Happenstance, Strategies and Tactics: Intrinsic Design in a Volunteer-based Community

Susanne Bødker, Henrik Korsgaard, Peter Lyle & Joanna Saad-Sulonen
Department of Computer Science & Centre for Participatory IT, Aarhus University
Aarhus, Denmark
{bodker, korsgaard, peter.lyle, jss}@cs.au.dk

ABSTRACT

This paper presents the study of a volunteer community, its technologies, and the processes in and through which it develops, sustains and makes its community artifact ecology work. Based on previous work proposing the concept of community artifact ecology as a way of understanding the constellation of technologies a community owns, has access to and uses in their practices, we examine the dynamics and development of such a community artifact ecology in detail. The findings indicate that in volunteer communities developing a working community artifact ecology is a process mixing happenstance, community strategies and everyday tailoring and appropriation tactics. Additionally, much of the design and infrastructuring work in shaping the community artifact ecology and making it work both blurs with use and can be considered as intrinsic design as it is conducted by members of the community, with no input from the outside. Based on the empirical findings we expand on multiple positions within the theoretical space of design-in-use and intrinsic practice transformation mediated by technology and conclude with a more multi-faceted understanding of the shaping of technology in volunteer-based communities.

Author Keywords

Community artifact ecology; infrastructuring; intrinsic practice transformation; intrinsic design; design-in-use; strategies; tactics; volunteerism.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

INTRODUCTION

Information Technology is an integrated part of community work and organisation. As everyday coordination and communication in urban and local communities move onto online platforms, these communities adopt and appropriate existing technologies to support and manage their practices. We have previously characterised the collection of tools and technologies a community owns, has access to, and uses to support their practices as a community artifact ecology [4]. Making the community artifact ecology work is a challenge as volunteer-based communities operate with few economic and human resources, often disproportionately distributed and dependent on when and how members can contribute (e.g. [14]). As a result, they tend to favour free or readily available technologies, and often need to combine existing technologies, adapt or develop new tools, or become dependent on technology adept members. As a consequence the process of making the community ecology work can be characterised as complex, combining happenstance, with strategic community efforts and everyday appropriation and tinkering. This is the frame wherein we position our research questions: How does a volunteer-based community develop their community artifact ecology throughout their life-cycle? What is the role of community meetings and everyday appropriations in shaping technology? And, how does this unfold as a continuous interplay between happenstance, strategies and tactics? In an effort to address these questions we have followed a volunteer-based organic food community in Aarhus, Denmark, from 2014 to 2016.

Whereas our previous work has focused on understanding the community artifact ecology and the interplay between the development of a community and the tools they use, this work confronts empirical findings with several frameworks that address the relationship between design and appropriation/design-in-use: Dourish's [8] adaptation of De Certeau's [6] notion of strategies and tactics in relation to design, Wulf & Pipek's [17] points of infrastructure, and Kaptelinin & Bannon's [12] intrinsic versus extrinsic practice transformation. Based on our analysis of the empirical material, we point out that a richer set of concepts and understanding is needed to fully appreciate the variety of design-in-use happening in this complex setting, where volunteering work over a long time-frame is inter-woven with decisions about adoption and appropriation of technology. The contribution of this paper is a) a detailed examination of how a community develops its community artifact ecology, b) to identify the role of community decisions on technology, c) the various everyday tactics employed to make the community artifact ecology work, and d) to expand on existing understandings of how technology development at large unfolds in volunteer-based communities around points of infrastruc-

NordiCHI '16, October 23 - 27, 2016, Gothenburg, Sweden

ACM 978-1-4503-4763-1/16/10...$15.00
DOI: http://dx.doi.org/10.1145/2971485.2971564

ture, in particular the model proposed by Wulf & Pipek [17, p.458] and the concepts discussed by Kaptelinin & Bannon [12].

BACKGROUND AND RELATED WORK

In the following we reiterate previous conceptual and theoretical work on community artifact ecology and present the primary frameworks on intrinsic practice transformation and appropriation and design-in-use. We will return to this after analysing the empirical findings and position the implications of our findings.

Community Artifact Ecology

A community artifact ecology is the particular constellation of artifacts that a community owns, has access to and uses in its activities [4]. This concept draws on work on personal artifact ecologies [11, 3], i.e. artifacts that an individual uses and owns, and information and cultural ecologies [16, 1], i.e. place-specific constellations of (information) artifacts belonging to and/or available within a particular context. Artifact ecologies are dynamic and change over time – individuals learn new tools through peers and practices. Practices and places change in terms of the information resources and technologies available [3].

In previous work [4] we found that a specific community artifact ecology originate from multiple overlapping ecologies, e.g. the artifacts that individuals bring into the community, inspiration from other communities, what is available in the community space and dictated by resource constraints etc. When a community is founded and/or decides on the specific tools the community will use these to support their practices (e.g. common social media platform, web-applications, shared repositories, a website etc.), the tools and knowledge thereof originate within the personal ecology of the deciding members, similar communities and/or general tools, e.g. a credit card terminal. The artifacts belong to the community, e.g. in ownership or as embedded in their practices, and the artifacts are 'somewhere' – in a shared community space, virtual and physical. This process is ongoing as new tools are introduced, as the community and its practice changes, and as new members move from the periphery into the core activities. Although new tools are introduced into the ecology over time, the older artifacts tend to linger. These lingering tools are due to a dependency (actual, or a familiarity) by members for specific activities, and the difficulty of consolidating the disparate tools and (critical) information hosted or embedded within these. The result is a community artifact ecology with a complex genealogy and multiple overlapping ecologies, activated as part of particular community activities (events, accounting, managing members, communication etc.).

