Expanding Design Space: Design-In-Use Activities and Strategies

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Abstract

This paper introduces an analytical framework for understanding the collaborative nature and distributed structure of what is often referred to as *design space*. We propose that the design space should be conceptualized as the space of possibilities for realizing a design, which extends beyond the concept design stage into the design-in-use activities of people. By locating different activities and mapping participants' possibilities in a continuum from consumption to active creation, we develop a framework for understanding and locating design research interventions and a tool for mapping design activities. We argue that: 1) a design space is always actively co-constructed and explored by multiple actors through their social interactions with and through technologies and 2) the participating actors, resources, conditions and supporting strategies frame the design space available. In doing this, we bring forth relationships between an expanded view of the design space, contemporary discussions on the nature of innovation and the imperative to support explicit collaborative and participatory design activities.

Keywords

The term design space seems to be fairly common concept in design research literature (see e.g. Westerlund 2009). While many make use of the evocative dimensions of the word-pair to convey a place that can be explored, few define it explicitly. In general terms we can say that the concept of design space is used to highlight the freedom to choose from many options and to explore alternatives (e.g: Fischer & Giaccardi 2004, McKerlie & MacLean 1994, Sanders 2001, Westerlund 2005). Sometimes it also seems to refer to all design relevant information that is available in a design process (e.g: Hassenzahl & Wessler 2000). Another common use is to describe it as a territory that expands and contracts as the brief or challenge for the project changes during the process (e.g: Gero & Kumal 1993). However, two common threads emerge from the literature. First, the fact that the discussion of the idea of a "design space" is taken up from the point of view of a typical "design actor" – a designer or an organization involved in the creation of a product. It is usually the professional who defines and explores the design space, or if it is done in collaboration, he or she will be the one typically initiating the explorations. Second, the design space seems to be considered as a space that is mostly present at the concept design stage or rather a feature of it.

This is in contrast to other strands of research located in-between innovation and science and technology studies, which could contribute to the design field new dimensions for understanding the nature of a design space. For instance, the capacity of so-called lead users (von Hippel 2005) to actually envision and construct the design space themselves leads them to create new product genres, as e.g. described by Baldwin et al. (2006). Building on those insights, distributed accounts of innovation that focus on the role of users suggest how a design space could be effectively and collectively explored and constructed by a network of users alone (von Hippel 2007). Furthermore there is a range of research contributions that argument for expanding the scope of what counts as innovation, suggesting a richer and varied view of what counts as the design space that is been explored when innovations emerge (Tuomi 2002, Shove & Pantzar 2005, Hyysalo 2007). These accounts, for example, point out how individual user customizations and more importantly, the social practices of users, form a part of the design space that is being collectively charted and created.

There are two important and most immediate implications of this view: firstly, more people are exploring the design space (not only producers or designers, or designers inviting users into some

user centred process) and secondly, what counts as design space should also be expanded to include other things like social practices and agreements and not only physical artefacts. In so far as the design space available to stakeholders frames largely the evolution of the artefacts involved and the practices that carry them (e.g Hyysalo 2007, Shove & Pantzar 2004), a clearer account of what could be considered as design space and what are its components is needed.

In the rest of the paper we will follow Redström's invitation to develop accounts that explore "*what it is that we do rather than who we are*" (2008:410p) with respect to a design process in order to avoid unproductive user-designer dichotomies. The paper is structured as follows: first we will introduce our definition of the concept and its relationship to design-in-use discussions. The next section concentrates in locating different activities in a continuum from consumption to creation in order to develop a framework for understanding and locating design research interventions and a tool for mapping design activities that make those design spaces explicitly visible. In addition we introduce some design research cases and related support strategies for designers that we have experimented with. The paper closes with some remarks and directions for future research.

Expanding design space

Westerlund´s elaboration of the concept of design space, in terms of a conceptual tool to design and understand design processes (2009), is a good starting point to elaborate more on the potential of this concept. In his work Westerlund describes how workshops are ideal locations to explore jointly the design space of future product functionality with a variety of actors in a user centred design processes (UCD). He found out that the exploration of the design space is not only done from the point of view of problems, but rather from the vantage point of view of possible solutions. Those solutions, he claims, are what actually constitute the design space. From this perspective, the design space is turned into a useful concept to reframe and develop more up-to-date design process by focusing in "possibilities" rather than dwelling in the problems alone. While his conceptualization identifies the co-operative nature of this exploration and moves the focus from problems to possibilities, it leaves a lot of explanatory weight on the shoulders of complete "solutions" or at least ideas that are considered as meaningful solutions. In this conceptualization other surrounding factors, like for example the resources available to participants to actually imagine those solutions are not thoroughly explored.

In this paper we will refer to the design space as the space of potentials that the available circumstances afford for the emergence of new designs. This space though, is not constituted in a vacuum or somehow "pre-existent". It is rather made possible through the presence of different stakeholders, tools, technologies, materials as well as social processes and agreements. Within that space all of those who are designing make choices and eventually a design comes to being in an ongoing process that extends beyond the concept design. The design space in this case is actively co-constructed and co-designed by multiple actors in their social interactions with and through technologies and processes, which are brought to the design space and mobilized by the participating actors.

