

Distance as asset? Knowledge collaboration in hybrid virtual communities

Gernot Grabher*[†] and Oliver Ibert**^{***}

*Urban and Regional Economic Studies, School of Urban Planning, HafenCity University Hamburg, Winterhuder Weg 31, 22085 Hamburg, Germany

**Leibniz-Institute for Regional Development and Structural Planning, Flakenstr. 28-31, 15537 Erkner, Germany

***Institute for Geographical Sciences, Freie Universität Berlin, Malteserstr. 74-100, 12249 Berlin, Germany

[†]Corresponding author: Gernot Grabher. *email* <gernot.grabher@hcu-hamburg.de>

Abstract

This article takes issue with the reification of proximity in the current debates about the geographies of knowledge production. It aims at developing a more differentiated view on the spatialities of learning by focussing on knowledge practices in which neither physical nor relational proximity are available. More specifically, the article explores on the basis of a 'netnographic approach' interactive knowledge collaboration in nine 'hybrid virtual communities' that reflect a broad spectrum of organizational set-ups from firm hosted over firm related to independent communities. Our empirical analysis reveals that hybrid virtual communities even in the absence of physical or relational proximity are able to produce economically useful knowledge; that despite the low importance of proximity the physical and material conditions play a crucial role for knowledge collaboration in hybrid virtual communities; and that hybrid virtual communities afford unique technical opportunities and social dynamics that foster learning processes unattainable in face-to-face contexts.

Keywords: virtual communities, knowledge practices, proximity, distance

JEL classifications: D83, L14, L17

Date submitted: 21 June 2011 **Date accepted:** 10 May 2013

1. Aims of the article

Debates about the geography of knowledge production and innovation for a rather long time revolved around the issue of physical proximity. In fact '[a]t the very foundation of the contemporary literature in economic geography is the idea that proximity matters' (Gertler, 2008, 203). Physical proximity, as the prevailing consensus maintained, was regarded as a most advantageous precondition for knowledge collaboration. The numerous success stories of 'territorial innovation models' (Moulaert and Sekia, 2003) seemed to produce unequivocal proof that co-location offers unique advantages for collaborative knowledge production. The competitive asset was seen in the rich opportunities of face-to-face interactions that generate local 'buzz' (Storper and Venables, 2004). Moreover, 'spatial proximity stimulates firms to develop similar language, technology attitudes and interpretive schemes [and] trust tends to exist in local milieus as something inherited' (Malmberg and Maskell, 2006, 7).

In other words, physical proximity co-produces relational proximity, and relational proximity in turn promotes learning as it cultivates mutual understanding.

These standard lines of reasoning, however, have increasingly been confronted with critical perspectives. First, the notion of physical co-location has been differentiated. Collaborative knowledge production is not contingent on *permanent* physical co-presence. Rather, knowledge is also produced under conditions of *temporary* physical co-presence through, for example, collaboration on a temporary project site (Grabher, 2004; Torre, 2008), meetings in the course of corporate travel (Urry, 2002; Faulconbridge et al., 2009) or in the context of temporary clusters such as trade fairs (Maskell et al., 2006; Jansson and Power, 2008; Bathelt and Schuldt, 2010). Even geographically dispersed actors can benefit from the advantages of immediate face-to-face interaction (Storper and Venables, 2004) as long as the key persons are factually accessible (Asheim et al., 2007).

Second, during the last few years research has increasingly challenged the crucial role of (literally) ‘being there’ for knowledge collaboration. Instead, the respective work posits that physically distanced relations and knowledge flows through inter-organizational ‘pipelines’ provide critical conduits for processes of knowledge production by supplementing and complementing local buzz (Bathelt et al., 2004). In addition, the Internet has given rise to new forms of mainly informal collaboration of practitioners that reaches far beyond agglomerations of co-located firms. These informal knowledge communities quite obviously constitute spatially fragmented and socially distanced constellations of collaborators (Amin and Roberts, 2008; Gertler, 2008; Grabher et al., 2008; Bathelt and Turi, 2011) that fundamentally challenge theoretical debates in which learning has been inextricably tied to the notion of proximity.

Our intention here, of course, is not to rehearse tired misunderstandings. We concur with Malmberg and Maskell (2006, 9) that the localized-learning argument does not presuppose automatically that most or the most relevant interaction should be local, and that local interaction automatically is *superior* to global interaction. However, we seek to take issue with the wide-held assumption in our field that the notion of distance denotes a state of inferiority and deficiency (lacking, by definition, all the economic benefits associated with proximity).¹ Even virtual collaboration has been approached with a primary interest to detect dimensions of proximity within them (i.e. ‘virtual proximity’; Morgan, 2004). In general, economic geography has invested much more empirical effort in understanding proximate learning relations whereas distanced relations in empirical terms remain largely underexplored. Given these ‘proximity biases’ (Grabher and Ibert, 2006), we would like to side with those authors (Amin and Cohendet, 2004; Glückler, 2007; Amin and Roberts, 2008; Gertler, 2008; Bathelt and Glückler, 2011; Bathelt and Turi, 2011) who have undertaken first steps to develop a more differentiated view on the subtle spatiality of learning and innovation by appreciating proximity and distance as categories of equal epistemological relevance.

1 Proximity, it seems, is treated as *raison d’être* of geographical analysis, as the disciplinary anchor in our globalized times. Distance (as well as centrifugal dynamics of all sorts), in turn, is treated as a threat to the relevance of geographical analysis, and the disciplinary identity more generally (as, e.g., the passionate repudiation to the ‘death-of-distance’ arguments reveals; see, e.g. Morgan, 2004).

Our understanding of knowledge in this article builds on the rich body of research on communities of practice (Lave and Wenger, 1991; Wenger, 1998; Amin and Roberts, 2008). We employ the term ‘knowledge practice’ to emphasize that human knowledge-ability is inseparable from social practice. Knowledge is not an object in its own right (Amin and Cohendet, 2004), but a relational resource (Bathelt and Glückler, 2005). A flute maker’s knowledge, for instance, is not an individual achievement, let alone a possession. Rather, it is distributed among the involved craftspersons’ brains and fingertips and the used materials, artefacts and tools assembled in the workshop (Cook and Brown, 1999). Additionally, this understanding emphasizes that knowledge is the ability to act (Stehr, 2001), it only becomes concrete and palpable when actively performed (Ibert, 2007). To foreground these performative dimensions, we prefer the verb ‘knowing’ (Orlikowski, 2002) rather than the noun ‘knowledge’ that resonates with an understanding of knowledge as an object (Ibert, 2007).

Our analysis also draws on the analytical distinction between tacit and codified knowledge as elaborated by Michael Polanyi (1966). Polanyi argues that all human knowing rests to a lesser or larger degree on implicit assumptions. This ‘tacit dimension’ of knowing eschews explication, either it is not explicated while relying on it or it is not explicable at all, even if one tries to (Gertler, 2003). In our study we fully acknowledge the tacit dimension of *all* knowledge. The ability of sharing knowledge and the potential of learning something new depend on the degree of similarity and dissimilarity, respectively, in the underlying assumptions of the actors involved. For instance, members of the studied virtual communities circulate pieces of codified information, mainly in form of textual utterances or graphical representations (sketches or photographs). The adequate perception, correct understanding and interpretation of these pieces of information, however, depend on the shared tacit knowledge. Similarities or dissimilarities between the underlying assumptions of sender and receiver give rise to misunderstandings and tensions (Meusbürger, 2009), either in a productive (Stark, 2009; Ibert, 2010; Hautala, 2011) or an unproductive fashion.

Starting from these key assumptions, our empirical analysis focuses on knowledge practices in which physical and relational proximity quite obviously seem dispensable. More specifically, the article explores interactive knowledge collaboration in ‘hybrid virtual communities’ in which face-to-face encounters are the exception rather than the rule, and personalized trust hardly is present. A thorough examination of these specific knowledge practices promises empirically grounded contributions to on-going debates on knowledge in at least three ways.

First, our intention is to demonstrate that knowledge practices in hybrid online communities can, despite the obvious lack of physical and relational proximity, compensate for the obvious absence of sensory clues (Hancock and Dunham, 2001) and accomplish quite demanding collective goals in a trustful fashion in a wide range of knowledge domains—a possibility that is only seldom acknowledged in the extant geography literature.

Second, the empirical cases are suggestive to a better assessment of the interdependencies between online environments and the physical and spatial context. We elucidate that these interrelations are far more complex and subtle as prevailing debates on the (limited) substitutability of face-to-face encounters through virtual exchange suggest.

Third, our empirical material allows a more comprehensive and detailed exploration of virtually mediated collaboration and its specific contributions to knowledge creation.

Virtual relations across physical distance, as the title of our article—‘distance as asset’—seeks to convey, afford technical opportunities and social dynamics unattainable in face-to-face only settings.

Our article proceeds as follows. After introducing key notions of the empirical field (Section 2) and presenting our methodological approach (Section 3), we first analyse to what extent knowledge can be traced within the observed virtual communities and to what degree collaboration between community members has been interactive (Section 4). Subsequently, our analysis explores essential spatial dimensions of these communities, their territoriality as well as the interplay between material and virtual environments in particular (Section 5). Finally, rather than regarding virtual exchange as a deficient substitute of face-to-face interaction, we appreciate the unique qualities of online interaction in enabling (and limiting) knowledge collaboration (Section 6).

