Digitalization and the Design of Everyday Life

steps in the evolution of a research agenda

Kari-Hans Kommonen

Abstract

This thesis is a collection of four published articles that describe a selected set of steps of the evolution of a research agenda and activity regarding Digitalization and the Design of Everyday Life – from an early manifesto that describes the issue space, through two conference papers that discuss concepts that have been developed to facilitate research and analysis, to finally a journal article that discusses a more specific research finding.

The articles deal with topics such as the impact of digitalization on everyday life and the field of design; the need to consider a wider idea of design; the role of designers in this development; the idea of people as designers of their own practices; the way how our artifacts and practices form design ecosystems; and discusses concepts such as the personal digital ecosystem, design toolkit, design platform and design space. The final article is related to the idea of supporting users as innovators within organized settings, and examines critically the idea of Living Labs and of Open Innovation.

Keywords

Digitalization, design, emergent design, design and evolution, everyday life, practices, social practices, individual practices, design of practices, design ecosystem, design toolkit, design platform, design space, open innovation, living lab, commercial open innovation, public open innovation.

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During the years, I have had a chance to develop a connection to Japan. Discussions about the digital challenges to the field of design with Takeshi Sunaga of Tama Art University, a pioneer of Information Design education, have been very valuable. I was very fortunate to be able to work on the concepts presented in these papers more deeply during my stay in Japan as an International Fellow at the Interfaculty Initiative in Information Studies in the University of Tokyo in 2011-2012. I want to especially thank Shin Mizukoshi for making my visit possible, and my students in the Design of Everyday Life course at Todai for our important discussions that helped me to develop and clarify my themes and argumentation.

Special thanks go to my supervisor, Kari Kuutti, for his excellent guidance even in the difficult situation where I felt I had not choice but to go on working on a topic that is in reality too broad for an MA thesis.

Finally, I want to thank my parents, Lily, and my children, Matias and Anna Maria, for their support over the years. Now it is time to move on to the next challenge!

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Introduction

This thesis is a collection of four published articles that describe a selected set of steps in the evolution of a research agenda and activity regarding Digitalization and the Design of Everyday Life – from an early manifesto that describes the problem space, through two conference papers that discuss concepts that have been developed to facilitate research and analysis, to finally a journal article that discusses a more specific research finding. This work has taken place within Arki[1], one of the research groups of the Aalto ARTS Media Lab, which I have founded and led since 1996. The work has involved many projects and researchers over the years and have covered a wide range of topics. However, these topics have all had a connection to the research agenda described in the first of these articles, and have led to the thoughts, concepts and findings reported in the last three ones.

The first one, "Design for Society in Transformation", published in the Special Issue of Japanese Society for the Science of Design (JSSD)[2] in 2002, sets the stage and outlines the framing of the research directions we were taking, discusses what design is, presents an analysis of the impact of the digitalization process and in this light, proposes a set of contemporary concerns for designers and the field of design in general.

I was invited by Takeshi Sunaga, the leader of the Special Interest Group in Information Design of the JSSD, to write this article to the special issue that deals with the future of design education especially concerning Information Design, based on our discussions and my presentations about these topics in Japan and in Finland.

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[1] http://arki.mlog.taik.fi

[2] http://jssd.jp/modules/tinyd5/index.php?id=101

The second and third articles present and discuss a set of interconnected concepts that I have developed during several years, based on the work done within our group in many projects, as well as on the review of a large multidisciplinary collection of literature, to tackle the problems of how to analyze and describe the complexity of the digital environment that surrounds every person in the contemporary society and provides increasingly significant infrastructures and tools for our daily lives. It has been an important theme in our research to keep in mind that digital devices and tools are not isolated products, as they form an ecosystem with many kinds of dependencies between them. We have built on this thought in our research plans, and have mobilized it in the work and methods in several projects to help us to paint a more holistic picture of the diversity of configurations and practices in people's lives, but we have lacked a more elaborated analysis of what this "ecosystem" means, what it consists of, and what kinds of implications do the "ecosystemic" characteristics create for an understanding of digital technology in everyday life.