Building on this expanded view of the design space, we believe that it is increasingly important to recognize the role of the former "users" as designers, more so because of changes in our technology landscape and new opportunities for collaboration. In an earlier era, where the capability to manufacture products was tied to an industrial mass production process, considering the idea that so-called end-users have always been designers in their everyday life, at home as well as at work, was philosophically interesting but had very little significance for design practice. However, in the digital, globally networked circumstances, a dramatically wider diversity of roles and potentials beyond consumption and production become relevant.

Design-in-use

From an earlier exclusive focus on the role of the "object" and "the design brief" as the focal points of the design process, we have seen a gradual opening up towards more situated perspectives on design activity. It is more common today that designers and researchers situate design activities in a wider complex socio-technological context, where it also matters how a project is approached, and not only its results (Findeli & Bobaci 2005, Krippendorff 2006). As asserted by several commentators, the relationship between "design" and "use" has become central concern in developing design approaches and theory (Jones 1984, Redström 2006, Ehn 2008). The opening

up of new concerns is perhaps more evident today in the growing popularity of techniques for user orientation and user experience and a general embracing of so called user-centred design approaches. As a matter of fact, studying people and use situations to inform design process has become a recommended design practice in many areas, especially in relation to computer artefacts and digital systems and services (see Bekker & Long 2000 and Iivari & Iivari 2006 for reviews). These approaches, especially the pragmatic orientations, are today no longer an obscure research endeavour of a few, they are rather relatively well recognized lines of practice, or at least featuring high in the list of differentiation factors of design "expertise".

There is no doubt that concerns regarding user orientation and involvement have brought a wave of fresh air and new insights for professional design practice. However it has been questioned whether these stances truly recognize the complexities of what it is at stake (Iivari & Iivari 2006, Stewart & Williams 2005); or whether they are able to recognize that so called "user needs" and "experiences" are not phenomena that exist a priori or in isolation (Shove and Pantzar, Shove, Watson, Hand & Ingram, 2007). In line with insights made through decades of research in areas like Science and Technology Studies, there is a need to recognize that a variety of people, through their everyday activities, are already engaged in a continuous and dynamic process of learning, creative appropriation, domestication and shaping of technology (Shove et al. 2007, Haddon et.al. 2006), and furthermore, that these appropriations take place even under adverse circumstance (see e.g Eglash et.al. 2004). Some commentators even remind us that people are not necessarily waiting to be taken into consideration by a user centred process (Spinuzza 2003), and that there is an unproductive stance that needs to be challenged, specifically when some of the user oriented perspectives in design tend to portray designers as the "heroes" that fix the situations while users are considered sort of "victims" in need of salvation (Spinuzza 2003, Stewart & Williams 2005).

In contrast, the idea that indeed a variety of use situations can display design-like characteristics invites us to consider that it is in supporting those instances (of design-in-use) that more work needs to be carried out from professional designers' side. Already in the early 60's design theorist and architect Christopher Alexander described processes of "unselfconscious design", in an attempt to account partly for the pervasive enactment of design activities over time well beyond the professionals' intervention. These activities, he claimed, were usually taken for granted but nonetheless exercised by all kinds of people; in order to maintain the equilibrium of designed systems (Alexander 1964). More recently Brandes (2008) and Wakkary & Maestri (2008) have provided concrete illustrations of some of the resourceful, adaptable and emergent qualities of everyday designs in contemporary mundane and domestic contexts. To support these types of pervasive design-like activities, several propositions have been made. An important earlier conceptualization made by Henderson and Kyng (1991) identified continuing design-in-use and tailorability as key things to consider for truly collaborative design. Extending these arguments, Fischer & Scharf (2000) and Fischer and Giaccardi (2004) amongst others have advocated for strategies to support meta-design. Despite these advances on our understanding of design-in-use activities, the fundamental ways in which these activities are articulated in our everyday life practices and vice-versa have not been fully understood and analysed (Shove et. al. 2007).

When new practices and contemporary forms of innovation have flourished in parallel to the growing access to network technology, collective endeavours and sometimes bottom up creation projects have been made visible. There is no doubt that computer users and developers are probably one of the most recognized and discussed user-designers and innovators in the literature (see e.g. Tuomi 2003, Floyd et. al. 2007). The case for blurring up the division between design and use (production and consumption) has been made several times using examples from Free and Open Source projects. These communities have a long history where software developers and advanced users engage in a collaborative design and development process with established tools, methods and work practices.

Unfortunately, everyday people without particular technological expertise (i.e. knowledge of specific programming languages) have had very limited possibilities to explore some areas of the design space of these technologies. However, recent emergence of collaborative digital tools, technologies and their associated practices (e.g. linked to blogs, wikis and RSS-feeds) have also made other types of active and concerted participation more visible. It has also opened the possibility for more diverse contributions that are not limited to programming. This effectively expands the design space that is visible and available for the people. These developments locate

current discussions of design-in-use in a very different setting than the one that existed when user centred design approaches emerged.