2. Object of analysis: hybrid virtual communities

The article provides an in-depth exploration of collaborative knowledge practices in nine hybrid virtual communities. We regard a *community*² as an informal group of people who share a common practice and voluntarily adhere to common rules (such as rules of admission, exclusion and behaviour). These shared practices and rules enact a system of relationships between people, activities and the world (Lave and Wenger, 1991; Horrigan and Rainie, 2001; Haythornthwaite, 2009; Hercheui, 2011, 5). Participation in a community is strongly rooted in intrinsic motivation, if not passion for the product, genre or activity around which communities crystallize. The prevailing governance mechanism at work within a community is ‘sharing’ (Belk, 2010). In the prototypical case, sharing means that members contribute to a common pool of resources without the expectation of immediate reciprocity, while every member can legitimately use this pool according to his or her demand (Belk, 2010). These mechanisms of distributing resources entail a sense of common responsibility, mutual recognition and of considerate utilization of the joint pools of resources, time and mutual attention.

Communities cultivate knowledge as a joint practice. Paradoxically, knowledge, like for instance the same language, is enriched rather than diminished by sharing it with like-minded people (Belk, 2010). This, however, does not mean that more strategic considerations are generally precluded. Rather to the contrary, sharing might partially be motivated by career concerns and signalling effects (Lerner and Tirole, 2002). The jointly cultivated knowledge pool offers considerable incentives for the involved participants (like firms’ employees or core contributors aspiring for entrepreneurship) to act strategically by monopolizing a winning margin from the shared knowledge pool (Grabher et al., 2008). However, as the following empirical accounts will reveal, compared to the prototypical case, knowledge sharing seems to be stronger motivated by the desire of being acknowledged by peers and of gathering status from other users (Stewart, 2005; Wiertz and de Ruyter, 2007).

2 We deliberately refrain from an in-depth etymological discussion of the notions of community, network or collective (see, e.g. Willson, 2010), and employ the concept of the community since it is most firmly associated with debates about online forums.

Virtual communities are communities within which interaction is mainly mediated by communication tools provided by the Internet, and in publicly accessible online environments (Preece, 2000; Amin and Roberts, 2008). Although corporeal meetings of community members are possible, not even uncommon, virtually mediated communication is the quintessential form of interaction. Virtual communication, of course, more recently has been transformed fundamentally. From the early static websites, bulletin-boards and listserv-mailing systems, the evolution of the so-called web 2.0 affords new dimensions and qualities of interactivity (Napoli, 2010). In fact, virtuality implies a novel mode of ‘two-way mass communication’—the one interacts directly with the few, and indirectly with the many (Gulbrandson and Just, 2011, 1100).

Hybrid communities denote a specific kind of community, which encompasses on the one hand the sphere of professional expertise, and the mundane world of ordinary users, lay-persons, enthusiasts and hobbyists, on the other (Grabher et al., 2008). Characteristically, interaction in hybrid communities unfolds horizontal (expert-to-expert; user-to-user) and vertical dynamics (expert-to-user, professional-to-lay-person). Scientific attention to hybrid communities so far has largely focused on sectors organized around digital products (e.g. like software). More recently, however, these communities have also been apprehended in a much wider range of industries and knowledge domains like, for instance, trend sports equipment (Shah, 2005), cultural industries like fashion (Kawamura, 2006), dance (Aoyama, 2007) and music (Pinch, 2003; Jeppesen and Frederiksen, 2006), and increasingly in the field of health care and pharmaceuticals (Boon et al., 2008)³.

Hybrid virtual communities can be subdivided into three distinct types, each of which is defined by the kind of relationship between commercial producers on the one hand, and users and enthusiastic laypersons on the other. *Firm-hosted communities* are initiated and maintained by professional and commercial producers. These firms set up the online forum of exchange, employ the community’s moderators, define and police the norms of interaction and can, if deemed necessary, set the agenda by explicitly soliciting feedback on specific topics. *Firm-related communities* are launched by community members who create and enforce the rules of interaction in a self-organized process. However, these communities are not independent from professional producers. Rather, the object of common interest is associated with a distinct brand or even a specific product. In contrast to the partially solicited advice in firm-hosted communities, knowledge collaboration typically unfolds around questions and practices that emerge from daily utilization. Finally, *independent communities* emerge and evolve without the impulse or assistance of professional or commercial organizations. Interaction dynamics are driven by the motivations and aspirations of community members alone. Relative to the two other types of communities, knowledge collaboration in independent settings is most rigorously focused on the ‘epistemic object’ (Knorr Cetina, 2001) whereas firm-related communities in particular unfold strong lateral dynamics around off-topic threads or simply ‘noise’.

3 In the course of our explorative study we also compiled information on hybrid communities evolving around topics such as technical devices (e.g. navigation systems), travelling (e.g. business travels, hiking, snowtracks, mountain trails), automobiles, gardening, home improvement, food (with wine and coffee as favourite domains), scientific discovery, TV entertainment and investment/stock-trading (see also Section 3 on methodology).

This typology, of course, represents a static classification. In the constantly shifting field of online environments and social media, virtual communities on the one hand are inherently dynamic. In particular firm related and independent communities, rather than static and sterile, are fuzzy and unruly social formations (Grabher et al., 2008, 270). Communities learn and forget; they get bored or turn angry, consolidate or drift apart. Communities, in short, evolve and over longer time-horizons might migrate across the boundaries of our typology. On the other hand, these virtual communities are enmeshed in a wider evolving ecology of online media and social network sites with shifting boundaries, changing attributions and usage patterns. Facebook, for example, which in its early years was largely confined to all sorts of non-professional socializing and content-sharing increasingly provides socio-technical affordances for semi- and professional knowledge collaboration (see, e.g. Beer, 2008; Boyd, 2010).

3. Research design: netnography

To explore the evolving field of hybrid virtual communities empirically, we were primarily interested in detecting good practice cases in which the respective collaborative procedures across distance are well established and in which the spatial dimension as well as the unique qualities of online collaboration are clearly observable. The selection, in other words, was explicitly not geared towards the average or representative case. This particular focus, of course, has to be taken into account in the interpretation of findings that cannot be generalized in a straightforward fashion.

3.1. Case selection

According to this overarching goal, our strategy for case selection was highly selective. We approached the field in two successive steps; collection of potential good practice cases and selection of good practices cases for in-depth analysis.

In order to be able to select appropriate cases, we built up a database of pertinent virtual communities. We conducted an online inquiry across highly diverse knowledge domains and were able to gather data on 121 different communities. We collected basic information about these communities that embrace the topic of knowledge practices, the relation to existing firms and brands, the existence and mode of moderation, the age of the community (date of foundation), its size (total number of contributors) and its present state of activity (approximated through the number of actually active members). Since the resulting sample offered sufficient choice of good practice cases (see footnote 5), we proceeded with the selection of communities for a closer investigation.

To grasp the diversity of knowledge collaboration practices for the subsequent in-depth analysis we sought to cover a broad spectrum of communities that met the following criteria. First, we conducted a series of spot tests to make sure that interaction within our selected communities is focussed on 'epistemic objects' (Knorr Cetina, 2001) that are developed further in a collaborative way. We examined in how far the focus of interaction was on improvement and amendment of these core artefacts. In other words, we excluded communities that were restricted to simple ratings and ephemeral subjective expressions of approval or disapproval (like in the case of many fashion communities, for example).

Second, our research was restricted to currently active and to publicly accessible communities. Our sample is biased towards communities that were able to evolve and

consolidate over several years. This ‘survivorship-bias’ implies, of course, that our account is skewed towards community formats that proved to be able to reproduce themselves and towards knowledge domains in which virtual hybrid communities apparently offer some sort of advantages. Our study, in other words, has to remain silent about the universe of virtual hybrid communities that never took off or ceased to exist after a short period of time.

Third, in order to reduce variance in the institutional influences across the selected cases, we concentrated on English-speaking communities that are primarily active in the USA. However, the protocols reveal that the community members practice knowledge collaboration in a wide range of places all over the world.

Fourth, since we expected that the intensity of knowledge collaboration will decrease with the degree of dependency of the community from the respective producers, we selected cases that cover all typical constellations of community-firm relations (see Section 2), and choose for each constellation three examples. Our cases that represent *firm-hosted communities* are:

- ‘*Huggies Happy Babies Forum*’. This forum has been initiated by Kimberly Clark and offers the opportunity for young parents to share their experiences in raising their newborn children.
- ‘*Kraft Food Message Boards*’. Users of this forum are mainly people with a passion for home-cooking, but due to different circumstances in their daily lives are mostly not able to spend much time on it.
- ‘*Dell’s Ideastorm Forum*’. On this site, users of Dell computer hardware discuss technical issues with the firm’s technicians and with other users.

Our sample covers three *firm-related communities*:

- ‘*IKEA Fans*’. As the word ‘fans’ indicates, this community encompasses mainly enthusiastic supporters of the IKEA philosophy.
- ‘*Nikonians*’. This community offers a forum for professional and hobby photographers who share their dedication to Nikon camera equipment.
- ‘*BMW Luxury Touring Forum*’. This is a community of dedicated motorcyclists with a preference for BMW motorcycles.

Finally, we also considered three cases that epitomize *independent communities*:

- ‘*A Swarm of Angels Forum*’. This community of artists seeks to produce a feature-film in a completely self-organized way and exclusively in an online environment. The physical production sites and the technical equipment (such as audio studios, cutting facilities and cameras) are distributed among the community’s members. This forum has temporarily been suspended, but announced a continuation of the project in the immediate future.⁴
- ‘*Sandboarder Forum*’. Sandboarders are a trend sports community that uses modified mono-skis to surf on sand dunes and hills.