These articles have been very hard to write, because the topic has always been broader than conveniently fits in a 10-15 page article and each of the concepts is so entangled with the rest of them, and all are sufficiently new or different compared to the possible earlier ways the terms have been used, so that they all need some specific elaboration. However, I finally managed to write them as a pair of papers to two conferences that both took place during the summer of 2013, in a fashion where each of the two focuses a bit more on one side of the whole topic, while leaving the rest for the other paper to clarify.

The first one of the two, "Design Ecosystems as the Landscapes for Co-Creation", was presented in the Co-Create 2013 conference in Dipoli in June 2013[3]. This one focuses on presenting a broad idea of what design is, starting from the proposition that it is a good idea to pay attention to what *designs* are, regardless of what kind of *design process* has created them. I point attention to *emergent design* and the connection between *design and evolution*, as well as how *practices* can be thought about as designs. These ideas form a foundation on which the *design ecosystem* concept can be built. The

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[3] http://cocreate2013.net

ecosystem idea is discussed further, as well as the concepts *design toolkit*, *design platform* and *design space*.

The second of the two, "Design Ecosystems and The Design of Everyday Life", presented in the IASDR 2013 conference in Tokyo[4], starts with a brief discussion of the ideas regarding design, refers to the earlier paper, and focuses more on the discussion of what ecosystems concretely are and highlights the way how everyday life practices organize the ecosystem, mobilize the various components into meaningful activities, and establish the connections between the various components. I start from the description of practices and the ecosystem idea using the kitchen as a context and present the main ideas regarding practices and the ecosystem with kitchen and cooking based examples. After that, I move on to explain what is a *personal digital ecosystem*, and highlight some of its peculiarities that result from the nature of the digital technology. One of the most prominent characteristics is the exceptional dependency within the ecosystem on the operating systems, the design platforms that make its most critical components. Finally, I present a summary of the most important reasons why the digital ecosystem differs from the non-digital one, and a summary of why taking an ecosystemic approach to study the digital environment of everyday life might be useful.

The fourth and final article, "Are the Users Driving, and How Open is Open?", published in the Journal of Community Informatics (JoCI) in 2013[5], moves on to a more specific topic that relates to how people can gain new benefits from digital technology and influence its development through participating in joint development activities. It discusses critically the topic of User-Driven Innovation and whether "Living Labs" can function as a realistic means to enhance the possibility of people to influence or even lead the development of technology based solutions. This article, co-written with Andrea Botero, reflects our experiences in three projects, two

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[4] http://www.iasdr2013.jp

[5] http://www.ci-journal.net/index.php/ciej/article/view/746/1026

of which were developed with large consortia led by industrial partners, and one led, initiated and designed by us.

Our findings are that the Living Lab activities we have participated in and observed, seem to not reach the ideals of being user-driven that they subscribe to, mostly because they, in spite of the Living Lab ideology, continue to be designed according to the interests and priorities of participating companies. We contrast these Living Lab projects with the one we initiated and designed ourselves, and describe how this project focused on facilitating the user community we were involved with to come up with their own ideas of what they would need and have use for. Eventually, the project activities were geared towards making a useful new tool for their everyday life management. We point out that, as our example shows, user driven innovation can be realistically furthered, if projects are designed with appropriate mechanisms for people to actually be in a leading role as well as beneficiaries, which is not always the case in the Living Lab projects, due to their design.

We also find that that one of the reasons for misunderstandings between participants in these processes, and consequently, failures to reach successful results for all stakeholders and especially the participating users, relates to what the word "open" means in practical terms in these projects; the term "open innovation" has a specific meaning to the business management community that differs from the idea of many other "open" movements and ideas such as "open source", "open access", "open culture" and so on; in the latter, the focus is on free revealing of the contents and results publicly to anyone, while in the former, focus is on commercial exchange of well protected intellectual property between participating companies. We point out several problems and consequences that relate to this confusion and propose several points that that future Living Lab projects could take into account to overcome these problems.