These issues outlined above effectively invite us to reconsider: What does design-in-use mean for professional designers interested in creating partnerships and collaborative alliances, and what should we do about it? In doing this we propose that a better understanding of the scope and structure of the design space is needed. We proceed now to introduce the main components of the framework and its relationship.

Structure and components of the design space

In this section we present an analytical framework that aims to understand the structure of the design space we see emerging and to locate and identify different strategies. The following key questions are discussed in particular: What kinds of activities are people engaged in? What kinds of possibilities for appropriation are available? To construct the framework we have made use of several strands of research that have discussed similar issues in the past, and complemented it with empirical observations of current digital practices, when deemed necessary.
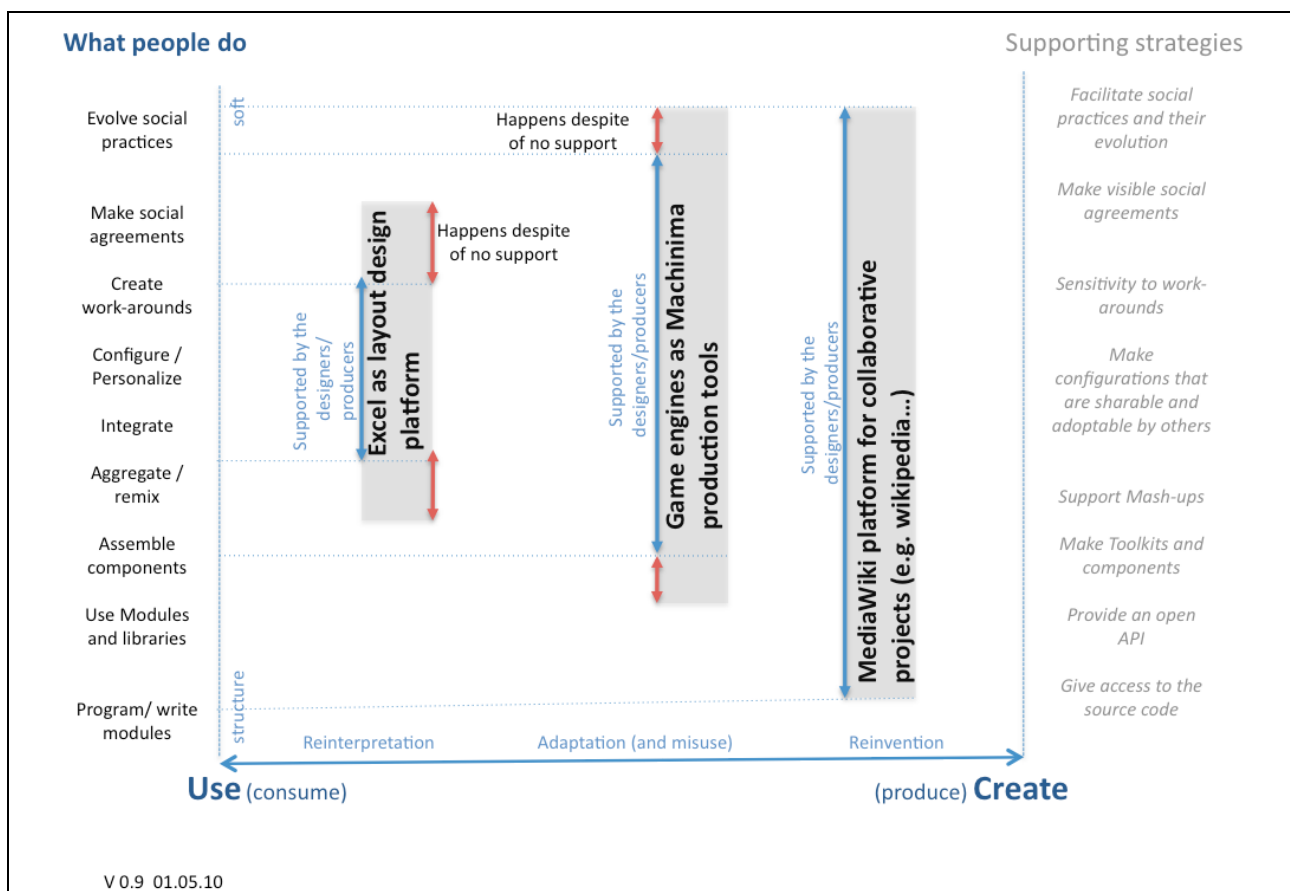

Figure 1 Framework for a structure of the design space

Figure 1 presents the basic dimensions of the framework. The vertical dimension presents an account of "**What people do**" as a *layered view* on different design activities in the digital realm. The activities are located in a continuum from "structural" to "soft" types as a way to convey the different points of view that need to be reconciled and that effectively complement each other. The horizontal dimension is meant to qualify those previous activities, by proposing that they might relate differently to the continuum between "**Use and Creation**". Some of these activities might be more linked to basic aspects of consumption (understood in its more passive side), and others are aspects more linked to engagement and creation. To elaborate the discussion further, we illustrate the framework by positioning three contemporary examples along the continuum. In this case, their particular position depends on the conditions and possibilities that surround the activity carried out, which, effectively makes "slices" of the design space more explicitly available for people. We will now elaborate further on the components and meaning of each element.