4 The viability of user-generated feature film projects has been demonstrated, for example, by the Blender Foundation (<http://www.blender.org/features-gallery/blender-open-projects/>) that successfully completed three open-source movies (‘Elephants Dream’, 2006; ‘Big Buck Bunny’, 2008; ‘Sintel’, 2010).

- ‘DCA Forum’. This forum combines an informal global research network that seeks to advance the development of a new drug against cancer (DCA, short for dichloroacetic acid) together with a community of committed members, mainly cancer patients and their relatives. As the DCA-drug cannot be patented anymore, the pharmaceutical industry shows little interest in investing in product development.

Finally fifth, our selection of cases reaches beyond those fields in which successful online collaboration is already well acknowledged. The emblematic cases, like Linux for example, suggest that distance can be overcome most easily when the epistemic object is immaterial (software) and when codified knowledge and professionalism predominate (Haythornthwaite, 2002; Hew and Hara, 2007; Dahlander et al., 2008). Our study, in contrast, explores virtual collaboration in a wide spectrum of knowledge domains that do not fit into this scheme. Rather, our sample includes virtual communities that, for instance, perform highly material practices (such as furniture construction), that reach far beyond the boundaries of shared virtual platforms as well as practices that are usually considered to mainly rely on tacit knowledge (for instance, child care or film making). Most importantly, as *hybrid* virtual communities, by definition, include a broad spectrum of users, hobbyists and enthusiasts, the selected communities are open for non-professional expertise.

3.2. Netnography

We accessed these communities empirically by a netnographic approach (Kozinets, 2002; Garcia et al., 2009). Analogous to an ethnographer, the netnographer gathers data by participating and directly observing practices while they are performed. We were, however, not able to observe the entire communities directly. Virtual communities are fuzzy social phenomena with blurred boundaries, as they usually interact in several forums, each of which with a different thematic scope and spatial reach (Baym, 2007). For instance, the virtual community of Nikon enthusiasts interacts on such diverse forums as Nikonians, Nikonistas, Nikonistes, Nikoncafe or dpreview.com. In such cases we conducted several pre-tests in order to make sure that we select forums that are major platforms of the community (in terms of actually active members), that are currently active and that are accessible for observation. In the case of Nikon camera users, for instance, we picked according to these criteria, the Nikonians Forum.

We then subscribed to these forums as ordinary members and thus acquired a role that allowed us to directly observe the ongoing interaction between community participants. From June to September 2007 and from January to March 2008 we collected data from 10 threads (a stream of contributions that centres on a single topic) for each of the nine communities. Streams rather than single messages can be regarded as the minimum ‘production unit’ of the community that result in the production of a collective epistemic object (Akrich, 2010). Given the immense volume of data produced by communities we were forced to analyse the ongoing interaction selectively. Before starting an in-depth analysis we first conducted a cursory pre-examination of threads in order to identify those streams of conversation that promised to be most product related and oriented towards improvement and advancement.

Moreover, we were only able to observe the active parts of the community. According to previous research only a small share of a community really contributes to the

ongoing discussions and thereby becomes visible for the netnographer. In quantitative terms the majority of community members (about 90%) only watch and listen what is going on in online forums. These ‘lurkers’ (Preece et al., 2004), however, are an important sub-group of the community. As the average customer belongs to this group of rather passive voyeurs, in firm-hosted and firm-related forums firm representatives are quite aware of the fact that speaking *with* the active parts of a community at the same time means communicating *to* a major share of the customer base (Rubicon Consulting, 2008). Moreover, peripheral members who participate in multiple communities might transfer and contribute divergent ideas that are less likely to be circulated within the core group of the community (Frederiksen, 2010).

All in all, we analysed 90 threads, 10 in each of the 9 selected forums. Our observation data cover 1470 posts (a post is a single contribution to a particular thread). These posts have been contributed by approximately 800 community members. This particular structure of the data offers distinct opportunities and limitations for an empirical analysis. On the one hand it allows access to a qualitative investigation of a social phenomenon which is difficult to grasp as it connects diverse sites across the globe, is open for many contributors who use nicknames that hide their true identity, and usually only becomes manifest in asynchronous interaction. On the other hand, in such a socially diffuse, temporally fragmented and spatially dispersed setting, due to pragmatic reasons (limited accessibility of sites, the lack of identifiable representatives) the costs for collecting complementary qualitative data are exceedingly high, especially when—as in our case—the research design is explorative and the range of divergent communities is broad. Due to these pragmatic limitations we decided to ground our analysis solely on data as it is represented in online protocols. We were able to triangulate evidence, but only within the same set of data, and not across different sets of data.

In an iterative process that shifted back and forth between data analysis and conceptualization we developed codes for distinct types of knowledge circulating within these communities as well as different intensities of knowledge collaboration. When allocating codes to posts we checked whether participants refer to their personal experiences, judgements and beliefs when explaining functional and/or technical aspects of the product, its usability or its contexts of usage or manufacture. We deliberately refrained from discriminating useful from useless contributions, as we wanted to observe how ‘usefulness’ is interactively negotiated within the communities. Additionally, we also interpreted the contributions of community members with regard to spatial dimensions of these online interactions and with respect to the distinctive qualities of online interaction compared to more traditional forms of collaboration and exchange. In the following section we first present tables that demonstrate the quantitative distribution of coded passages across the analysed forums. Subsequently, we exemplify how we allocated codes to text passages by providing typical quotes from the original data.

4. Spatially dispersed yet collaborative: knowledge practices in virtual communities

Our findings support the widely shared view that communities generate knowledge that is *potentially* commercially useful and thus could be harnessed by firms whose products

or wider markets are subject matter of the communities. These communities might have a positive impact on innovative performance (Laursen and Salter, 2006; Flowers, 2008; Mahr and Lievens, 2012), particularly in highly turbulent environments (Lichtenthaler, 2009) as long as the respective firms are open to integrate this highly heterogeneous expertise into their internal routines.

We did not study in a systematic fashion how the involved firms tried to economize on the knowledge generated in communities. In fact, many firms seem not yet decided how to interact with the flourishing ecology of communities they are confronted with (Berthon et al., 2007)⁵. However, our data do reveal what kind of knowledge these communities share. Although the knowledge domains within our sample are highly diverse with respect to the concrete content, three forms of practical relevance of knowledge reoccurred across all our cases: *usage knowledge*, *design knowledge* and *procedural knowledge*. Moreover, our data reveal recurring patterns of collaboration ranging from *validation* to *advancement* and *variation* of ideas.

4.1. Types of knowledge in hybrid virtual communities

As Table 1 shows, in our data set of 1470 posts we identified 800 contributions (57% of all posts) that reveal some form of product-related knowledge the share of which, however, varies considerably; it ranges from 9% (Dell's Ideastorm Forum) to 84% (Nikonians) of the analysed posts.

Table 1. Knowledge types (percentage of posts containing the respective forms of knowledge)

	Firm-hosted communities			Firm-related communities			Independent communities		
	Dell	Huggies	Kraft	BMW	Nikonians	IKEA	Sandboarder	Swarm of DCA Angels	DCA
Usage	9	60	26	28	66	11	44	41	31
Design	0	1	2	2	17	47	19	35	21
Procedural	0	0	0	0	1	18	3	7	24

5 The design of our study focused in particular on the knowledge creation dynamics *within* hybrid virtual communities. Due to this focus we are unable to exactly identify how ideas that circulate within the selected communities are transferred to the respective firms, and how these findings are translated into actual input for product development or marketing campaigns. However, the emergence of a new market segment for dedicated service providers that initiate and moderate hybrid virtual communities and solicit, scan, and synthesize information exchange in these communities corroborate the value firms attribute to these community-generated knowledge (Rubicon, 2008). Cases in point are *Communispace* (customer community management), *Visible* (social media monitoring, analytics and engagement), *Nielsen BuzzMetrics* (social media monitoring and consumer insight) among others (Grabher et al., 2008). At the same time, however, even professionally managed hybrid virtual communities evade a straightforward instrumentalization through the respective firm. Due to the diversity of motivations for sharing information and benefitting from collaboratively produced knowledge, communities unfold 'a life on their own' (Wiertz and de Ruyter, 2007, 370). These internal social dynamics will always pose far greater challenges to integrate hybrid virtual communities into the knowledge production practices of a firm than (internal) R&D- and marketing departments.

Moreover, [Table 1](#) shows that hybrid virtual communities circulate different types of knowledge whereby the intensity of knowledge increases as the latter forms of knowledge (design and procedural) usually include the former. *Usage knowledge*, acquired during several years of intensified use of a product, is spread widely across all observed communities. The following quotations illustrate what kind of knowledge-ability these highly experienced users are able to contribute:

I have ridden motorcycles now for just 47 years. Most of the time my bike has been my primary transportation. I have ridden many, though not all brands and for the last several years have ridden Yamaha and Goldwings (BMW Luxury Touring Forum, thread #3).

An active contributor to the Nikonians forum adds:

I [. . .] have taken almost 10.000 photos with the D200 and countless more with D50 previously. And there does seem to be some combination of factors which I'm still trying to figure out which yield photos that are to my eye underexposed (Nikonians, thread #4).⁶

As [Table 1](#) further illustrates, usage knowledge can be regarded as the archetypical form of expertise provided by hybrid virtual communities. It is the only type of knowledge that occurs in *all* the selected forums. Moreover, it is the predominant type of knowledge, as in all cases except the IKEA Fans Forum; utterances of usage knowledge score the highest counts. However, the relative importance of usage knowledge varies considerably from community to community. While the three firm-hosted communities are more or less restricted to mere usage knowledge, firm related and even more so independent communities circulate deeper forms of expertise to a greater extent.