Intrinsic Practice Transformation and Community Design

In design and adoption of information technology, Kaptelinin & Bannon (see [12, fig. 4]) distinguish between extrinsic and intrinsic practice transformation. Extrinsic practice transformation is primarily performed from the outside and is driven by designers. By contrast intrinsic practice transformation is initiated by users, is continuous, directly relates to the practices and activities at hand, and results in idiosyncratic designs. Intrinsic is driven by needs of the users, or an imbalance between the current setup's capabilities and the users' needs/wants. Intrinsic and extrinsic are not mutually exclusive, and, as we shall see, can be interpreted as a continuum. In the vocabulary of Kaptelinin & Bannon, extrinsic is closely linked to the process of user-centred design and iteratively moving through and analysing the existing practice with the aim of developing and introducing an artifact that will transform this practice (at a later state). Intrinsic practice transformation, then, is more akin to design-in-use and appropriation where people are *"more concerned about how to use all available resources, including interactive technologies [. . .] to further develop their practices and improve their environments."* [12, p.287]. Dourish [8] offers a related perspective in his adaptation of De Certeau's [6] concept of spatial strategies and tactics, stating that *"strategic practices are the practices of design, whereas tactical practices are the practices of use."* [8, p.302].

Design-in-use and Infrastructuring

As community activities and practices stabilise, and in particular when the community is anchored in a shared physical space, its community artifact ecology can be characterised as an infrastructure and the dynamic aspects of the community artifact ecology as infrastructuring [19, 21]. However, the dynamic, disparate, and evolving character of the community artifact ecology is far from artful, and as we shall see, not envisioned as the primary object of work or design, although taking up considerable community attention.

Nonetheless, research on infrastructuring provides a useful anchor for analyzing the dynamics of the community artifact ecology. Pipek & Wulf [17] present the *point of infrastructure* as the point in time where general development and specific design processes meet use (and development in use). To them, tailoring is the technical development, and appropriation the practice development that happens in use, after the point of infrastructure. Before that lies both general technological and organizational development, and specific design projects.

Henderson & Kyng [10] referred to *continuous design in use* to address the expansion of design into the realm of use. Design-in-use refers to design activities that happen after professional or preparational design activities have taken place and after a designed artifact has been deployed into use [7], or *intrinsically* as per Kaptelinin & Bannon [12]. Design-in-use can be understood as an umbrella concept that includes activities such as appropriation, tailoring, and adaptation, a familiar topic in Human-Computer Interaction (HCI) and related areas. The traditions of tailoring and end-user development have a long record of studying both how users pick-up and use/reuse technologies built by others, how technologies may be build to support such development, and the roles and competencies of various groups of people.

Happenstance, Strategies and Tactics

Instead of concluding that extrinsic practice transformation are strategies and intrinsic practice transformation is tactics, or that infrastructuring is a solely strategic endeavour, a matter of planning and deciding, we summarise by outlining simple distinctions that are analytically useful in the present case.

Happenstance encompasses not only events and circumstances related to the potential and particular community artifact ecology, but also the external and internal conditions under which it is stabilised around points of infrastructure. In their early studies of tailoring and use of CAD, Gant & Nardi talked about gurus and gardeners as roles that emerge during design-in-use [9], and McLean et al. about how the tailors (or tinkerers) live on the plains of competencies in tailoring [15]. In that light, happenstance include the people who happen to be there and take on the work to make the community work and define the role multiple technologies play – implicitly through activities or explicitly through community decisions.

Strategies are design activities intrinsic to the practices of the community, that are directed at, but momentarily detached from the activities at hand. Strategies are the design activities that a community engages in collectively in more formal community meetings when discussing issues, concerns and future needs. By contrast, tactics are situated activities attempting to deal with happenstance as well as changes occurring in everyday community practices. Both encompass *articulation work* [20, 18]: The secondary activities needed to divide, allocate, coordinate, schedule, mesh, and interrelate work activities. Although articulation work occurs both in situated activities and related community meetings, it is a useful concept to understand the role of community meetings in relation to community design of technology as strategies. Tactics are closely related to the everyday activities, and as Dourish points out, a way of reacting to plans and designs, made outside the immediate situation.

In relation to the work presented here, it becomes interesting to understand how appropriation and design-in-use happens in artifact ecologies at large (see also [2, 3]), and in community artifact ecologies in particular, as a complex combination of happenstance, strategies and tactics.

CASE STUDY: AARHUS ORGANIC FOOD COMMUNITY

Aarhus Organic Food Community (AOFF) is a local organic food community active in the city of Aarhus, Denmark. It was founded by two women who wanted to have alternative and cheaper access to local organic food. They initiated the community in late 2010 and were inspired by the practices of a organic food community established in Copenhagen. The main activities of the community consists of ordering vegetables and eggs on behalf of their members from two local farmers. Members cannot choose what vegetables they will get, but instead place orders for receiving a bag of vegetables. The selection of the bag content is done by members of the purchasing group, who decide what can be covered by the fixed bag price for all members. The farmers then deliver their goods each Thursday to a local community center where the community distribute the goods. Some members volunteer for the packing shift to make goods available for all members to both pick up and place new orders. Since early 2016 the community has introduced a web shop on their new website where it is also possible for members to order their bags online beforehand.

Period	Function	Artifacts
c.2011	Communication	AOFF.dk (v1), Facebook, Email
–	Organisation	Wikispaces, Google Drive
c.2013	Thursdays	
c.2013	Communication	Facebook, Twitter, Instagram, MailChimp
–	Organisation	AOFF.dk (v2), Google Drive, Google Mail
c.2015	Thursdays	Community Laptop, Google Drive, WiFI, Credit Card Terminal
c.2015	Communication	Facebook, Twitter, Instagram
–	Organisation	AOFF.dk (v3), Google Drive
c.2016	Thursdays	Community Laptop, WiFi, Swipp, Mobile Pay, AOFF.dk (v3)

Table 1. AOFF's Community Artifact Ecology in different stages [4].