What people do:

The bottom part of these design activities deal with issues of composition, material selection and definitions of structures. These are easy to recognize as activities pertaining to design or development professionals. In identifying them we draw on contemporary practices around human computer interaction, interaction design and software programming, all which deal with the design of digital media and technology. Every time a layer is added, the upper element represents more of an organizational or social type of activities. Some of these top layer activities would not necessarily be considered as design activities from a pure product design point of view. However, these activities increasingly account for what can be considered as design (Shove et al. 2007, Hyysalo 2007). To define and synthesize these "soft" design activities, we used concepts and ideas from literature in Science and Technology studies (STS) and issues explored in e.g., Participatory Design (PD).

- *Program / write modules:* On the basic level, digital system design operates with compiled software programming languages, such as C, C++, Java, and on a slightly higher level with interpreted languages such as JavaScript and Python. These activities require understanding of algorithms, data and information management, and include design decisions and exploration that affect the technology choices and production tools. Moreover it deals with the actual writing of code and the abstraction process required. The resulting designs are usually organized into modular reusable components that provide streamlined services for other designs through an Application Programming Interface (API).

- *Use modules and libraries*: On the next level of software design, software is composed into applications that perform some functions relevant to users. These integrated software packages take advantage of underlying modular software libraries. This usually takes place within one computer.

- *Assemble components*: Some software design can take place without extensive software experience, and many toolkits have been designed with the intention that non-experts could design their own systems or at least customize ready-made systems for some more specific purpose. Usually some, but most often quite a lot of programming expertise is still required. (MacLean et. al. 1990, Henderson & Kyng 1991). These types of design activities customize and expand a system by attaching new components, such as plugins, that bring new capabilities to the system and create localized manifestations of it.

- *Aggregate / remix*: A complex ecosystem of loosely connected services is evolving (Hartmann et al 2008, Nestler 2008), where mash-ups (a recent evolution of Internet applications and representative feature of the Web 2.0 phenomenon) can be considered as new service designs created by aggregating selected information from other web services, to some extent relying on services that offer an open web API.. A lot of contemporary design activity is concentrated in developing skills to aggregate and remix in inspiring ways. (Several web services, such as Google Maps, YouTube and Flickr, have quickly embraced the opportunity to become the platform of choice to be a standard component in mash-ups by offering e.g. map, video or image related services).

- *Integrate*: Most of the software that we use daily in our personal devices is in some ways connected to other software, those particular configurations are only known in use. Since the diversity of circumstances of use calls for a diversity of tools this represents a formidable and growing system integration and design-in-use challenge that faces us in our everyday lives.

- *Configure / personalize*: This is a typical area where more and more end-users need to engage in design activities when it comes to digital products. Software based systems usually include many kinds of settings, and as they often also mediate communications and interactions, they often contain also a lot of various types of information that is very much context dependent and often quite personal.

- *Create workarounds*: Workaround is a type of activity used to describe the ways in which users of some product or system develop creative ways to overcome a shortcoming of the product or service they have encountered. Creating workarounds is not only creative but also dynamic way of weaving artefacts to own working and ways of doing thins. It is an especially familiar term for

software developers, but has also been used widely within the sociology of technology community, to highlight the ways in which users can act when facing an inflexible technology (Pollock 2005).

- *Make social agreements*: A social agreement is a shared understanding or consensus around a particular task or objective within a certain group or community. The nature of the agreement is usually a small group initiative that later evolves into a commonly implemented convention. One example of a social agreement with growing creative and practical consequences is *hashtagging*, the use of the hash symbol (#) to precede a term when microblogging in services like Twitter. The hashtag (e.g. "#opendata") adds additional context and metadata to the posts/tweets that makes it also easier to follow, organize and disseminate later.

- *Evolve social practices*: Social practices are embodied and materially mediated arrangements of human activities; they describe a particular way of going about an activity with its associated resources (Reckwitz 2002). Social practices, as an analytical unit, are shared and persist, because a group of people continuously reproduces them (De Certeau 1984). Eventually a set of social agreements (like the ones described above) or patterns of behaviours can evolve into a social practice that makes use of specific artefacts and conventions. For example, in video sharing sites like YouTube there are very advanced community initiated social practices for inviting and sustaining audiovisual conversations, via specific uses of visual genres, annotation workarounds, making visible of time-coded information and so forth.

Use-Create:

The Use - Creation continuum is structured around three intermediate positions: reinterpretation, adaptation and reinvention. These analytical categories are borrowed and further adapted from the ones introduced by Eglash when referring to technology appropriation (2004:xi), which we found insightful and relevant to this endeavour.