In this article, I was the main author and wrote most of the analysis and arguments. Andrea contributed especially with her practical experiences and insights from the three projects in which she was the project leader, and we have reflected on the issues together over the years.

I have collected all the four articles into one document, with page numbers running continuously from the first to the last, and given them a somewhat consistent layout and typographical appearance. However, I have not changed the textual formatting (e.g. preset titles) or referencing styles that have been required by the conference/journal formatting guidelines – hence these conventions remain different in all four articles.

1. Design for Society in Transformation (2002)

Kari-Hans Kommonen

Media Lab, University of Art and Design Helsinki UIAH

Finland

Introduction

Design and designers are facing an opportunity and a challenge of unprecedented proportions, because the society is being transformed in design processes that are much more rapid, comprehensive, pervasive and driven by humans and their systems than ever before in history. This is the context for the future of design, whether the design field or the society in general perceives it or not.

We tend to see the world according to categories we have defined or grown to respect. If we have learned that design is a certain kind of thing, it will be hard to see it differently. But we owe it to future designers to have an open mind and be prepared, and prepare them, to work in a new landscape of design, with a much broader diversity of design problems to deal with, and with a growing arsenal of new kinds of materials for design to know and utilize.

My views are based on the work we have been doing in the Media Lab at the University of Art and Design Helsinki UIAH in the ARKI research group (http://arki.uiah.fi), in order to develop an understanding of how digitalization may influence the society, and what that means to design.

I do not know what the most important new areas and expertises will be, or how their teaching should be initiated, but I want to present some indications of future directions and propose some points of view to take into account when designing design education.

The issues I will bring forth will clearly touch those who are in some way directly involved with new technology and computers, and might be of interest to those who want to explore new areas, but I would propose that the globalized, integrated, design and technology intensive, market driven circumstances make it necessary for all design to make the effort to see the larger picture and establish a position – or accept that it very likely will find itself furthering questionable developments in society.

Design is a universal, ubiquitous phenomenon

Design has been defined in a variety of ways, but none of these seems to capture the idea in a way that would persuade a dominant following. Instead of presenting here a gallery of examples, I will just quote Richard Buchanan, who discusses this phenomenon in his very inspiring and insightful reflection of the idea of design and design thinking in an article titled "Wicked Problems in Design Thinking":

> *"Despite the efforts to discover the foundations of design thinking in the fine arts, the natural sciences, or most recently, the social sciences, design eludes reduction and remains a surprisingly flexible activity. No single definition of design, or branches of professionalized practice such as industrial or graphic design, adequately covers the diversity of ideas and methods gathered together under the label."*
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> …
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> *"There is no area of contemporary life where design – the plan, the project, or working hypothesis which constitutes the "intention" in intentional operations – is not a significant factor in shaping human experience."*
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> …
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> *"The challenge is to gain a deeper understanding of design thinking so that more cooperation and mutual benefit is possible between those who apply design thinking to remarkably different problems and subject matters."*

All human beings design, and the ability to design is one of the fundamental things that differentiates us from other animals. Also culture and everyday life is permeated by design, and it is impossible to impose a tightly defined view over such diversity.

Given the ubiquity of design, the cultivation of this pluralism is beneficial and even essential.

For a designer it is important not to surrender to this apparent difficulty of defining design. I believe that it is a designer's responsibility to develop a personal understanding of the field of design, as well as to be able to elaborate and explain this view to others. The characteristic of tolerating and even cherishing such a subjective freedom is one of the strengths of the field.

