of the community.

Once more tool systems-in-their-context of use get modelled it will become possible to answer the question of whether there is a core set of tools together covering a wide range of required collaborative functionalities. There are so many (social media) tools out there, with which ones should the average – or a particular – community get started? If we are to take the reuse of design solutions seriously, it is important that we get a core initial set of tools covering most collaborative requirements. More exotic tools can always be added later, but it is very important not to overwhelm communities with too many tools in the beginning, as learning curves are often steep and this can overly fragment the necessary communal focus and lead to social media overload and unnecessarily frustrated community members.[7] Work is currently underway on a tool, called CommunitySensor, to develop "socio-technical quickscans" of communities so that this kind of pragmatic diagnosis in professional communities can be more effectively and efficiently done.

Never before has there been such a communicative potential available to humanity. Social media are the newest kid on this block. However, they come with a paradox: although they enable more potential interactions in terms of people and content than ever before, at the same time their abundance and unruliness may mean a loss of collaborative focus, which may make getting complex things done together actually become more difficult. A social media systems design perspective may help communities to make the best use of this great(ly underused) potential.

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[6] http://www.twitstat.us/ is one service that generates such search widgets.

[7] There is still little attention for this in the literature, but "social media overload" is starting to become a serious topic of discussion, as is exemplified by the mounting support for the "Slow Media Manifesto" http://en.slow-media.net/manifesto

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