- *Reinterpretation*: This stage refers mostly to possibilities that exist for surpassing the semantical associations that are proposed to people in relationship to a given structure. An example provided by Eglash was that of the graffiti artists' interventions into the urban space, which provide a reinterpretation of the function of that space as a place for self-expression or political commentary without changing the structural conditions of the space itself. In digital environments, reinterpretation is obviously a possibility that is always available and relays strongly in the activities occurring at the soft layers of our "what people" do categories. An interesting case of reinterpretation can be found in the unintended uses of spreadsheet programs designed to calculate and manipulate numbers, as graphical layout design programs to create interiors and user interfaces (Berger 2006). This is done by reinterpretations of certain features of the software and basic shared agreements between a group of users. As seen in Figure 1, from a design process point of view the explicitly available design space is made visible mainly through the possibilities for basic configuration of the product, but there is little support to share and or extend user practices as this are mostly developed informally or in closed circles. In this case the possibilities of changing or adapting the lower layers are also more restricted; although there is always hacking strategies, this is not something that is encouraged.

- *Adaptation*: this second stage according to Eglash, implies a certain degree of flexibility in the underlying technology coupled with a sense of violation of intended purpose. These means not only of the designers' intentions, but also equally of the marketing strategies and / or gender assumptions embedded in a product. An adaptation involves creativity to look beyond assumed functions and recognize new possibilities, while the underlying structures are not necessarily changed. Eglash's classical example includes the "misuses" of early cassette players by Beduine tribes that saw beyond the playback machines (as they where marketed and sold to them) and used them as recording equipment for their own cultural productions. An example from digital realm can be found in the use of real-time three-dimensional game engines to produce computer animations. These animations where originally made to record playing episodes and performances, and they soon evolved to include the creation of new story lines and different creative appropriations for game-based movie making (Lowood 2008). This practice generated a new genre termed "Machinima". In Figure 1 we illustrate the layers that are covered by this example. Besides of being a very clever reinterpretation of what computer game software is meant to be for, the further development of the practice includes activities such as custom made

adaptations and hacks of the software engines, in some cases supported directly by the game engine producers. Machinima practitioners gather in online forums to develop and discuss the genre as well as present their work in festivals, which effectively support the consolidation of a community with a shared practice.

- *Reinvention*: In the category of reinvention, a manipulation of semantics, use and structure is usually achieved and new functions are created. A true reinvention usually involves being able to produce changes and alterations to the original structures, like the case reported by Eglash in which Latino mechanics appropriate automobile shock absorbers to create shock producers for their low-rider cars. The multiple adaptations and recreations of the MediaWiki engine that runs Wikipedia to endeavours different than and encyclopaedia writing can be considered as an example of reinvention on the digital realm (see an overview in: MediaWiki 2010). As Figure 1 shows the platform is offered with open access to the code, so it includes explicitly the possibility of altering the lower levels. However reinvention is complemented strongly by the soft layers as well. The Wikipedia project exemplifies how it also involves adapting and evolving the social practices that made these type of collaborative production possible through many sophisticated and well-documented community agreements (Slattery 2009).

Making the design space explicit: some supporting strategies

In previous sections we introduced a layered view on design activities in the digital design domain by giving examples of what people do in the design space; with the focus on revealing design-in-use activities. In the digital realm shifting and moving between stages is –in theory– easy to perform, but in practice it is hampered by such things as the type of programming knowledge required to make the changes, standards conflicts between products and services, providers' and producer's use and licensing policies (open or closed), lack of support and shared practices, to mention just a few. For these reasons, the project of making the design space more explicitly available also in design-in-use, requires changes and support in mostly all the layers of the design activities.

In this section we will briefly introduce three design research cases we have conducted that have helped us to reflect on the possibilities of the suggested analytical framework. Based on these cases we have identified resources, conditions and supporting strategies needed; these characteristics will be elaborated and discussed further.

Facilitating practices of creative production and reuse of media: Today more communities are engaged on audiovisual creative activities, while some have not yet been able to take advantage of the many possibilities that audiovisual media could bring to their activities. How to make it easy for anyone to create, reuse and share audio and video productions over the Internet legally, without costly servers and complicated system management? As part of our research strategy we designed and implemented the Fusion platform (http://p2p-fusion.org/). The platform binds together a peer-to-peer network, a distributed metadata layer, social processing and enrichment features, support for embedded licenses and a component-based toolkit called Social Media Application ToolKit (SMAK). A Specific, practical goal for the system was to support social activities that include the creative use and reuse of audiovisual content, and to provide a software toolkit with re-usable components. The aim was to enable people to build their own applications with SMAK to share and distribute videos, edit and socially enrich them collaboratively. The work was carried it in collaboration with different Finnish communities (possible end-users) ranging from a music makers' community, to an extended family as well as enthusiast practitioners of acrobatics and parkour (For a more complete account of the case see: Marttila et. al. Forthcoming).