This essay relies on such a subjective view[2]. I believe that the difficulty in defining design results from the desire to find clear and indisputable boundaries; because design is such a broad phenomenon, this pursuit generally leaves large areas of design outside of the boundaries. My concern is to study design wherever it can be found, and hence this definition may seem vague, open, and broad; however, I have found it useful and eye opening for my own needs and in facilitating work with colleagues and students from many disciplines.

I propose that 'design' means the set of characteristics that more or less essentially defines the structure and functioning of something. We differentiate things from one another by their design. The activity of 'designing' is to intentionally create designs.

'Designer' is an expert role in design processes - an expert person who designs. Some people design intentionally without calling it design or identifying themselves as designers. Some people identify themselves as designers, and a subset of those has been educated as designers in a design institution. In this article, I will use the word 'designer' to refer mainly to those who identify themselves as designers.

But designs are created in a variety of design processes and many, if not most, designs result from processes that are not intentional and do not employ human designers. For example, evolution has produced uncountable designs that existed before humans appeared.

Design operates within an evolutionary framework

Evolution did not stop designing when humans developed the ability to design. Instead, humans have increased the speed of evolution by introducing intention and conscious evaluation into the selection process. The human mind, society and language created a platform for cultural evolution, a process that produces immaterial design artifacts, or ideas, as well as material artifacts, which embody or materialize some of these ideas.

The interaction of cultural and social evolution has led us to the world we have now, and in the process we have created an appreciation for the ability of individuals to contribute to the evolution by introducing new ideas and practices.

Unfortunately, a concept of design that emphasizes individuals and their creativity and innovations often overlooks the evolutionary and societal framework and the multitude of processes that actually influence and determine the success of designs. This may give well earned respect for inventors and designers and their skills, but fails to bring forth a more comprehensive, useful and fair picture of design in society.

One source of this trouble is our reluctance to accept that complex and functional designs can emerge without the intentional designer. In spite of the fairly common acceptance of Darwin's evolution as the process that created the diversity of life on earth, we still always attempt to identify the intelligent being who masterminded the things we think exhibit design and intention.[3]

But if evolution designs, what is the role of the designers? I propose that designers should not be seen as the individualist creative heroes that single-handedly change the world. Instead, the human mind and culture form an amplifier and extender that makes the design processes and the emergence of new designs dramatically more efficient. In this view, all people, and designers especially, act as agents of evolution – but within its constraints – when they design.

Wicked problems demand design expertise

There are many areas in society where designs are created in ways and processes that could benefit from the kind of design expertise that has been developed in the fields of design. But because the designs created in these new areas are not labeled as 'designs', and because there is no design education for those fields, the fields are not generally connected to design.

However, I believe that this is changing now, and the change is driven by the parallel and interconnected developments of increasing convergence, globalization, and the imperative of sustainability.

Convergence of our technology, infrastructures, businesses and cultural conditions connect and combine things in new ways, and makes new interactions between surprising elements suddenly essential. Globalization grows the scope and impact of design and introduces completely new kinds of concerns for cultural and ethical issues. Demand for expertise of a new kind that was not even envisioned a little while ago, suddenly pops up. The society grows more and more 'wicked problems' for which it desires to develop comprehensive, systematic solutions, as opposed to one-off improvised solutions.

Buchanan brings up the concept of the wicked problem, as introduced by Horst Rittel. Rittel argued that most of the problems addressed by designers are wicked problems: they are, according to his formulation, a "*class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing.*"

Buchanan goes on to propose that design problems are indeterminate and therefore wicked, because "design has no special subject matter of its own apart from what a designer conceives it to be. The subject matter of design is potentially universal in scope, because design thinking may be applied to any area of human experience." [4]

Another interpretation I would like to offer is that design deals with wicked problems because it has evolved for that purpose. Design as a field has evolved, and

design expertise has been developed, because people and the society have always had wicked problems to deal with, and this requires approaches that some other disciplines are not willing to accept. Thus, to be able to address wicked problems is a special characteristic of design, very intimately connected to its identity and the justification of its existence as a field of its own.