AOFF is also a legal entity in the form of a registered association which requires a board, by-laws and a yearly general assembly. The community is highly organized with their board plus seven working groups who managing the community, arranging events, coordinating with authorities (permits and hygiene inspection), buying and coordinating with the local farmers, and then selling and distributing the organic food goods to the ordinary members of the community. The board and the working groups represent a stable core membership base of approx. 40 volunteers, while the wider community consists of approx. 900 registered members. They pay a fee upon joining the community and are required to volunteer for three hours each month, coordinated through a scheduling tool on the community website. The community organization is open to all members, with weekly meetings in the working groups, monthly community meetings and an annual general assembly. AOFF emphasise that every decision should be made democratically. Issues and decisions are presented to the community in agendas distributed to all members beforehand and minutes are shared in the members section of the website.

In [4] we describe and discuss the technologies deployed over time by the community, in what we term the community artifact ecology. Three stages were identified where different members of the community and its board have been instrumental in activating (introducing, tailoring and 'hacking') various technologies that were brought in from elsewhere. We report on the technologies in table 1, divided into three stages. The first stage refers to the initial steps in shaping the community and its artifact ecology; the second stage refers to the everyday community work, once the community was established, and the kind of everyday appropriations that took place; and the final stage is the vision of the future and the steps taken to overcome frustrations.

METHODOLOGY AND DATA

We have followed AOFF activities since autumn 2014, when one of the researchers joined the community. Since then, we have engaged in participant observations, interviews, and

Name	Role(s)	Membership	Length
Laura	Founder work group and board member	2010 – 2014	01:07:05
Karen	Work group and board member	2012 – now	01:09:48
Nadia	Work group and board member	2011 – now	00:48:31 (01:09:48 follow up)
Robert	Work group and board member contact to authorities	2011 – now	00:54:48
Paul	Work group member web developer	2011 (active 2012) – now	01:02:19
Christine	Work group member web support	2013 – now	00:54:11

Table 2. Interviews and respondents role within the community

content analysis of online material produced by the community. For this study, we utilise data from the minutes of community meetings (kollektiv møder)(N=56 between 2011 and March 2016), as reported in the members' section of the community website, and a series of interviews conducted between 2014 and 2016 with six core members of the community, who had some involvement in technology-related decisions or activities (see table 2). The interviews were semi-structured, transcribed and analysed through meaning-condensation [13]. The key identified events and relations from the interviews was subsequently compared to the events and details captured in the meeting minutes.

We were granted permission by the board members to use data from the minutes, as long as we render our reports anonymously, make no direct citations, and do not openly refer to specific personal conflicts if such were reported in the minutes. In cases where dates and chronological events are described inconsistently in the interviews, the meeting minutes are considered authoritative.

To underline the empirical grounding we report the results separately before extending the findings with our analysis in the following sections. We draw on multiple theoretical constructs to drive our analysis: strategies and tactics help to frame three example technology-specific processes and identify the role of happenstance; points of infrastructure provide a frame to denote aspects of these technology-specific processes, presented concurrently along a timeline; and, the distinction between extrinsic and intrinsic design is explored in contrast with the roles and actions of community members.

RESULTS

We present the results of our empirical investigation in the following two subsections, creating a distinction between the types of activities that relate 1) to community decisions on technology, often undertaken through a formal process embedded in their democratic decision-making mechanisms, and 2) to everyday tailoring and appropriation operations, which take place in different situations and depend on the technological skills of those undertaking them. The community decisions presented are primarily informed by the community meeting minutes and supported by our qualitative interviews, whereas the everyday actions are based solely on the interviews.

Community Decisions on Technology

As soon as AOFF became an organised association they discussed, in their community meetings, the tools and technologies they use, need and envision. The minutes of meetings show a steady use of updates, feature requests for the community website, additional tools, and reactions to changes. The first meeting began with an update on the initial design of the first community website, and the last reviewed meeting minutes fittingly announce the newest version of the website (their second website), which includes a webshop feature. Decisions on key aspects of the community artifact ecology are evident throughout the minutes and important decisions on payment, design and features have been debated and voted on at the community meetings. When put on the agenda, each proposition is dealt with and discussed toward some form of outcome, a decision or rejection of the proposal.

Suggestions and Features

Throughout the last 5 years of community meetings we see multiple instances of leading community members suggesting features and additions to the website and other aspects of the artifact ecology. These vary from proposing the procurement of a community laptop, a desire for accounting software, to various changes to the website's features and content. As early as 2011 the community discussed online ordering and payment via the community website features. Later, features such as shift reminders, an online news feed, and enabling online member sign-ups were suggested. Some of these suggestions never materialised, others have later become part of the community artifact ecology without being further mentioned at the meeting, and finally some resulted in longer investigations leading to formal decisions made at later community meetings. For example, in 2014 during a meeting, there was discussion regarding procurement of a laptop for the community space, and later we learned from the interviews that a member subsequently donated her old laptop. When it comes to proposing features, which seems a recurring element at the community meetings, some are forwarded to the member acting as web-developer, while others are rejected, often based on existing initiatives, e.g. not adopting a new payment model while in the process of examining webshop functionality. One of the major frustrations regarding feature implementation, as came through in the interviews, was that the member who actually implemented their first website, later became less and less interested in the community, to the point of being unavailable for updates and maintenance.

Initiating Processes

A second function of the community meetings in relation to technology and formulating strategies is initiating processes. Although slow progress is a fundamental constraint in a volunteer-based community with few resources, the discussions at the community meetings indicate a careful position related to larger decisions. For instance, adopting, and later changing, the options for accepting payment was initiated as a lengthy process where a member acting as their main accountant examined the costs and options. This was done in three different phases: 1) as part of the initial explorations of the possibility of a webshop (2011), 2) as part of choosing

between credit card payments and competing mobile technologies, and 3) as part of the much later introduction of the webshop in 2016. Similarly, the community was invited to participate in applying for funds for a national IT platform for food communities, an initiative discussed in 5 meetings spanning 10 months. The community agreed to participate in the funding application, and later in the process of developing a national IT platform for food communities[1].