Facilitating practices for active citizenship: This case deals with the role of digital technologies, specifically location based services, in the emergence of new forms of citizen participation in the urban environment. As a research strategy we initiated the collaborative design of a prototype environment and service called Urban Mediator (UM). UM is a server-based software that provides users with the possibility to create, obtain, and share location-based information (http://um.uiah.fi). The service contains a set of tools for both city administration officers aimed at increasing their capacity to construct more active forms of citizenship and thus initiate innovations in the way digital participation services are being planned and delivered, by offering an in-between-space that is not in control of any actor. Collaborations were initiated with both active citizens and city officials in

Helsinki (For a more complete account of the case see: Botero & Saad-Sulonen 2008, Saad-Sulonen & Botero 2008)

Facilitating the coordinating of everyday life in a project of growing old together: This case intertwines with a collective project to develop and experiment alternative social arrangements for growing old initiated by a seniors association in Helsinki. Together we asked ourselves what kind of applications and digital media would be interesting and meaningful in such a community? Besides of other experiments, the biggest intervention made was centered around the collaborative design and development of what the community called their Everyday Life Management System (DailyWorks) and it's articulates to their project of ongoing design of the communal living arrangements. In concrete terms this is a collection of web-based tools for the seniors, which assists in the coordination and sharing of everyday life activities and information (http://arki.uiah.fi/adik/dailyworks). (For a more complete account of the case see: Botero & Kommonen 2009)

Based on the experiences gained in the cases, we want to discuss how e.g. professional designers or other stakeholders who are in a position of power regarding the design structures in question, could support and facilitate these multiple activities that vary from "soft" creations into "structured" and more rigid designs. In other words: How to expand the design space, in Eglash (2004) terms, to accommodate more explicitly "reinterpretation", "adaptation" and moreover, the "reinvention" activities (the results of design-in-use activities)? We open up the discussion by proposing four key factors we have identified based on our projects:

* *Support open-ended design process and flexible agency:* Design space, as traditionally perceived by designers, has been available for everyday people only by invitation or engagement through a professional designer or a predetermined process with objectives and outcomes that are identified a priori. This setting implies also preset roles and agencies available for people, which might prevent the richness of design-in-use activities that would trigger and uncover the social patterns, agreements and practices that people might possess in the design space. Moreover, these "soft" social designs should be carefully turned into design descriptions, structures and functions without losing the essence of the design knowledge (e.g. practices, agreements and workarounds).

* *Provide meaningful access to the resources available:* In order to facilitate the creative design-in-use activities and expansion of the design space, professional designers should provide access to infrastructures a pool of resources that are reusable. By granting open and meaningful access (e.g. contextualization of data, digital tools and guidance for various levels of engagement) we might enhance the different agencies in the space. Also access to knowledge can be critical when people are experimenting and being creative.

* *Create means for sharing designs:* another key factor is to create means for sharing "designs" that have been created in design-in-use. Individuals, groups and communities share their design knowledge and experiences with peers, social networks and other stakeholders in the design space e.g. in discussion boards, wikis and social media platforms. In these environments for sharing, professional designers should acknowledge existing procedures and collaboratively design and develop mechanisms for giving recognition and attribution to contributors, aim for nurturing trust and building motivation, and when applicable, create means for compensation.

* *Design for openness and designability:* The fourth and final aspect of supporting strategies of design-in-use is the design for openness and further designability of other designs. Fischer (2000, 2003) refers to a similar stance with the concept of Meta-Design. This strategy should acknowledge people as potential designers of future applications and platforms, and should provide an open access to different levels of software from source code to API's and CSS, through appropriate licensing and publishing of the designs – for instance: Free, Libre and Open Source and Creative Commons, and so on.

Formulating insights and sharing these design-in-use strategies are focal to the extended design space and its vitality. The means of exchange of design knowledge, e.g. solutions, workarounds, practices and innovations, varies from diverse things such as ad-hoc crowd-sourcing to the formation of communities (see e.g. Botero et.al. 2009). It is also important to notice that sharing design knowledge and experiences in a design space does not only happen between peers; but

also with other stakeholders who have access to the information (e.g. what companies like Google can infer based on their user data).

Conclusion

The emergence of the digital environment and its ecosystems has created a new set of circumstances for design. These new circumstances provide many new opportunities for all types of stakeholders to benefit from new design interventions and engage in design activities. The framework presented here has been of great value for our work, as we have tried to make such new potentials visible and relate them to already familiar design processes and patterns. The framework highlights how the design-in-use activities of a very diverse set of actors can become realistic sources of innovation and material for other designs. By mapping specific activities on the graph, and through considering their potential design interactions with new actors or the adoption of new strategies, new collaborative design spaces can be envisioned and possibly explored. Since, these different activities have not been discussed with in a single framework it is possible that further refinement of the categories would be needed in the future. In any case, we believe that the novel combination and holistic understanding of the activities we are proposing has interesting implications and presents a useful view of the design space. Our future work includes testing the validity of the model with other empirical cases with a view to iterate the concepts and the structure of the framework.