For instance, eight of the nine observed communities share *design knowledge*, though to a lesser extent (the shares vary between 1% and 47% of posts in the analysed communities), and only rather rarely so in firm-hosted forums. This type of knowledge involves a deeper understanding of principles of the product architecture and of intricate technical construction details of a product, as the following quotation illustrates:

CMOS describes a common (modern) electrical logic system where . . . power loss happens at the transition of logic levels [. . .]. No power is required to maintain the state of the system (Nikonians, thread #8).

Surprisingly, design knowledge is not restricted to expert members; quite often it is also expressed by users. Even a young mother who participates in the Huggies Forum seems familiar with technical details of how diapers work:

It's not lint. It's a crystallized stuff that turns into jelly as it absorbs the pee. It's not the diaper falling apart (Huggies Forum, thread #6).

6 To give an impression of the empirical material as original as possible we refrained from correcting typos, substituting abbreviations or translating community-specific jargon. Our few remaining interventions in the quotes are indicated by [squared brackets].

Similarly, non-professional members of the DCA Forum not only show the ability of explaining how the pharmaceutical works ('DCA has been shown to activate the mitochondria of cells which allows them to die'.) but seem also be able to deduce possible limitations of the drug's effects from their knowledge⁷:

[...] the number of mitochondria varies from cell to cell [this is] the reason why DCA is effective against one type of cancer and not another. On the shell of cells there are receptors these receptors act as a lock only allowing molecules that have the proper shaped key to enter ie: some cancer cells may allow DCA pass through the shell while others may not' (DCA Forum, thread #2).

Usually, users acquire this close to expert-like design knowledge through participation. Many have also collected own practical experiences, for instance through repair, modification or improvement of existing products (BMW Luxury Touring Forum, IKEA Fans, several threads).

Some of the observed virtual communities even generate *procedural knowledge* that is the ability of users to self-organize the division of labour in a complex constellation of collaboration among physically dispersed settings (including the protocols of knowledge circulation). This form of expertise comes to the fore, for instance, when community members arrange where to store data for joint use, how to solve software incompatibilities or how to distribute sub-tasks among fellow peers. This deepest form of expertise, however, is the least common form of knowledge within our sample of communities, and it mainly appears in forums used by independent communities (whose sustainability crucially depends on the ability to develop procedural knowledge).

This is a good idea, a great way of flexing the collaborative aspects for the ASOA [A Swarm of Angels] project. With this in mind, I think this should be the primary aim of the video to test out ideas and processes that we can take forward to either another test project or the film proper [...] If we use DV footage then it can be distributed quickly and edited on 'normal' computers leaving people time to think about the processes involved rather than getting the best quality (A Swarm of Angels Forum, thread #3).

Woodswell, it would be great if you could take notes when you do your modification, including where to put the drawer glides for the various drawers. I may ask ma question as a new thread because I'm thinking there must be some information somewhere (amongst this well-informed group) about how to many holes you need to leave between drawer glides for the various size drawers (IKEA Fans, thread #7).

The relatively high share of procedural knowledge identified in the IKEA Fans Forum (18%; Table 1) is of course partially the result of our selection of threads. As we focussed on good practices with respect to knowledge collaboration we detected in the course of our pre-examination the most promising contributions by IKEA Fans on the IKEA Hacker's sub-forum. In contrast to wide parts of the IKEA Fans Forum, within which loyal enthusiasts of the IKEA philosophy exchange ideas about furnishing and share their experience on the IKEA product's usability, this sub-forum operates in a quite distinct logic. As the name indicates, *IKEA Hackers* use the firm's products as

7 This marks the transition from 'lay knowledge' to 'lay expertise' (Akrich, 2010): While lay knowledge refers to knowledge stemming from lay expertise rather depicts the result of the appropriation of scientific knowledge by laypeople.

raw material for their own furniture designs in a ‘rip, mix, burn’-manner (Currah, 2006):

Our search lead us to ikea where i decided to hack a stolmen shelf and create a floating sink/vanity. i cut a hole to allow the hollviken sink to set down in the shelf and mounted the wall (IKEA Fans, thread #2, original emphasis).

4.2. Interactive learning in hybrid virtual communities

Furthermore, our research demonstrates that hybrid virtual communities do not only circulate different types of knowledge, but are also driven by different types of collaboration intensities, ranging from validation to cumulative advancement and variation of ideas. Table 2 summarizes typical forms of feedback loops we identified in our sample.

Straightforward utterances of approval or dissent on propositions are the least complex form of feedback provided by community members. Almost 20% of all contributions are utterances like ‘please go on’, ‘great idea’, ‘yes, I agree’, ‘very good point’ or ‘I hate it’. These positive or negative feedbacks can be regarded as important for knowledge collaboration as they indicate significance, and channel further communication. Moreover, positive affirmations reduce ambiguity about quality while avoiding overt criticism (Long Lingo and O’Mahony, 2010). Put briefly, this resonance from within the community contributes to a *validation* of knowledge. As one member of the BMW Luxury Touring Forum expresses it: ‘I just want assurance from people who would know best’ (BMW Luxury Touring Forum, thread #3).

The most prevalent form of feedback, with scores between 5% and 70%, however, is more constructive and responsive in character. Most propositions by community members triggered a whole cascade of additional suggestions that contributed to a significant qualification and differentiation of ideas. In the DCA Forum, for instance, community members discuss how to interpret tomography data that document the course of a disease.

The CAT (taken when) shows a reduction in comparison the CAT taken in January. Was anything else done as it seems that there were six months with no treatment, i.e. before the

Table 2. Degree of collaboration: kind of feedback provided by community peers (percentage of posts containing the respective forms of feedback)

	Firm-hosted communities			Firm-related communities			Independent communities		
	Dell	Huggies	Kraft	BMW	Nikonians	IKEA	Sand-boarder	Swarm of Angels	DCA
Validation (approvals/dissents)	29	38	24	23	38	31	9	25	29
Advancement (qualification of ideas)	8	47	5	12	50	53	38	70	51
Variation (competing proposals)	0	0	0	1	0.5	4.5	2	12	4

DCA, and 8 months with no “official” treatment between January and August. At the end it is difficult to understand if the DCA which helped (started in June) or the chemo (1, done in August) or even the combination of the two (DCA Forum, thread #7).

These dialogues afford the stepwise and cumulative *advancement* of ideas. For instance, in the Sandboarders-Forum a contributor from Georgia raised the question how to construct a boarding park ‘with jumps, rails and boxes. We have hills but they are not hella steep but we want to be fast’ (Sandboarder Forum, thread #6). In the following conversation many alternative solutions have been suggested (different undergrounds and various methods of increasing surf speed by modifying the topography of dunes) and critically discussed (for instance, in how far the sandboards’ components will be affected by different undergrounds). In the end, one member of the community came up with a thumb sketch (‘kinda crude drawing . . . but yeah’) that summarizes the essential insights from the previous discussion.

Finally, especially in independent forums, suggestions by community members sometimes provoked competing ideas. Such alternative proposals open up new perspectives on a given topic, or in other words, trigger *variation* of ideas. The IKEA-Hackers’ sub forum provides an example that also illustrates that intensified feedback depends on a deep understanding of the design principles of a product:

I don’t think the Malm series would be that easy to modify. . . they use a honeycomb construction on the insides and relying on a harder ‘frame’ around the border. Such makes it lightweight and strong, but highly unsuitable to be cut-to-size. I think you will be better off getting the occasional table and adding drawers instead (IKEA Fans, thread #5).

Moreover, these alternative propositions also hint at the potential for economic exploitability of knowledge as they sometimes indicate unmet user needs and preferences, as this quotation from the Nikonians forum exemplifies:

I can’t answer your question about condensation-resistant lenses [. . .] But I can make a suggestion. The d200 with a 17-55 f/2.8 will fit (snugly) into a Ziploc 1-gallon plastic storage bag. So will the 70-200 f/2.8 VR, the 12-24 f/4 DX and a variety of lenses, SB-800 flashes, etc. All my gear stays packaged in plastic bags inside my Domke canvas bag. (Nikonians, thread #7).

This participant does not only give a suggestion, additionally he has also already collected some experiences concerning its practical usability:

When the gear goes outdoors, it stays in plastic bags for 20-30 minutes. This is time enough to warm up so that moisture doesn’t condense on o in it (Nikonians, thread #7).

5. Virtual yet spatial: territorial and material preconditions of virtual interaction

In some cases, face-to-face encounters and personal meetings of community members are part of the repertoire and culture of the virtual community. Both forms of interaction occur and often go hand in hand (Mok et al., 2010). Members of the IKEA Fans Forum, for example, occasionally organize meetings in the stores of their home regions. Physically co-located members of the Nikonians forum occasionally meet

personally undertaking photo excursions. However, our observations suggest that these physical meetings are hardly indispensable for knowledge generating activities. We did not find any evidence of arrangements of face-to-face meetings for the purpose of an intensified knowledge exchange, nor did we find complaints about missing opportunities to discuss things personally and more deeply. This suggests that personal meetings rather support informal and ephemeral socializing that, in general tends to increase the affection with the community and the willingness to help other members (Sessions, 2010). In relation to the ongoing, intense and cumulative knowledge exchange online, face-to-face socializing, however, seems only to have a limited impact on the depth of knowledge exchange within these communities.⁸

Moreover, membership in a community whose members are geographically widely dispersed offers opportunities of delegating a thorough inspection of products which otherwise would be out of reach. For instance, in the BMW Luxury Touring Forum one member located in Florida offered to examine more closely a used motorcycle a fellow motorcyclist located in Colorado wanted to buy.