Making Decisions

At the community meetings the participants make decisions affecting the community artifact ecology. In some instances this is visible as updates on the feature suggestions and the initiated process outline above, in other cases it is a result of a specific discussion raised within a shorter time frame. When the community was formed they decided to use a wiki as the primary community platform. Later, when presented with an opportunity to have their own website, their needs evolved, and they decided to close the wiki and use the newly developed website as the community platform.

Throughout the lifespan of the community there were several options to accept payment in the community space, e.g. cash, credit card and lately different mobile solutions. In mid 2015 they made a decision on a specific payment solution for the webshop and in 2016 they decided to cancel the on-site credit card payment. From the minutes we have seen how these decisions are informed partly by the increased cost of maintaining the credit card option and the changes in available payment technologies since 2011. The community makes collective decisions regarding investments in technology and associated costs. The aforementioned decision on payment options and ongoing costs of hosting the website are all part of the budget and the community annual meeting, where the budget is approved by members. Similarly, when they needed to pay a member to develop their second website (2015), it was decided at an extraordinary community assembly.

Change and Uncertainty

As the development of the online payment and website slowly became a recurring topic at the community meetings, we see frequent updates on the status of the development or recognition that someone should contact the web-developer or responsible member. Frequent delays of work on the different iterations of the website were announced during the meetings, without community members initiating further investigation (as reflected in the minutes). When they moved away from the first website toward initiating a redevelopment process with a new web-developer, this appears abruptly in the meeting minutes. In October 2011 there is discussion of the status of the website and how they are in the midst of transferring multiple documents, and in November 2011 they propose the adoption of a new CMS system and transferring responsibility to a new developer, as the development of the initial website had been at a standstill for "some time" (this took about 18 months before the idea of fixing the first website was eventually abandoned). Although they made plans and discussed specific features repeatedly (webshop, online payment, member management), they also had to respond to changing circumstances, e.g. core participants' lack of time to invest or even changes in technology.

To summarize, community decisions on technology are often undertaken through a formal process embedded in the democratic decision-making mechanisms adopted by the community/association. Though formal, and on the surface somewhat rigid, it is also happening in an ongoing struggle with uncertainty and change in both available technologies and human participants.

Everyday Tailoring and Appropriation Practices

While many of the decisions related to technology are taken following a lengthy process and through the democratic design making mechanisms adopted by the community, we also find instances of everyday tailoring and appropriation. These are initiated and undertaken by a variety of community members in order to keep the core community activities running, despite breakdowns or happenstance. In the following, we identify hacks, substitutions and workarounds, rejections, and on-the-spot and in-time maintenance activities as examples of the kind of everyday situated actions when members *"have to be kind of creative to make things work"* (Paul).

Hacks

The fact that the first website was hosted on a server owned by the volunteer member who created the website, and the fact that this member eventually lost interested in the community, led to frustrations and resorting to hacks and workarounds. For example, in order to get a calendar on the first website, Paul, the member who later went on to develop the second website, *"went into the database and put in an iframe as a content element... that's not done through the CMS at all, that's just some injected some SQL, into the database, which cause the calendar feature [...] but I mean, that's what we had, that's what we could do, it's the only possibility"* (Paul).

Paul also adapted the credit card terminal that the community came to use for a certain period of time. The community did not have access to the Internet via an Ethernet connection in the community space they were using. The problem regarded access to an Internet connection for the credit card terminal, whose model required an Ethernet plug. This was fixed by Paul hacking the community laptop in such a way that it would provide the existing WiFi connection to the credit card terminal, using the LAN-port of the laptop.

Substitutions and Workarounds

The same frustration emerging from the inaccessibility of the first website led some members to take matters in their own hands, and substitute existing website-dependent solutions to more flexible ones, which did not require significant technical know-how, but was based on experience with particular tools. For example, one member, Karen, decided to create a Google mail account for the working group she was a member of, as nothing could be done to fix the problems with the mail list associated with the community website.

[1] eggplant.dk

Rejections

Rejecting the use of a particular tool is part of appropriation (see also [5]). It occurs when the tool does not automatically answer the needs of the users and the skills and knowledge of those handling it are insufficient for any form of adaptation, such as hacking or workarounds. For example, when the founding members started the community, they took the example of the Copenhagen organic food community and set up a wiki as their main online tool for communication and information. However, as they became familiar with the wiki, leading community members eventually decided against its use. According to a founding member, the wiki had usability issues and – in their understanding of the possibilities it offers – only allowed for public information to be posted, and did not support having a separate members-only section. Paul reported a different example: As members could not add documents to the first website, some of the working groups stopped writing their minutes of meetings all together. This affected the practice of keeping records of community activities and work, and created gaps in the community's archives.

These two examples of rejections have triggered design decisions regarding new systems. In the case of the first website, it was clear that it should offer what the wiki did not, which required a more user-friendly interface and a members-only section for internal information. In the case of the second website, Paul deliberately considered the writing of meeting minutes in his design decision: *"... the new system basically would sit and, it's going to be [an] adaptive layout, so you can sit with a tablet or your laptop and take notes on the website basically, and they will be saved and catalogued between the different groups..."* (Paul).