The issues for society are not running out, and their wickedness is increasing, because we are realizing that we must take the whole of the world more and more into account in everything we do. As the wickedness and scope of issues grow, more design expertise is needed. And as Buchanan also says, design thinking can be applied to any area.

Digitalization breeds new wicked problems

One of the key activities that is teaching us a lot about the relationship of design and society and the future, is software related design. It is tied to the technological revolution that is enabling the global changes. This gives it a privileged ringside position in the development of new design approaches that become necessary because of, and benefit from, the emerging technological possibilities.

Software design gives us new ideas about the world and the potential for design, because one of its essential tasks is to create abstractions of the real world. Software designers must try to analyze patterns that make up human activities and social systems, and model them, or systems that complement them, in software. This is very interesting right now, because the whole society is being transformed by a process of digitalization[5], in which software design plays a very influential design role.

As more and more of social and cultural activities become mediated by digital software systems, the more social and cultural concepts, characteristics, structures and systems need to be understood and to some extent modeled by designers. While most social and cultural phenomena can't be reduced to software, and many important areas of our life might even deteriorate from growing efficiency, many more or less significant areas remain, which can gain tremendously in efficiency

through networking and digital software. This will generate a strong, irresistible drive to digitalize many aspects of our everyday life.

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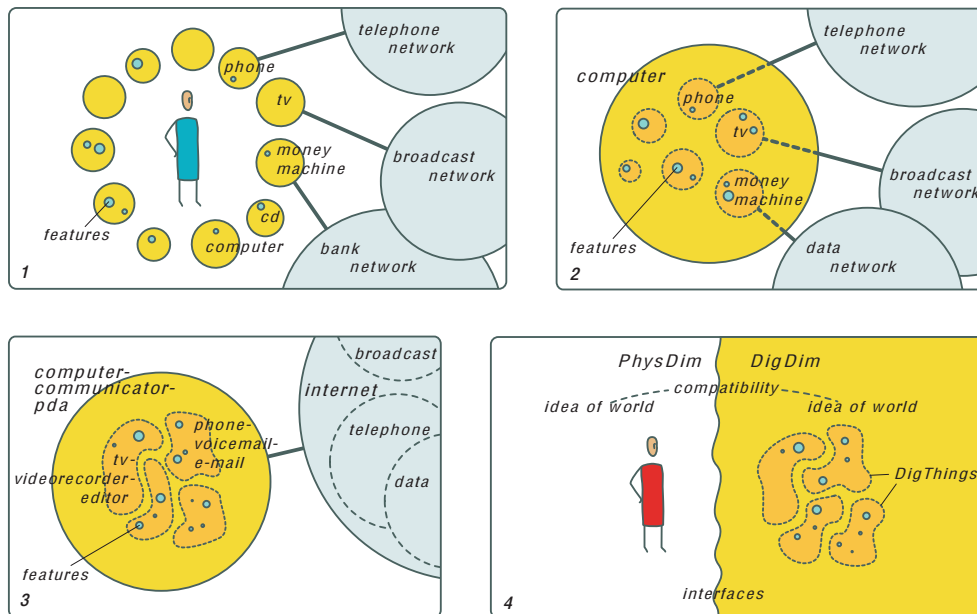
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For example, our food or our friends will not become digital, but some digital tools may form a very important part of our food-related social activities. We might use digital, efficient tools to find what we want, to be able to hold on to our demands concerning its quality, to negotiate a reasonable price, and to arrange our schedules so that we can eat in peace. While most people do not wish to be more efficient in everything, there are numerous practical and boring functionalities they do want to make more efficient.

The changes these digital, networked designs infuse into society are so powerful that they have a dramatic effect. They influence the ways we communicate, trade, make a living, make agreements, form communities, make decisions, participate in decisionmaking, get information and so on. The changes will touch all people in all societies, because many digital ways of doing things will replace old, non-digital ways.