I noticed in your profile that you are from Jersey and in your post that the bike is in Florida I am located in west central Florida and have several Florida dealers within easy drive of my location. Should it be within a reasonable distance I would be happy to go to the dealer and look it over and or take some pictures of it to send to you if you like (BMW Luxury Touring Forum, thread #3).

Interestingly, the Colorado motorcyclist did not respond to this offer to get first hand information right from the site. Instead, after several supportive comments from the wider community, he decided to make the deal without physical inspection. Here, the physical co-presence (in this instance of humans and objects), though practically possible, was finally regarded as dispensable. The supportive feedback from the virtual community was sufficient to come to a well-informed conclusion.

These findings on the overall low importance of immediate face-to-face (and face-to-object) encounters for knowledge collaboration, however, do not imply that the physical and material preconditions of virtual exchange in general are irrelevant. In fact, they are highly relevant, though in a way that is different than usually conceived.

5.1. The *modus operandi* as *locus operandi*

Virtual communities reflect the imprints of territorially bound institutions and conventions (Matzat, 2004; Hercheui, 2011). This sort of institutional embeddedness is above all evinced in the territorially specific norms, conventions and protocols of interaction and conversation. Various aspects of community governance and ‘netiquette’ like, for example, norms of providing help to other community members, modes of resolving conflicts, community-specific perceptions of the private sphere, the typical response time, the tone of the conversation as well as tolerance of humour or sidetrack

8 On the one hand, offline gatherings may provide individual benefits for members as the development of relationships strengthens ‘bonding’ social capital (in the sense of Putnam, 2000). On the other hand, however, these gatherings do not necessarily benefit the community at large as the resources found in weak ties (i.e. ‘bridging’ social capital) may be sacrificed as attendees of face-to-face meetings favour interaction with one another—at the expense of exchange with those who do not attend meet-ups (Sessions, 2010).

conversations echo respective territorial conventions (Grabher and Maintz, 2006). Put briefly, the *modus operandi* is the *locus operandi* (Neff and Stark, 2003).

As our analysis concentrated on US-American cases, we were not able to contrast territorialized institutions in a systematic fashion (for instance, with a comparison between different nationally dominated forums). However, our data still give some evidence for this type of correlation between the virtually established ‘netiquette’ and territorialized norms of communication.

The Kraft Food Forum, for instance, reflects the diversity of and contradictions between distinct cultural predispositions to issues such as cooking and nourishment by sub-dividing the forum into national sub-forums. These national sub-forums do not only use different languages, they additionally discuss nationally specific topics (for instance, ‘recipes for our boys in Iraq’ in the US sub-forum). Moreover, the online interaction is further tied to national territories by references to elements of national popular culture (e.g. by playfully referring to national TV-icons when using the term ‘McGyvering’ in the sense of tinkering).

The IKEA Fans Forum, in contrast, explicitly addresses an international (though English speaking) audience. The inherent increased potential for conflict and misunderstanding (Olsen and Olsen, 2003) here needs to be addressed directly in the forum’s ‘norms and conditions’ which highlight the relevance of generic virtues of conversation, such as ‘politeness’ and ‘mutual respect’ (IKEA Fans Forum) to allow cross-cultural exchange.

5.2. Materiality: sharing practice without sharing context

Laboratory studies conducted by sociologists of scientific knowledge (e.g. Knorr Cetina, 1981) and historical analyses by geographers of science (Livingstone, 2003) have revealed that human knowledgeability is deeply rooted in the social and material conditions provided by those localities where the respective knowledge practices are performed. This research highlights that engagement in practice is always situated in a shared local context (Wenger, 1998).

In an online environment, however, participants mutually engage each other in a shared practice even though a shared local context is not available. Virtual communities do not only involve members with similar expertise, interests or passions but also connect divergent places exhibiting more or less similar material contexts. Of course, with our research design we were unable to immediately observe all, or even some of the involved places, as the sheer number of dispersed locations involved in the observed interactions exceeded our research capacities. However, what we were able to register are ongoing negotiations between community members, in which they explicate the particularities of their material surroundings and the relevance of specific local conditions for the validity of the insights expressed in their posts.

The Sandboarders offer the probably most obvious examples for this kind of negotiations. As every sandboarding track is embedded into a unique landscape, members have to explicate the particular physical properties of their boarding spots to specify the wider relevance of their experiences and suggestions.

First of all Wisconsin sand is not great for sandboarding so don’t expect it to fly there. Second, hot sand is slower than cool sand, so you might want to try it early morning or later in the year when the temp drops (Sandboarder Forum, thread #2).

Contributions like that seek to identify critical parameters within which the valued knowledge of the community can be discussed in a meaningful way. Through interaction the community members jointly enact a framework of critical dimensions that contextualize their knowledge practices and at the same time neglect idiosyncratic particularities of the landscapes. For instance, the Sandboarders situate their knowledge practices in a framework that consists of hill gradients, sand granularity, weather conditions, ramps, board characteristics and so on. Similarly, before further discussing the issue of wobbling handlebars, a member of the BMW Luxury Touring Forum first asks for more detailed information to augment the context:

However, for ‘discussion’ purposes...can you give specs...Total Mileage, Tire Mileage Front/Rear, Air Pressure Front/Rear (BMW Luxury Touring Forum, thread #4).

In both cases, community members specify the parameters within which it makes sense to discuss the respective topics and thereby jointly constitute a shared practice without relying on a shared local context.

This theme is variegated in manifold ways by the observed communities. For instance, the IKEA Hackers take advantage of the standardization efforts undertaken by the global manufacturer of furniture. They can be sure that all their fellow peers across the globe will be able to act on exactly the same materials, screws, pegs and pins—as long as they will be obtained from IKEA. The same holds true for Nikonians who frequently exchange detailed data on the properties of their gears: ‘My list is as follows: NIKON D200 or D300 BODY, TOKINA AT-X 124 AF Pro DX 12-24mm f/4.0, TOKINA AT-X 280 AF 28-80 f/2.8, Cokin Z Pro filter holder’ (Nikonians, thread #8). With the help of such lists of specifications members with the same camera equipment can come together as ‘gear twins’. These identical equipments can then be tested against the background of the divergent local conditions of the respective camera users. Exposition to multiple stress factors can provide a fuller and deeper understanding of the product’s performance properties (von Hippel, 2005).

Finally, sharing practice without sharing context entails interaction that seeks to determine the degree of generalization of the shared knowledge. The Nikonians exchange precise sets of data in order to make explicit under which local conditions (like, e.g., climatic conditions) their experiences have been made and thus at the same time under which conditions their knowledge is most likely to be valid. Another case in point is IKEA Fans who provide accounts about the age and the restlessness of their children in order to validate their suggestion for a particular design:

[...] if your kids are like mine, they’d never stay in place [...] With or without the legs, the cabinet is sturdy and has held up to three children who absolutely, positively can NOT sit still during a meal. Plus, I frequently find all three standing on the benches to write on the stick-on chalkboard above the bench (IKEA Fans, thread # 3).

Moreover, the members of the forums not only discuss the limits of their knowledge but also seek to find ways to expand the scope of generalization by altering the set of relevant framework conditions within which to discuss a particular issue:

I am not a wedding photographer but obviously you are dealing with a huge range of different lighting conditions. However it is not just wedding photographers that have to cope with such changes (Nikonians, thread #4).

Within virtual communities shared practice is not a result of socialization in a context of physical co-location, but rather of collective heedful engagement (Weick and Roberts, 1993) with similar but physically distanced material contexts. Crucially, shared practice provides the preconditions for those interrelating activities that are critical for triggering moments of collective creativity (Hargadon and Betchky, 2006): help seeking, help giving, reflective reframing (in which each actor in turn attends to and builds upon the comments and actions of others) and affirmation (e.g. through organizational values that support individuals' seeking and providing help and reflective reframing).

6. Unique qualities of virtual interaction: the advantages of not being there

The hybrid virtual communities we studied do not only seem capable of producing deep insights and complex knowledge. In fact, we maintain that liberated from the limitations of physical neighbourhood (Haythornthwaite, 2002), these communities also afford technical opportunities, organizational practices and social dynamics that foster particular learning processes unattainable in face-to-face contexts. In other words, while the absence of face-to-face encounters and the dependence on distanced online interaction mostly are perceived as bottlenecks for knowledge collaboration, we seek to appreciate the enabling character of these very circumstances.

6.1. Low multiplexity and quasi-anonymity

Since members in hybrid virtual communities (except moderators with an explicit role description) are quasi-anonymous, online interaction is characterized by low degrees of multiplexity. In this sense, hybrid virtual communities can economize on the proverbial 'strength of weak ties' (Granovetter, 1973). Relations are almost purely informational (Grabher, 2004, 1505–6). In fact, the pure informational character of exchange is reinforced in the code of conduct of hybrid virtual communities that frequently precludes personal attributions and stress the open and in principle egalitarian constitution of the community. The status of quasi-anonymity is only legitimately suspended if additional information facilitates the validation of specific posts (like, e.g., revealing the fact of having young children when discussing the robustness of furniture; IKEA Fans, thread #3).