Maintenance

The inability to maintain the first website led to some of the hacks, substitutions and workarounds mentioned above. It also led to the strategic decision to create an entirely new website. However, as this new website was adopted in late 2015 and its online webshop was activate in early 2016, the question of who would maintain it was not completely solved. Paul, the member who had developed the second website, was clear that he did not have time to maintain it himself. The board thus placed an ad on their mailing list, Facebook group, and the new website to ask for volunteers to maintain the new website. One volunteer, a web content designer by occupation, answered. She was interested in doing the work because she was already familiar with Drupal, even though her experience with it was limited to using it for managing content. Being mostly on her own and with limited proficiency with Drupal, she has to come up with ways of dealing with the problems at hand, often as they arise. This involves *"mimic[ing] what has already been done, and when it doesn't work then you are like 'what should I do then?', also because Im the one with the head responsibility."* (Christine). She also attempts to maintain contact, where possible, with others who might help, such as Paul (when he can be reached), the chairman of the association (who also has administrator access but no particular technical knowledge), and a member of a similar community from another town who implemented the webshop feature now in use by the AOFF website. Christine mentioned putting in around 10 hours a month on the maintenance work, which is much more than is expected of a normal member (3 hours). The time dedicated to maintaining the website had not been discussed prior to her involvement, nor did she know what to expect. However, one of the tenets of the community is that members would do as much work as they like and that no one should be forced.

The Formal and the Everyday

The above sections document the variety of ways through which the community comes to shape its artifact ecology. Our empirical research has looked at how this shaping happens: on the one hand in the context where formal decisions are made as part of the community's democratic mechanisms that rely on a flat hierarchy and consensus seeking in community meetings, and on the other hand through everyday tailoring and appropriation practices. In the following we look deeper at the ways these different activities are linked to each other, and across boundaries.

HAPPENSTANCE, STRATEGIES AND TACTICS

To understand how the community artifact ecology is shaped through a mix of events, community decisions and everyday appropriation practices, we examine the process and dynamic relationship around salient instances of changes occurring in the empirical findings. We return here to the notion of strategies and tactics, and examine three technology-specific processes where strategies and tactics interweave, which leads to a momentarily stable situation for one or more elements of the artifact ecology. Each of the instances are illustrated (figures 1,2,3) to show the relationship between strategies (top) and tactics (bottom), internal (black) and external events (white), and their direct (line) and indirect (dashed) relations. Direct relations are active consequences of decisions and events, whereas the indirect relationship are influences and indirect consequences.

From Wiki to Website(s)

Moving from using a community wiki to a community website stands out as an important point in developing the community artifact ecology. Throughout the first two years the community moved from using a community wiki adopted from a sibling-community, to engaging in design activities and developing their own community website. The wiki created and used from the beginning (a) (Figure 1), was later abandoned because they found the wiki model to be inconsistent with some of their needs. In particular the need to separate the wiki between a public section and internal private section that could service community tasks (b). In the same period, the community was contacted by a web-developer who offered to help them develop a community website (c). Thus, their perceived insufficiencies of the wiki coupled with the external offer created the foundation for a strategic decision to develop a dedicated website for the community (d), and later, when released (e), to start using it to support the community activities. Once in use, we see from the community meetings a steady flow of suggested features and a decision on developing a second iteration of the website together with the web-developer (f). However, the development and update

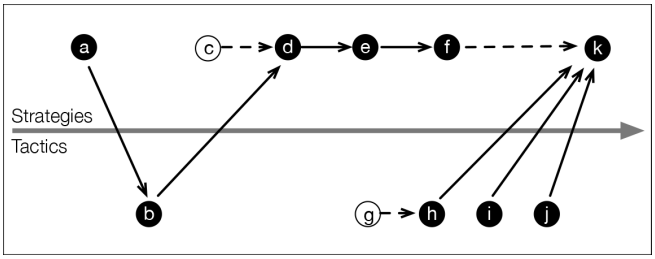

Figure 1. From wiki to website(s) process map (details in text).

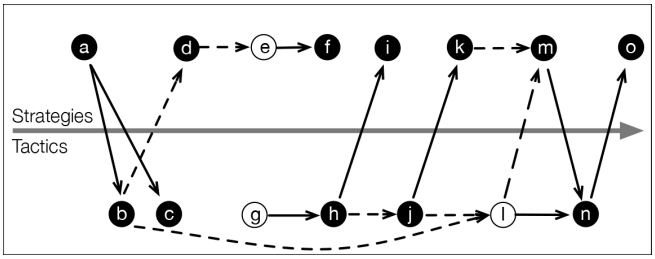

Figure 2. From website to webshop process map (details in text).

of the website happened slowly and lasted around 18 months before it was eventually abandoned (g).

Meanwhile, community members employed different tactics to compensate for the lacking features, e.g. hacking the database (h), adopting another mailing list (i) or stopping the use of the website for meeting minutes, and for some working groups even stopping the practice of writing and archiving minutes of meetings (j). The main reason for abandoning further developments for the website and resorting to tactical operations was the fact that the initial web-developer became less and less involved with AOFF around 2011 and 2012, resulting in minimal development, slow communication and lack of access to the basic configuration on the backend, forcing the community to "invent" alternatives around the website. Frustration with efforts to deal with the situation led to the community deciding to pay Paul, a member and also a web-developer, to develop a new website (k).

From Website to Webshop

The decision to abandon the first website and the ongoing process of updating it with new features was effectively decided at a community meeting (a) (Figure 2). The new developer made two key decisions: to base the new website on Drupal (the previous website was Joomla-based), and to adapt a component from the website of an organic food community from another town (b) and initiate a process where key members were involved in identifying, prioritising and helping with the list of features (c). "Importing" elements from a similar website were proposed as a way of keeping the code and website components more open (source) and potentially allow others to make use of the developed features.

In April 2014 the community was approached by a national network of food communities about applying for funding for the development of a general IT platform for such communities (e). AOFF decided to participate (f), possibly influenced by the experiences with existing modules from other food communities (b) and ambitions toward contributing broader by making their own components broader available (d).