This makes us all eventually dependent on digital technology. Anyone who is involved in the buying or selling anything; in using money or credit; in communication; in passing through locks; in travelling or staying in foreign places; and so on - will be touched by these changes, whether they want to or not.

My motivation in pointing out the likely extent of the impact of digitalization is not to glorify nor condemn it, but to suggest that it is something that we all must take seriously into consideration in the long run, and the sooner the better. People everywhere would benefit from a better understanding of what is going on, but designers who do play a more active part in the making of our common future should make it a point to make sense of the this development, because of its influence on any area of life, but also because of the new areas of design it reveals to a perceptive observer.

But what the techno-economical actors who are driving this development are beginning to see is that software and technology expertise is not enough for success. Many technologically advanced products have completely failed in the market. The failure of the dot-coms testifies of grandiose expectations that were completely unfounded. Why?

Technology develops much faster than its applications, because technological problems are not wicked while application problems usually are. People and organizations do not have direct demand for technology - they need benefits. These benefits do not result from consumable products, but from changes in the practices, activities and products which technology makes possible. The success of new technology is not possible without social and cultural evolution and innovation that can take advantage of it.

Therefore, even though software design is at the core of this development, and its needs are pushing many of the new ways to think about design, the most important design issues technological development bring forth do not really belong to the technological realm. Software can not serve people if it does not enable new social and cultural innovation. Software expertise will be needed for the software problems, but expertise about the whole diversity of life is needed in order to enable the

technology to become material people can use to construct their own ways to apply it.

The ecosystem we design for is now always global

Another great challenge is to deal with the responsibility of attempting to create fair and sustainable designs. We can't escape globalization any more, in any field. Globalization creates a global market, which brings benefits but also makes problems global. Within economies, polarization grows - the rich get richer, and the poor poorer. Growing efficiency means that production does not need as many people as it used to, while the production that is still necessary tends to move to locations where it is cheapest. In the wealthier economies, this development marginalizes many people and creates new poverty, crime and instability.

These economies have built that wealth through exploitation of other economies over the past centuries. This exploitation now continues in new forms, for example through the utilization of cheap labor (which is cheap because of the lack of investment in the kinds of societal services and infrastructures that the workforce in the wealthier economy enjoys), and continues to create responsibility to those who benefit, for its consequences.

Design decisions can make a difference in influencing, for example, whether the potential of new means will be used to increase the efficiency of the exploitation, or to increase the fairness of trade.

Designs can create structures of exclusion. For example, although a credit card seems to be designed for a certain purpose, it is being used as a general measuring stick of the holder's reliability. A number of products and services can't be bought if you don't have a credit card - regardless of whether you have the money or not. In many countries, it is not possible to rent a car or reserve a hotel room without a card. Internet payments are almost impossible without one. Subtle, but powerful and cumulating details that often are overlooked. Convenience and efficiency creates dependency and new structures with implicit, often at least seemingly unintended power.

Growing efficiency, scope and speed mean that the consequences of actions and decisions can have much more devastating and irreversible consequences than ever before. If we find that some design was not good, it may already have destroyed the structures that existed before, and this may have taken place in a global scale. In design, we need to pay much more attention to issues of sustainability before we make the changes, and consider economical, social and cultural aspects as well as environmental ones. Societies are wholes, and individual people live in them whole lives. Even though our designs play only a part, that part interacts with these wholes, and we need to be aware of these possible interactions.

While the basic situation is not new, what has changed is the scale, speed and efficiency, and that through the global media network we have access to any information we might want, any time. People will be unable to claim that they did not know what was happening; their only excuse can be that they did not understand how it works and how they were responsible. But designers, as the experts who must be able to assess the characteristics of the designs they help to create, can't hide behind such an excuse. They can't blindly rely on a superficial understanding of a static world, because they are creating new circumstances in a changing world. They must define for themselves what it is that they should know about the context of the things they design, and take that responsibility seriously, as part of the ethical foundation of the profession.