The condition of quasi-anonymity implies the absence of alternative cues of professional experience, disciplinary background and formal status or contextual clues such as office location, seating position or even clothing that exert influence on communication (see, e.g. Bathelt and Turi, 2011, 525; Dubrovsky et al., 1991). Under these conditions individual posts are primarily valued according to their contribution to the specific problem at hand. Quasi-anonymity, in this sense, implies a redistribution of influence from formal status to competence, commitment and enthusiasm. In all our observed cases reputation and credibility appear strictly community specific: in general the standard format of interaction protocols only reveals the duration of community membership ('Join Date') and the overall number of posts of the specific member as a proxy for commitment and knowledgeability.

This emancipation from cues to formal status might not only give a voice to views that in more traditional face-to-face settings (e.g. such as patients in the setting of a

conference of medical professionals) could not be raised or would remain unheard. It also motivates sustained engagement over long periods (without any tangible results) and thus nurtures (long-term) cumulative knowledge dynamics (Otto and Simon, 2008). The DCA Forum, for instance, manages to keep momentum since several years despite any formal approval of their cancer therapy approach.

In a sense, knowledge circulation in virtual hybrid communities comes rather close to the ideal of the ‘mode 2’-type of knowledge production (Gibbons et al., 1994). In this mode the locus of knowledge collaboration shifts from the traditional institutional framework of disciplinary organized knowledge production to learning and knowledge creation in the ‘context of its application’. Each particular context of application implies its particular set of theories, analytical strategies, modes of validation and learning practices. The mode of knowledge collaboration prevailing in virtual communities not necessarily generates ‘superior’ knowledge (in scientific terms), but more useful knowledge.

6.2. Cumulative learning, selection and memory

Participation in hybrid virtual communities is largely driven by intrinsic motivations and the prospect of gaining reputation among peers or vis-à-vis the focal firm (Wiertz and Ruyter, 2007; Grabher et al., 2008). Even firm-hosted communities hardly offer monetary or material compensation beyond the occasional symbolic gesture of handing out a gift for particularly promising ideas. The particular incentive structure also shapes the ways in which knowledge is produced in virtual communities. Whereas the involvement of extrinsically motivated participants is more strategic, selective and situational, intrinsically motivated members typically are more experientially oriented, more enduring in their engagement and relate to a broader spectrum of issues (Füller, 2010, 106).

The more sustaining engagement in the community is conducive to the cumulative dynamics of advancing knowledge that in turn is further enhanced by specific features of online exchange. Virtual hybrid communities are ‘hypertextual’ (Gulbrandson and Just, 2011, 1099)⁹—a form of textuality that ‘encourages writerly, active reading rather than passive consumption of what has been produced by a conventional authorial author’ (Gaggi, 1997, 104). It is common practice in virtual communities to explicitly refer to previous statements (by copying posts partially into the subsequent post):

Originally Posted by nicasian:

I'm building an extended window seat with fridge cabinets and was wondering how you attached the Akurum legs to the bottom? There are no built in holes on these wall cabinets so did you have to drill some? Thanks.

You don't need to drill holes to attach the legs. You can cut off the peg on the leg plate and screw the leg plate into the bottom of the cabinet. (IKEA Fans, thread #3).

Discussion threads are persistent over years due to the storage of messages, and message databases in most cases may be searched via electronic queries. Such a rewinding time

9 In a fully hypertextual community, texts to which one moves are also networked to their own references and allusions (...) what results is a complex, interconnected network of nodes and links. The reader enters at any node and chooses any path through and about the network’ (Gaggi, 1997, 102).

to accurately review and collectively re-elaborate a discussion thread seems hardly possible in a physical meeting (Akrich, 2010, 6.4). The practice of following on from certain previous posts (while ignoring other statements) acts as an effective collective ‘selection environment’ for ideas (Kozinets et al., 2008, 343). Moreover, this sort of explicit cross-referencing produces a collective memory and cultivates a certain sense of focus and accuracy that discourages spontaneous and unrelated utterances. More generally, heedful interrelating with ongoing interactions within the community foster collective cognition that connects individual ideas and experiences in ways that both redefine and resolve the demands of emerging situations (Hargadon and Betchky, 2006, 486). Heedfulness and on-topic professionalism (Ren et al., 2007) indeed is partially codified in the rules and codes of conduct of the communities. Across all threads of our sample only 4.2% of all posts or 0.6 posts per thread classify as non-topic contributions.

Finally, a discussion of certain topics can lead to preliminary epistemic objects that are isolated from the ongoing flow of exchanges: about half of the analysed communities formalize products of knowledge collaboration by creating a space in which insights and suggestions of more general relevance are organized into a knowledge corpus. A particularly rich example is the site of the DCA Forum that over time has developed an increasingly differentiated register that offers access to relevant papers, studies, reports on dosage and side effects, alternative therapies and a ‘Frequently Asked Questions’-section that is continually extracted from ongoing debates (DCA Forum). This sort of experiential knowledge formalization fosters a culture of rational discussion in which individual experiences and perspectives are articulated and collectively re-elaborated with insights from science and technology (see also Akrich 2010, 6.1–6.10).

6.3. Asynchronicity and reflective reframing

In contrast to immediate face-to-face encounters that take place in real time, and thus hardly stretch out beyond the moment of physical co-presence, the long-term engagement of intrinsically motivated participants implies that debates on particular issues might delve into the subject matter for a considerable period of time. In the Swarm of Angels Forum, for example, some of the observed threads lasted almost for 2 years (the most extensive thread went on for 596 days). These time spans allow interactive processes of ‘reflective reframing’ (Hargadon and Bechky, 2006) that are not available in the most intensive face-to-face encounters.

In general, interaction within the observed forums is characterized by long response times. On average, across all the analysed threads contributors took about 114 h for reacting on fellow peer’s suggestions. Asynchronicity leaves more time for the participants to contemplate answers or to test various modifications and versions before reacting on a contribution (very frequent in the IKEA Fans Forum) or to wait with an answer until reliable diagnostic material or test results are available (for instance in the DCA Forum). Longer response times, moreover, offer richer opportunities to support an argument with additional material, for instance with a sketch, a blueprint and a section from a research report, a CAT-scan, a set of supporting data or a photography. Finally, asynchronicity allows community members who typically are simultaneously involved in a range of related communities (Frederiksen, 2010) to triangulate information by consulting alternative forums.

Asynchronicity thereby allows to harness the problem-solving benefits of cognitively diverse perspectives (Brabham, 2010).

The practice of conveying ideas and suggestions through multi-dimensional cross-referencing (by inserting weblinks, comments, articles, audio interviews or videos) prevailing in virtual communities opens up new avenues for associative mind-mapping and increases collective reflexivity. In general, thinking and tinkering through metaphors, analogies and comparisons enhances creative problem solving (Burroughs and Mick, 2004, 404). Quite obviously, instantaneous face-to-face encounters do not leave as much space for playful and experimental tinkering that seems perfectly legitimate in virtual communities (Kozinets et al., 2008, 343). In fact, the communities with the deepest knowledge and the most constructive forms of feedback (IKEA-Hackers sub-forum, A Swarm of Angels Forum) are at the same time the communities with the longest lasting threads and response times beyond average.

Asynchronicity unfolds its full advantages in cases of ‘advancement’ (the qualification of ideas) and ‘variation’ (the proposal of competing ideas). Asynchronicity, in other words, turns out to be beneficial in instances of elaboration and tinkering along a complex trajectory with a high level of ‘knowledge interdependence’ (Molinari et al., 2009), like in the case of cancer treatment in the DCA Forum or the collaborative production of a feature film, as in the case of the Swarm of Angels Forum. Conversely, asynchronicity is less advantageous in cases with low knowledge interdependence, and in cases in which spontaneous responses produce decisions of relatively higher quality, i.e. decisions in which an immediate impulse reflects accumulated (tacit) experience, as is the case when members validate proposed ideas by spontaneously expressing dissent or consent (see also Kahnemann, 2011).

7. Summary and conclusions

In this article we seek to challenge new and old certainties about the spatiality of learning. In particular, we take issue with the prevailing analytical strategy in geographical studies of learning that attribute the notion of proximity an epistemological privilege. In these studies relational and physical proximity are widely perceived as supportive conditions for collective learning processes. The notion of distance, however, is mostly addressed in an indirect fashion: Regarded as a lack of proximity (Ibert, 2010), distance in this perspective appears as a state of deficiency and inferiority (bereft, by definition, of all the economic benefits associated with proximity). In contrast, this article seeks to contribute to a more recent strand of inquiry into the geographies of knowledge generation (Amin and Cohendet, 2004; Glückler, 2007; Amin and Roberts, 2008; Gertler, 2008; Bathelt and Glückler, 2011; Bathelt and Turi, 2011), which appreciate both proximity and distance as geographical categories of equal epistemological status.

As the title of our article—distance as asset—insinuates, this study seeks to contribute to this emerging line of reasoning by systematically exploring benefits of distanced relations in learning processes that so far have been understated or even overlooked. We do so in chartering an empirical field—hybrid virtual communities—in which knowledge practices, despite the unavailability of physical co-location and personalized trust, evolve in elaborate ways and accomplish quite demanding tasks. We were able to show that these communities share knowledge of diverse kinds (usage, design and

procedural knowing) and unfold rather complex collaborative dynamics (validation, variation and advancement of existing knowledge). As our findings further demonstrate, collaborative knowledge practices across physical and relational distances are not at all a-spatial or immaterial. For instance, when sharing practice without sharing context, community members establish a common framework within which important issues of the community can be negotiated meaningfully. They jointly negotiate which elements of their surrounding material contexts are crucial to establish a shared practice, and which of these elements represent only local idiosyncrasies without any relevance for the shared knowledge practice. Moreover, as the ‘gear twins’ in the Nikonians community and the IKEA Fan Forum exemplify, community members refer to product ID’s and order codes to assemble almost identical material ‘constellations of practice’ (Faulconbridge 2010) at geographically disperse locations. The purposeful creation of similar material conditions allows a more meaningful *in situ* validation, exploration and variation of the virtually shared knowledge.