As design is usually a pragmatic activity, the actors engaged are concerned with finding a workable solution, and are likely to draw the boundaries of the design space so that they exclude unrealistic options. This of course also means that things like ideas, ideals, imagination and inspiration belong all to the category of conditions that influence the dynamic composition of the design space. Along the same lines, all design operates with tools and on the basis of earlier designs and design expertise or experience that is available to stakeholders. These aspects can become available through personal experience, knowledge sharing, external services or collaborative team effort. In this sense, the design space of a stakeholder that has the necessary economical means, access to tools, a good design network around and working experience of collaboration within it, has most likely a persistently wider design space for a variety of projects than an actor with few means or bad and un-motivating earlier experiences. Thus for supporting successful design-in-use, it would be important to make available useful and realistic sets of resources and conditions for constructing solid design spaces.

The expansion of the design space has also wider societal significance. If the design capacity of free and collaborative actors that operate in the various levels of design-in-use activities we outline, is grown through open strategies as we propose in this paper, and they are linked together in a well functioning and dynamically self-organizing ecosystem, the collaborative design space is expanded and made more persistent for all – in effect increasing the design capability of all people in society. This is a very powerful strategy to increase the capabilities of more people to influence the transformations that are taking place in society. We hope our work is a contribution in this direction.

References

Alexander, C. (1964). *The Synthesis of Form*. Cambridge, MA. Harvard University Press.

Baldwin, C. Y., Hienerth, C., & von Hippel, E. (2006). *How User Innovations Become Commercial Products: A Theoretical Investigation and Case Study*. Research Policy, 35(9), 1291-1313.

Bekker, M., & Long, J. (2000). User Involvement in the Design of Human-Computer Interactions: Some Similarities and Differences between Design Approaches. In *People and Computers XIV - Usability or Else: Proceedings of HCI 2000* (pp. 147, 135).

Berger, N. (2006). The Excel Story. *Interactions*, 13(1), 14-17. ACM

Botero, A., & Kommonen, K. (2009). Aspects of social media design and innovation in a project for aging together. In *Enhancing Interaction Spaces by Social Media for the Elderly, International reports on socio-informatics* (Vol. 6, pp. 21-34). Bonn, Germany: IISI - International Institute for Socio-Informatics.

Botero, A., & Saad-Sulonen, J. (2008). Co-designing for new city-citizen interaction possibilities: weaving prototypes and interventions in the design and development of Urban Mediator. In *Proceedings of the Participatory Design Conference 2008* (pp. 266, 269), Bloomington, Indiana, USA: CPSR/ACM.

Botero, A., Vihavainen, S., & Karku, K. (2009). From closed to open to what? An exploration on community innovation principles. In *Proc. of MindTrek Conference: Everyday Life in the Ubiquitous Era* (pp. 198-202). Tampere, Finland: ACM / MindTrek.

Brandes, U., Stich, S., & Wender, M. (2009). *Design by Use: The Everyday Metamorphosis of Things* (Board of International Research in Design). Berkhäuser Verlag AG.

De Certau, M. (1984). *The Practice of Everyday Life*. University of California Press.

Eglash, R. (2004). Appropriating Technology. An Introduction. In R. Eglash, J. L. Croissant, G. Di Chiro, & R. Fouché (Eds.), *Appropriating Technology. Vernacular Science and Social Power.* University of Minnesota Press.

Ehn, P. (1988). *Work-Oriented Design of Computer Artifacts*. Arbetslivscentrum & Lawrence Erlbaum Associates, Inc.

Findeli, A., & Bousbaci, R. (2005). L'éclipse De L'objet Dans Les Théories Du Projet En Design. In *Proc. of the European Academy of Design, EAD Conference: Design-Système-Évolution*, Bremen, Germany. EAD

Fischer, G., & Giaccardi, E. (2004). Meta-Design: A Framework for the Future of End-User Development. In *End User Development – Empowering People to Flexibly Employ Advanced Information and Communication Technology*. The Netherlands: Kuwer Academic Publishers.

Fischer, G., & Scharff, E. (2000). Meta-Design: Design for Designers. *In Proc. of the Third International Conference on Designing Interactive Systems (DIS 2000)* (pp. 405, 396). ACM.

Floyd, I. R., Jones, M. C., Rathi, D., & Twidale, M. B. (2007). Web Mash-ups and Patchwork Prototyping: User-driven technological innovation with Web 2.0 and Open Source Software. In *Hawaii International Conference on System Sciences* (Vol. 0, p. 86c). Los Alamitos, CA, USA: IEEE Computer Society.

Haddon, L., Mante, E., Sapio, B., Kommonen, K., Fortunati, L., & Kant, A. (Eds.). (2006). *Everyday Innovators: Researching the Role of Users in Shaping ICTs* (1st ed.). Springer.

Hartmann, B., Doorley, S., & Klemmer, S. R. (2008). Hacking, Mashing, Gluing: Understanding Opportunistic Design. *IEEE Pervasive Computing*, 7(3), 46-54.

Henderson, A. and Kyng, M. (1991). There's no place like home: continuing design in use. In *Design At Work: Cooperative Design of Computer Systems*, J. Greenbaum and M. Kyng, Eds. L. Erlbaum Associates, Hillsdale, NJ, 219-240.