In October 2014 the web-developer realised how time consuming the task of creating the new website was and needed to prioritize other tasks outside his volunteering work (g). This lead him to suggest that the community would compensate him for his time by paying for the remaining development to ensure that he could prioritise this (h). This was approved in a general assembly in late 2014 (i). Later, the developer suggested launching the new website without the online shop (j), which was hesitantly approved by the community (k). At the same time the community they had taken inspiration earlier in the development process (b) released a beta version of their webshop (l). Getting the website almost done and ensuring delivery, and the possibility of adapting an existing component, motivated the community to begin recruiting for a new person to take charge of maintaining the website (m), and adapting the webshop module for their own website with the aid of the developer from the other community (n). The previous influence from the development process of the other community (b) seem to have motivated a subsequently adopting a webshop component developed by the same community (l). Early 2016 the community was able to announce that the anticipated webshop feature was finally ready (o).

From Cash to Mobile Payment

Our final example of the way in which these strategies and tactics map to the events and decisions of the community regards their support of different payment options (Figure 3). Managing payment often requires technical solutions to track expenditure and handle the ordering of stock. Initially the community only accepted cash, but recognised the need to provide more flexible options to their members. As early as July 2011 we see discussions in the meeting minutes that led to a desire to support multiple ordering methods, both online and at the physical location (a). It was however, not until September 2013 before the decision to acquire a credit card terminal was made. After a process of getting approvals from the relevant financial authorities, the device was acquired in May 2014 (b).

The terminal that was part of this procurement required a cabled Internet connection, where the onsite location only provided wifi. Concurrent to this process a laptop had been donated by Nadia to the community to be used on site to assist with the logistics of signing up for shifts, ordering food and checking membership IDs (c). Paul was able to hack this donated laptop, where he configured it as a wireless access point for the credit card terminal (d). A year later in April of 2015, it became clear that the ongoing costs of the credit card terminal were too much for the community. While they could have reverted to the previous payment option of cash only, they recognised the need to support multiple forms for the convenience of their members (e). In addition, Denmark in general saw the release and success of mobile payment services (f). After investigating other payment options (g), they decided in May 2015 to make use of a mobile payment service. The credit card service was eventually ended late 2015, when the mobile payment facilities became active (h).

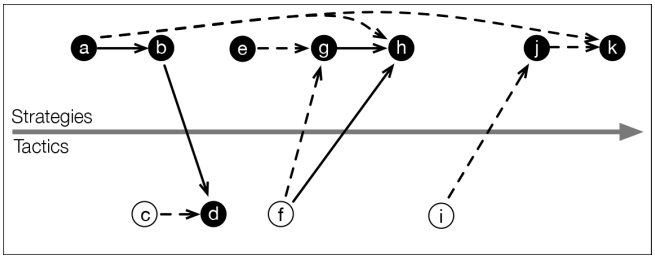

Figure 3. From cash to mobile payment process map (details in text).

Paul joined the team, and the community's website was redesigned and developed (with the intention of providing online shopping facilities, but initially released without). (i) and (j) represent approximations of this process from Paul joining to the initial release of the new website, described above in the *From Website to Webshop* section. This continued and eventually in March 2016, a webshop, with online ordering that supports some credit card providers, was released (k). In an interview with the current technology support volunteer at AOFF, he indicated that there are ongoing discussions regarding the available payment options, and that there is some desire in the community to make payment accessible as convenience to existing members.

INFRASTRUCTURING WORK IN AND AROUND THE COMMUNITY ARTIFACT ECOLOGY

We have shown in the previous section how strategies and tactics interweave in the way the community shapes its artifact ecology. Our analysis now takes a step back from the three technology-specific instances above and presents them together as part of a broader timeline of our research with AOFF's 'work to make its community artifact ecology work' (Figure 4). In creating this timeline we draw on Pipek & Wulfs [17] mapping of infrastructuring work and its different layers, and in particular at the way they indicate *points of infrastructure* as being those points in time where design meets use. The convergence of solid lines of figure 4 to a literal point represents identified points of infrastructure over time. The divergence after a point of infrastructure corresponds to the use and appropriation.

In the case of a volunteer-based community like the AOFF, we find multiple points of infrastructure that emerge out of combinations of strategic decisions and tactical tailoring and appropriations. Different to Pipek and Wulf's model, our case shows that the situation that occurs in the lead up to, and beyond a point of infrastructure, is not necessarily only that of receiving input, e.g. from infrastructural background work and preparation work, then having design-in-use activities following a straight line towards some resolution associated to the technology in question. This indicates that a point of infrastructure influences further discussion within the community and new emergent needs. A point of infrastructure shapes the ongoing process toward future points of infrastructure, with infrastructuring work dynamically unfolding over time. We have illustrated these influential circumstances in figure 4 with the dashed lines.

In Figure 4 (top), we first look at the infrastructuring work associated with AOFF's web presence. There, (1) represents a clear point of infrastructure as it denotes the moment when the first website is put into use. (2) is not an infrastructure point as per Pipek and Wulfs definition, but rather represents the eventual breakdown of infrastructure as there are plans and designs by the initial volunteer web developer which lead to (3). This represents a turning point - an abandoning of the iterative design of the first website as the initial volunteer web developer ceases involvement with the community (where there is a closure of the dashed lines), and Paul (having been involved in hacks and workarounds until this point) begins to lead a design process towards a new website (indicated by the new dashed lines that lead toward the next point of infrastructure). (4) is then again clearly a point of infrastructure, marking the deployment and initial use of the second website, albeit without the on-line payment feature. The launch of the on-line payment via webshop instead consolidates the next point of infrastructure, (5).