Furthermore, collaboration in virtual hybrid communities, of course, lacks the media richness and the entire spectrum of non-verbal cues (like gestures, body-language and language variety) through which face-to-face encounters eases interaction and mutual understanding (Bathelt and Turi 2011, 524–5). And yet, our empirical material suggests that distinct features of online interaction (quasi-anonymity, asynchronicity, virtual memory) do provide unique opportunities for collaboration, such as on-topic professionalism and cumulative and problem-oriented learning. Asynchronicity seems to unfold particular advantages in cases of high degrees of ‘knowledge interdependence’ (Molinari et al., 2009), like in the instance of cancer treatment in the DCA Forum or the collaborative production of a feature film by the Swarm of Angels Forum.

Finally, we wish to direct the attention to one conceptually promising but empirically unexplored issue. We agree that virtual exchange is more ambiguous than exchange in physical co-presence. Face-to-face interaction reduces the ambiguities of information exchange since interaction partners situated in the same context can more easily negotiate perceptions and interpretations (Song et al. 2007). In virtual communities misunderstandings and misapprehensions might remain undetected for longer time. However, whereas ambivalence and misunderstandings usually are perceived as undesired distortions, we suggest that both *can* unfold creative dynamics. Their settlement demands more explication, contextualization and mutual confirmation (see also Bathelt and Turi 2011, 525). By overcompensating the absence of sensory clues with verbal explication (Olsen and Olsen, 2003), community members might reveal the taken-for-granted aspects of everyday problem solutions and afford the explication of knowledge and practices that otherwise might remain unconscious and in fact tacit. Explication invites a problematization, further exploration and de-contextualization of practices. Communication under conditions of equivocality, thus, triggers the generative moments of incompleteness (Garud et al., 2008), creative dynamics occur not *despite* but *because* of misunderstandings (Stark, 2009, 193).

We think that online interaction should offer rich opportunities for these generative moments of misunderstandings. However, the structure of our data does not allow us to support these ideas empirically. To reveal generative misunderstandings it would be necessary to perform diachronic analysis from longitudinal data whereas our sample is designed for a synchronic comparison of different types of communities. Moreover, observational data of the collaborative dynamics on the community level would have to be confronted with in-depth interviews with individual community members to uncover

divergent interpretations of identical instances. Hence, it will be up to future research to explore in how far hybrid online communities might constitute a sort of ‘trading zone’ (Galison, 1997) in which divergent experiences and attributions are not ‘ironed out’ but spark sustained engagement.

Acknowledgements

We gratefully acknowledge support by the German Research Foundation (DFG: GR 1913/7). We also would like to express our gratitude to Saskia Flohr, David Tamoschus and Christian Paape for their excellent research assistance at different stages of the research process. Previous versions of this article have been presented at the 26th Colloquium of the European Group of Organization Studies (EGOS), 1st–3rd July 2010 in Lisbon, sub-theme 13 ‘Space in Inter-organizational Relations’, at the Global Conference on Economic Geography, 28th June–2nd July 2011 in Seoul, session 105 ‘Geography of the Internet and the Mobile’ and at the Workshop ‘Economic Sociology meets Economic Geography’, Center on Organizational Innovation, Columbia University, 23rd February 2012. We would like to thank the participants and organizers of these events for their critical and constructive feedback on our work.

References

- Akrich, M. (2010) From communities of practice to epistemic communities: health mobilizations on the Internet. *Sociological Research Online*, 15. Available online at: <http://www.socresonline.org.uk/15/2/10.html> [Accessed 23 June 2013].
- Amin, A., Cohendet, P. (2004) *Architectures of Knowledge: Firms, Capabilities and Communities*. Oxford: Oxford University Press.
- Amin, A., Roberts, J. (2008) Knowing in action: beyond communities of practice. *Research Policy*, 37: 353–369.
- Aoyama, Y. (2007) The role of consumption and globalization in a cultural industry: the case of flamenco. *Geoforum*, 38: 103–113.
- Asheim, B. T., Coenen, L., Vang, J. (2007) Face-to-face, buzz, and knowledge bases: sociospatial implications for learning, innovation and innovation policy. *Environment and Planning C*, 25: 655–670.
- Bathelt, H., Glückler, J. (2005) Resources in economic geography: from substantive concepts towards a relational perspective. *Environment and Planning A*, 37: 1545–1563.
- Bathelt, H., Glückler, J. (2011) *The Relational Economy: Geographies of Knowing and Learning*. Oxford: Oxford University Press.
- Bathelt, H., Malmberg, A., Maskell, P. (2004) Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography*, 28: 31–56.
- Bathelt, H., Schuldt, N. (2010) International trade fairs and global buzz, part I: ecology of global buzz. *European Planning Studies*, 18: 1957–1974.
- Bathelt, H., Turi, P. (2011) Local, global and virtual buzz: the importance of face-to-face contact in economic interaction and possibilities to go beyond. *Geoforum*, 42: 520–529.
- Baym, N. (2007) The new shape of online community: the example of Swedish independent music fandom. *First Monday*, 12. Available online at: <http://firstmonday.org/ojs/index.php/fm/article/view/1978/1853> [Accessed 29 May 2013].
- Beer, D. (2008) Social network(ing) sites... revisiting the story so far: a response to Dana Boyd and Nicole Ellison. *Journal of Computer-Mediated Communication*, 13: 516–529.
- Belk, R. (2010) Sharing. *Journal of Consumer Research*, 36: 715–734.
- Berthon, P. R., Pitt, L. F., McCarthy, I., Kates, S. M. (2007) When customers get clever: managerial approaches to dealing with creative customers. *Business Horizons*, 50: 39–47.
- Boon, W., Moors, E., Kuhlmann, S., Smits, R. (2008) Demand articulation in intermediary organisations: the case of orphan drugs in the Netherlands. *Technological Forecasting and Social Change*, 75: 644–671.

- Boyd, D. (2010) Social network sites as networked publics: affordances, dynamics, and implications. In Z. Papacharissi (ed.) *Networked Self: Identity, Community, and Culture on Social Network Sites*, pp. 39–58. London: Routledge.
- Brabham, D. C. (2010) Moving the crowd at Threadless. Motivations for participation in a crowdsourcing application. *Information, Communication & Society*, 13: 1122–1145.
- Burroughs, J. E., Mick, D. G. (2004) Exploring antecedents and consequences of consumer creativity in a problem-solving context. *Journal of Consumer Research*, 31: 402–411.
- Cook, S. D. N., Brown, J. S. (1999) Bridging epistemologies: the generative dance between organizational knowledge and organizational knowing. *Organization Science*, 10: 381–400.
- Currah, A. (2006) Hollywood versus the Internet: the media and entertainment industries in a digital and networked economy. *Journal of Economic Geography*, 6: 439–469.
- Dahlander, L., Frederiksen, L., Rullani, F. (2008) Online communities and open innovation: governance and value creation. *Industry and Innovation*, 15: 115–123.
- Dubrovsky, V. J., Kiesler, S., Sethna, B. N. (1991) The equalization phenomenon: status effects in computer-mediated and face-to-face decision making groups. *Human-Computer Interaction*, 6: 119–146.
- Faulconbridge, J. (2010) Global architects: learning and innovation through communities and constellations of practice. *Environment and Planning A*, 42: 2842–2858.
- Faulconbridge, J. R., Beaverstock, J. V., Derudder, B., Witlox, F. (2009) Corporate ecologies of business travel in professional service firms: working towards a research agenda. *European Urban and Regional Research*, 16: 295–308.
- Flowers, S. (2008) Harnessing the hackers: the emergence and exploitation of outlaw innovation. *Research Policy*, 37: 177–193.
- Frederiksen, L. (2010) A click away: positions inside and outside online communities as sources of innovation. Unpublished Manuscript. Copenhagen Business School.
- Füller, J. (2010) Refining virtual co-creation from a consumer perspective. *California Management Review*, 52: 98–122.
- Gaggi, S. (1997) *From Text to Hypertext: Decentering the Subject in Fiction, Film, the Visual Arts, and Electronic Media*. Philadelphia: University of Pennsylvania Press.
- Galison, P. L. (1997) *Image and Logic. A Material Culture of Microphysics*. Chicago: University of Chicago Press.
- Garcia, A. G., Standlee, A. I., Bechkoff, J., Cui, Y. (2009) Ethnographic approaches to the Internet and computer-mediated communication. *Journal of Contemporary Ethnography*, 38: 52–84.
- Garud, R., Jain, S., Tuertscher, P. (2008) Incomplete by design and designing for incompleteness. *Organization Studies*, 29: 351–371.
- Gertler, M. (2003) Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). *Journal of Economic Geography*, 3: 75–99.
- Gertler, M. (2008) Buzz without being there? Communities of practice in context. In A. Amin, S. Roberts (eds) *Community, Economic Creativity and Organization*, pp. 203–226. Oxford: Oxford University Press.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., Trow, M. (1994) *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage.
- Glückler, J. (2007) Geography of reputation. The city as locus of business opportunity. *Regional Studies*, 41: 949–961.
- Grabher, G. (2004) Architectures of project-based learning: creating and sedimenting knowledge in project ecologies. *Organization Studies*, 25: 1491–1514.
- Grabher, G., Ibert, O. (2006) Bad company? The ambiguity of personal knowledge networks. *Journal of Economic Geography*, 6: 251–271.
- Grabher, G., Ibert, O., Flohr, S. (2008) The neglected king: the customer in the new knowledge ecology of innovation. *Economic Geography*, 84: 253–280.
- Grabher, G., Maintz, J. (2006) *Learning in personal networks: Collaborative knowledge production in virtual forums*. Working Paper of the Center on Organizational Innovation, Columbia University. Available online at: <http://www.coi.columbia.edu/workingpapers.html> [Accessed 18 May 2013].