Hyysalo, S. (2007). User innovation, design space, and everyday practices: Rodeo Kayaking case revisited. In *Proc. of the Nordic Consumer Policy Research Conference* (pp. 1542-1558). Helsinki: Nordic Forum for Consumer Research.

Iivari, J., & Iivari, N. (2006). Varieties of User-Centeredness. In *HICSS 2006. 39th Annual Hawaii International Conference on System Sciences* (Vol. 08, p. 176.1). IEEE Computer Society.

Jones, J.C. (1984). Continuous Design and Redesign. In J. C Jones (ed) *Essays in Design*. John Willey and Sons.

Krippendorff, K. (2006). *The Semantic Turn: A New Foundation for Design*. CRC.

Lowood, H. (2008). Found Technology: Players as Innovators in the Making of Machinima. In T. McPherson (Ed.), *Digital Youth, Innovation, and the Unexpected*, The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning (pp. 165–196). Cambridge, MA: The MIT Press.

MacLean, A., Carter, K., Lövstrand, L., and Moran, T. (1990). User-tailorable systems: pressing the issues with buttons. In *Proc. CHI '90 Conference on Human Factors in Computing Systems: Empowering People*, New York, NY, 175-182: ACM

MediaWiki Contributors. (2010). *Sites using MediaWiki - MediaWiki.org*. Retrieved May 1, 2010, from http://www.mediawiki.org/wiki/Sites_using_MediaWiki

Marttila, S., Kati, H., & Kommonen, K-H. (Forthcoming) *Collaborative Design of a Software Toolkit for Media Practices - P2P-Fusion Case Study*. COST 298.

Nestler, T. (2008). Towards a mashup-driven end-user programming of SOA-based applications. In iiWAS '08 *Conference on information integration and Web-Based Applications & Services*. New York, NY, (pp. 551-554). ACM

Pollock, N., (2005). When Is A Work-Around? Conflict and Negotiation in Computer Systems *Development. Science Technology & Human Values* (30:4) 2005, pp 496-514.

Redstrom, J. (2006). Towards user design? On the shift from object to user as the subject of design. Design Studies, 27(2), pp 123-139.

Redström, J. (2008). RE:Definitions of Use. *Design Studies*, 29(4), pp 410-423.

Reckwitz, A. (2002) Toward a Theory of Social Practices. *European Journal of Social Theory* 5(2): pp 243-263.

Saad-Sulonen, J., & Botero, A. (2008). Setting up a public participation project using the urban mediator tool: a case of collaboration between designers and city planners. In *Proc of Nordic Conference on Human-Computer Interaction: Building Bridges* (pp. 539-542). Lund, Sweden: ACM.

Sanders, E. (2001). A New Design Space. In *Proceedings of ICSID 2001 Seoul: Exploring Emerging Design Paradigm*. (pp. 317-324) Oullim. Seoul, Korea. ICSID

Schuler, D. and Namioka, A. Eds. (1993). *Participatory Design: Principles and Practices*. L. Erlbaum Associates Inc.

Shove, E., & Pantzar, M. (2005). Consumers, Producers and Practices: Understanding the invention and reinvention of Nordic walking. *Journal of Consumer Culture*, 5(1), pp 64, 43.

Shove, E., Watson, M., Hand, M., & Ingram, J. (2007). *The Design of Everyday Life*. Berg Publishers.

Slattery, S. P. (2009). "Edit this page": the socio-technological infrastructure of a Wikipedia article. In *Proc. of the 27th ACM international conference on Design of communication* (pp. 289-296). Bloomington, Indiana, USA: ACM.

Spinuzzi, C. (2003). *Tracing Genres through Organizations : A Socio-cultural Approach to Information Design (Acting with Technology)*. The MIT Press.

Stewart, J., & Williams, R. (2005). The Wrong Trousers? Beyond the Design Fallacy: Social Learning and the User . In *User involvement in innovation processes. Strategies and limitations from a socio-technical perspective*. Munich: Profil-Verlag.

Tuomi, I. (2003). *Networks of Innovation: Change and Meaning in the Age of the Internet*. Oxford University Press.

Von Hippel, E. (2007). Horizontal innovation networks-by and for users. *Industrial and Corporate Change*, 16(2), pp 293-315.

Von Hippel, E. (2005). *Democratizing Innovation*. Cambridge, MA, MIT Press.

Wakkary, R., & Maestri, L. (2008). Aspects of Everyday Design: Resourcefulness, Adaptation, and Emergence. International Journal of Human-Computer Interaction, 24(5), pp 491, 478.

Westerlund, B (2005). Design Space Conceptual Tool - Grasping the Design Process. In *Proc. of the Nordic Design Research Conference: 'In the Making'*, Copenhagen: NORDES.

Westerlund, B. (2009). *Design Space Exploration. Cooperative Creation of Proposals for Desired Interactions with Future Artefacts*. Kungliga Tekniska Högskolan

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