With regard to the decisions and appropriation of payment methods, we start with (6) of Figure 4 (bottom), which indicates the consolidation of practices associated with ordering and paying by cash on Thursday afternoons. Beyond this point is a period of debate and discussions in community meetings that culminate in a decision at (7) to take specific action towards obtaining a credit card terminal. This leads to (8), when the credit card terminal has been acquired and becomes part of their practice. (9) represents the growing concern about the cost of the credit card terminal, as well as the increasing availability of mobile payment services in Denmark. (10) represents a point of infrastructure where the mobile pay service becomes active and (11) denotes a point of infrastructure where a new release of the website (as per (5)), but from the perspective of the on-line payment system becoming available.

Our use of infrastructuring theory here has highlighted some of the complexities and nuances of how each point of infrastructure contributes to the next, and how the processes of making the community artifact ecology work is ongoing.

INTRINSIC DESIGN

The concept of infrastructuring makes it possible to explore the blurred boundaries between design and use. In the following, we return to Kaptelinin & Bannon's [12] work to examine in more detail the nature of the design work that we have observed within the AOFF community. Kaptelinin & Bannon [12] make a clear division between extrinsic (user-center design – UCD – based and introduced by an external designer) and intrinsic technology-enabled practice transformations (introduced and accomplished by 'users'). When examining these concepts in the case of AOFF, we can say that technology practice transformation there was mainly induced from the "inside", with no UCD or any other professional design influence. However, we have seen aspects of UCD-like activities, from the inside, with Paul attempting to engage others at a certain point of the design process of the new website. He organised workshops and invited interaction via a project management tool. However, this UCD-like intrin-

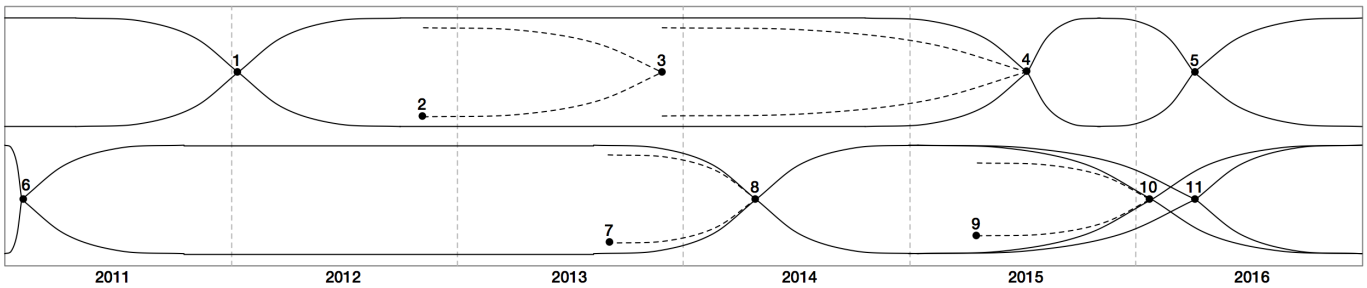

Figure 4. Overview of the community life-cycle and key infrastructure points. (Top) illustrating the processes related to the wiki, website and webshop, (bottom) illustrating the process related to the payment methods.

sic practice transformation did not require any of the traditional UCD phases of the designers having to get to know the communities and their practices, because Paul, as a community member, already had this intrinsic knowledge. Additionally, our case shows that some of the attributes of intrinsic technology-enabled practice that Kaptelinin & Bannon [12] present in opposition to extrinsic (p 286, Figure 4) are not so rigidly set if we look at intrinsic technology-enabled practices from within (so not in opposition to extrinsic ones).

For example, we may benefit from a finer grained terminology than Kaptelinin & Bannon's [12] 'designers' (extrinsic) and 'users' (intrinsic). We have community members, such as Paul, clearly and explicitly acting as a designer engaging in intrinsic technology-enabled practice transformation. We also have board members, and in fact any AOFF members taking part in community meetings and expressing opinions and voting on the adoption of a particular technology, thereby also engaging in intrinsic technology-enabled practice transformation.

Kaptelinin & Bannon [12] also refer to extrinsic technology-enabled practice transformation as being discontinuous, in contrast to the intrinsic being continuous. We have shown however that continuity is not always a given in intrinsic practice transformation. For example the decision of stopping the use of credit cards as a payment option on Thursdays ((h) in Figure 3) has brought discontinuity to certain purchasing and payment practices in the community. Finally, Kaptelinin & Bannon [12] emphasize generic designs in extrinsic practice transformation versus idiosyncratic designs in intrinsic ones. In the current study, the picture is not as simple: While Paul works intrinsically, he aims for general and generic solutions that can be useful to other communities, just like he and AOFF have benefited from the webshop feature of the organic food community of another town.

DISCUSSION: BEYOND DESIGN AND DESIGN-IN-USE

The fact that the study has focused on one particular community may be seen as a limitation, but on the other hand this choice of focus on a single community reflects the way this community sees itself. Despite the strong inspiration from and knowledge exchange with from similar communities, its members are very much aware of the specifics that make this community what it is: a combination of being local and of developing place-specific practices that fit the needs that emerge out of the local setting. Moreover, the very nature of volunteer work might be about idiosyncrasies that are perhaps more prevalent when participation is not driven by an employment contract but rather by an intrinsic motivation to do something because it benefits the community. This leads to a question to the HCI community: how do we account for this type intrinsic design related activities (whether of democratic decision-making, or of design proper or design-in-use in whatever form) that also induces change in practice?