- Granovetter, M. S. (1973) The strength of weak ties. *American Journal of Sociology*, 78: 1360–1380.
- Gulbrandson, I. T., Just, S. N. (2011) The collaborative paradigm: towards an invitational and participatory concept of online communication. *Media, Culture & Society*, 33: 1095–1108.
- Hancock, J., Dunham, P. (2001) Impression formation in computer-mediated communication. *Communication Research*, 28: 325–347.
- Hargadon, A. B., Bechky, B. A. (2006) When collections of creatives become creative collectives: a field study of problem solving at work. *Organization Science*, 17: 484–500.
- Hautala, J. (2011) Cognitive proximity in international research groups. *Journal of Knowledge Management*, 15: 601–624.
- Haythornthwaite, C. (2002) Creating and sustaining distributed learning communities. In K. A. Renninger, R. W. Shumar (eds) *Building Virtual Communities: Learning and Change in Cyberspace*. Cambridge: Cambridge University Press.
- Haythornthwaite, C. (2009) Online knowledge crowds and communities. Paper presented at the International Conference on Knowledge Communities. University of Nevada, Reno. February.
- Hercheui, M. D. (2011) A literature review of virtual communities. The relevance of understanding the influence of institutions on online collectives. *Information, Communication & Society*, 14: 1–23.
- Hew, K. F., Hara, N. (2007) Knowledge sharing in online environments: a qualitative case study. *Journal of the American Society for Information Science and Technology*, 58: 2310–2334.
- Horrigan, J. B., Rainie, L. (2001) *Online Communities: Networks that Nurture Long-Distance Relationships and Local Ties*. Washington, D.C.: Pew Internet & American Life Project, Final Report.
- Ibert, O. (2007) Towards a geography of knowledge creation: the ambivalences between “knowledge as an object” and “knowing in practice”. *Regional Studies*, 41: 103–114.
- Ibert, O. (2010) Relational distance: Sociocultural and time-spatial tensions in innovation practices. *Environment and Planning A*, 42: 187–204.
- Jeppesen, L. B., Frederiksen, L. (2006) Why do users contribute to firm-hosted user communities? The case of computer-controlled music instruments. *Organization Science*, 17: 45–64.
- Kahnemann, D. (2011) *Thinking, Fast and Slow*. London: Penguin.
- Kawamura, Y. (2006) Japanese teens as producers of street fashion. *Current Sociology*, 54: 784–801.
- Knorr Cetina, K. (1981) *The Manufacture of Knowledge*. Oxford: Pergamon.
- Knorr Cetina, K. (2001) Objectual practice. In T. R. Schatzky, K. Knorr Cetina, E. Savigny (eds) *The Practice Turn in Contemporary Theory*, pp. 175–188. London: Routledge.
- Kozinets, R. V. (2002) The field behind the screen: using netnography for marketing research in online communities. *Journal of Marketing Research*, XXXIX: 61–72.
- Kozinets, R. V., Hemetsberger, A., Schau, H. J. (2008) The wisdom of consumer crowds. Collective innovation in the age of networked marketing. *Journal of Makromarketing*, 28: 339–353.
- Laursen, K., Salter, A. (2006) Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27: 131–150.
- Lave, J., Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Lerner, J., Tirole, J. (2002) Some simple economies of open source. *Journal of Industrial Economics*, 52: 633–649.
- Lichtenthaler, U. (2009) Outbound open innovation and its effect on firm performance: examining environmental influences. *R&D Management*, 39: 317–331.
- Livingstone, D. (2003) *Putting Science in its Place. Geographies of Scientific Knowledge*. Chicago: Chicago University Press.
- Long Lingo, E., O’Mahony, S. (2010) Nexus work: Brokerage on creative projects. *Administrative Science Quarterly*, 55: 47–81.
- Mahr, D., Lievens, A. (2012) Virtual lead user communities: drivers of knowledge creation for innovation. *Research Policy*, 41: 167–177.
- Malmberg, A., Maskell, P. (2006) Localized learning revisited. *Growth and Change*, 37: 1–18.

- Maskell, P., Bathelt, H., Malmberg, A. (2006) Building global knowledge pipelines: the role of temporary clusters. *European Planning Studies*, 14: 997–1013.
- Matzat, U. (2004) The social embeddedness of academic online groups in offline networks as a norm generating structure. *Computational & Mathematical Organization Theory*, 10: 205–226.
- Meusburger, P. (2009) Spatial mobility of knowledge: a proposal for a more realistic communication model. *disP*, 177: 29–39.
- Mok, D., Wellmann, B., Carrasco, J. (2010) Does distance matter in the age of the Internet? *Urban Studies*, 47: 2747–2783.
- Molinari, G., Sangin, M., Dillenbourg, P., Nüssli, M.-A. (2009) Knowledge interdependence with the partner, accuracy of mutual knowledge model and computer-supported collaborative learning. *European Journal of Psychology of Education*, 24: 129–144.
- Morgan, K. (2004) The exaggerated death of geography. Learning, proximity and territorial innovation systems. *Journal of Economic Geography*, 4: 3–21.
- Moulaert, F., Sekia, F. (2003) Territorial innovation models: a critical survey. *Regional Studies*, 37: 289–302.
- Napoli, P. M. (2010) Revisiting ‘mass communication’ and the ‘work’ of the audience in the new media environment. *Media, Culture & Society*, 32: 505–516.
- Neff, G., Stark, D. (2003) Permanently beta: Responsive organization in the internet-era. In P. Howard, S. Jones (eds) *Society Online: The Internet in Context*, pp. 173–188. Thousand Oaks: Sage.
- Olsen, C., Olsen, J. (2003) Mitigating the effects of distance on collaborative intellectual work. *Economics of Innovation and New Technology*, 12: 27–42.
- Orlikowski, W. J. (2002) Knowing in practice: enacting a collective capability in distributed organizing. *Organization Science*, 13: 249–273.
- Otto, P., Simon, M. (2008) Dynamic perspectives on social characteristics and sustainability in online community networks. *System Dynamics Review*, 24: 321–347.
- Pinch, T. (2003) Giving birth to new users: How the minimoog was sold to rock and roll. In N. Oudshoorn, T. Pinch (eds) *How Users Matter: The Co-construction of Users and Technologies*, pp. 247–270. Cambridge: MIT Press.
- Polanyi, M. (1966) *The Tacit Dimension*. New York: Doubleday.
- Power, D., Jansson, J. (2008) Cyclical clusters in global circuits: Overlapping spaces in furniture trade fairs. *Economic Geography*, 84: 423–449.
- Preece, J. (2000) *Online Communities. Designing Usability, Supporting Sociability*. Chichester: Wiley.
- Preece, J., Nonneke, B., Andrews, D. (2004) The top 5 reasons for lurking: improving community experiences for everyone. *Computers in Human Behavior*, 20: 201–223.
- Putnam, R. D. (2000) *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.
- Ren, Y., Kraut, R., Kiesler, S. (2007) Applying common identity and bond theory to design of online communities. *Organization Studies*, 28: 377–408.
- Rubicon Consulting, (2008) *Online Communities and Their Impact on Business: Ignore at Your Peril*. Rubicon Consulting, Inc.
- Sessions, L. F. (2010) How offline gatherings affect online communities. When virtual community members ‘meetup’. *Information, Communication & Society*, 13: 375–395.
- Shah, S. K. (2005) Open beyond software. In D. Cooper, C. DiBona and M. Stone (eds) *Open Source 2.0: The continuing Evolution*, pp. 339–360. Sebastopol, CA: O’Reilly Media.
- Song, M., Berends, H., van der Bij, H., Weggeman, M. (2007) The effects of IT and co-location on knowledge dissemination. *The Journal of Product Innovation Management*, 24: 52–68.
- Stark, D. (2009) *The Sense of Dissonance. Accounts of Worth in Economic Life*. Princeton: Princeton University Press.
- Stehr, N. (2001) A world made of knowledge. *Society*, 3: 89–92.
- Stewart, D. (2005) Social status in an open-source community. *American Sociological Review*, 70: 823–842.
- Storper, M., Venables, A. J. (2004) Buzz: Face-to-face contact and the urban economy. *Journal of Economic Geography*, 4: 351–370.
- Torre, A. (2008) On the role played by temporary geographical proximity in knowledge transmission. *Regional Studies*, 42: 1–21.

- Urry, J. (2002) Mobility and proximity. *Sociology*, 36: 255–274.
- Von Hippel, E. (2005) *Democratizing Innovation*. Cambridge: MIT Press.
- Weick, K. E., Roberts, K. H. (1993) Collective mind in organizations: heedful interrelating on flight decks. *Administrative Science Quarterly*, 38: 357–381.
- Wenger, E. (1998) *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.
- Wiertz, C., de Ruyter, K. (2007) Beyond the call of duty: why customers contribute to firm-hosted commercial online communities. *Organization Studies*, 28: 347–376.
- Willson, M. (2010) Technology, networks and communities. An exploration of network and community theory and technosocial forms. *Information, Communication & Society*, 13: 747–764.