Notions of design and design-in-use (which includes e.g. tailoring and appropriation, among other activities) seem different in the context of volunteer-based communities than e.g. in project-based work settings. In the latter, choosing, designing, and adapting technologies, are organised and happen around such organisational constructs as milestones, deadlines, and deliverables (see e.g. [17]), whereas in volunteer-based communities, such as AOFF, they happen to the best one can make them work, depending on interest and availability of people, on resources etc. Additionally, the shaping of artifact ecologies goes beyond notions of design and design-in-use in general, with democratic decision-making regarding technology, which is apparent in the AOFF case through their own practices in community meetings, playing a crucial role. Here, and contrary to traditional top-down management practices in organisations, decisions regarding technology are embedded in a setting driven by democratic practices. However, this also does not happen seamlessly, as decisions related to technology also require a certain level of skills and understanding of technical possibilities[15]. This means that many decisions are left to those who 'understand' better and have the necessary skills and experience. The difference and the challenge with information technologies are issues such as the need to maintain them over time, especially as the practices and people in the community change. The lack of access to maintenance is what killed AOFF's first website. It is still unclear how they will respond to their current maintenance challenges. How can volunteer-based communities account better for maintenance challenges? How could it be provided and what is the role of HCI?

CONCLUSIONS

In this paper we have shown how a volunteer-based community develops its community artifact ecology through a process mixing external circumstance (their *happenstance*), community strategies, and everyday tailoring and appropriation tactics. Most of the community strategies seem to have emerged through formal community meetings, where all those taking part have contributed to taking decisions.

The tailoring and appropriation practices are tactics that have taken shape as results of unsatisfactory situations, using the set of skills of those involved. The interplay between happenstance, strategies and tactics as related to technological development unfolds throughout the lifespan of the community, around points of infrastructure, with things taking shape 'as they come', depending on the resources at hand and the people volunteering at a particular time, and whether these volunteers possess the skills and knowledge necessary to operate with technology at the required levels. Many of these activities can be understood as intrinsic design ones, undertaken by members of the community without interference from the exterior. Our study contributes to a more multifaceted understanding of the shaping of technology in the context of volunteer-based communities; A context, inviting the HCI community to look further into places where 'in house' and local design activities unfold, providing new insight on the interplay between design and use beyond the contexts of the home or workplace.

ACKNOWLEDGMENTS

We would like to thank AOFF for allowing us to conduct our study. This research is funded by the Centre for Participatory IT at Aarhus University.

REFERENCES

1. Bell, G. Making sense of museums: The museum as 'cultural ecology'. *Intel Labs 1* (2002).
2. Bødker, S., and Christiansen, E. Poetry in motion: appropriation of the world of apps. In *Proceedings of the 30th European conference on cognitive ergonomics*, ACM (2012), 78–84.
3. Bødker, S., and Klokmose, C. N. Dynamics in artifact ecologies. In *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design*, ACM (2012), 448–457.
4. Bødker, S., Korsgaard, H., and Saad-Sulonen, J. 'A farmer, a place and at least 20 members': The development of artifact ecologies in volunteer-based communities. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing*, CSCW '16, ACM (New York, NY, USA, 2016), 1142–1156.
5. Bødker, S., and Polli, A. M. Between initial familiarity and future use: A case of collocated collaborative writing. In *COOP 2014 - Proceedings of the 11th International Conference on the Design of Cooperative Systems, 27-30 May 2014, Nice (France)*, Springer International Publishing (Cham, 2014), 137–154.
6. Certeau, M. *The Practice of Everyday Life/Michel de Certeau; translated by Steven Rendall*. Berkeley: University of California Press, 1984.
7. Dittrich, Y., Eriksén, S., and Hansson, C. Pd in the wild; evolving practices of design in use. In *Participatory Design Conference*, CPRS (Computer Professionals for Social Responsibility) (2002).
8. Dourish, P. Re-space-ing place: "place" and "space" ten years on. In *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work*, CSCW '06, ACM (New York, NY, USA, 2006), 299–308.
9. Gantt, M., and Nardi, B. A. Gardeners and gurus: patterns of cooperation among cad users. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM (1992), 107–117.
10. Henderson, A., and Kyng, M. There's no place like home: Continuing design in use. In *Design at work*, L. Erlbaum Associates Inc. (1992), 219–240.
11. Jung, H., Stolterman, E., Ryan, W., Thompson, T., and Siegel, M. Toward a framework for ecologies of artifacts: How are digital artifacts interconnected within a personal life? In *Proceedings of the 5th Nordic Conference on Human-computer Interaction: Building Bridges*, NordiCHI '08, ACM (New York, NY, USA, 2008), 201–210.
12. Kaptelinin, V., and Bannon, L. J. Interaction design beyond the product: Creating technology-enhanced activity spaces. *HumanComputer Interaction 27*, 3 (2012), 277–309.
13. Kvale, S. *Doing interviews*. Sage, 2008.
14. Lyle, P., Choi, J. H.-j., and Foth, M. Designing for grassroots food production: an event-based urban agriculture community. In *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: the Future of Design*, ACM (2014), 362–365.
15. MacLean, A., Carter, K., Lövstrand, L., and Moran, T. User-tailorable systems: pressing the issues with buttons. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM (1990), 175–182.
16. Nardi, B. A., and O'Day, V. L. *Information Ecologies: Using Technology with Heart*. MIT Press, Cambridge, MA, USA, 1999.
17. Pipek, V., and Wulf, V. Infrastructuring: Toward an integrated perspective on the design and use of information technology*. *Journal of the Association for Information Systems 10*, 5 (2009), 447–473.
18. Schmidt, K. Cooperative work and its articulation: requirements for computer support. *Le travail humain* (1994), 345–366.
19. Star, S. L., and Ruhleder, K. Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information systems research 7*, 1 (1996), 111–134.
20. Star, S. L., and Strauss, A. Layers of silence, arenas of voice: The ecology of visible and invisible work. *Computer supported cooperative work (CSCW) 8*, 1-2 (1999), 9–30.
21. Syrjänen, A.-L., and Kuutti, K. From system development toward work improvement: developmental work research as a potential partner method for eud. In *End-User Development*. Springer, 2011, 123–138.