I am trying merely to point out that as we follow some of the threads such as these a little deeper, we find that there is almost a new world of design problems waiting to be taken into account. It used to be so that we could judge that many of these concerns would be out of scope, but in a global, converging scene, this is no longer true.

Challenge to design

The challenge to the field of design is to deal with the dramatic changes in society and the new responsibilities that result from growing design intensity combined with new pervasive technology and the global scope of everything. The best way to do that is to embrace the demand for new, unpredictable kinds of design expertise and

find ways to develop the education to respond to this demand, thereby realizing an important opportunity to increase the significance of design in society.

And while the drivers that bring this opportunity forth relate to technology and economy, the relevant response to this challenge should address social, cultural and political areas of design, but be very thoroughly fluent with the emerging technological means, in order to be able to use them as material.

This situation of increasing demand has an interesting characteristic: neither the design institutions nor the society at large have yet really identified its nature appropriately as a specific challenge for the field of design.

The categories we like to use to clarify the structure of the world often become barriers instead of facilitators. As the world is converging, and everything is interacting with everything else, design institutions may become prisoners of the boundaries they have defined for themselves if they take them too seriously and allow them to be too rigid.

In spite of the different ideas about specializations and boundaries of validity, there are many people who nevertheless cross them. This is very important and compatible with the reality in a useful way: the problems and designs do not have any respect for boundaries.

For the design institution, it is probably smart to design a flexible and enabling organization which can react quickly and support people who come with a capacity and vision to develop new activities, even if they were not envisioned by the institution, rather than make a long term plan with very specific fields and profiles, and then try to find people who fit the profiles.

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[1] Buchanan, Richard, "Wicked Problems in Design Thinking", *The Idea of Design*, Victor Margolin and Richard Buchanan, (eds.), The MIT Press, Cambridge, MA,1995. P. 3.

[2] This subjective view is obviously inspired and influenced by numerous authors whom I am not able to credit properly in this space.

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[3] Dennett, Daniel C.: *Darwin's Dangerous Idea: Evolution and the Meanings of Life*, Touchstone, New York, NY, 1996: An enlightening explanation of the relationship between evolution and design. PP. 64-73.

[4] Buchanan, R., "Wicked Problems in Design Thinking".

[5] Technology development is turning all electronic devices and communication systems little by little into components of a seamless, global digital platform, a digital dimension. This, in turn, forces all content on that platform to become digital as well. The digital platform is a network of computers, and the computers are all controlled and directed by software, which all has to be consciously designed by humans. For a more elaborated description of the development of the digital dimension, see http://arki.uiah.fi/concepts/digitaldimension

2. Design Ecosystems as the Landscapes for Co-Creation (2013)

Kari-Hans Kommonen

Arki, Media Lab, Aalto University, School of Arts, Design and Architecture

kari-hans.kommonen@aalto.fi

Abstract

This paper presents a very compact view of design, design processes and practices that forms a foundation for the concept of the design ecosystem. Design ecosystems are systems of connected and interacting designs, organized by the practices of the human participants of the ecosystem. The design ecosystem forms the context for any new designs and to creative activities, thus forming also the landscape for co-creation. Practices are also designs, and the design and adaptation of practices is the most common design activity for most people. Practices have an individual and a social dimension. New design is always based on earlier available design which forms the design toolkit. The abstract space of possible designs that can be achieved with the current resources, capabilities and constraints is the design space. Design platforms are dominant components especially in digital design ecosystems. These concepts are helpful for supporting a design-oriented analysis of diverse everyday life phenomena and provide tools for discovering opportunities for design.

Keywords

Design Theory, Design Philosophy, Design Ecosystem, Design Toolkit, Design Space, Design Process, Design Platform, Evolution of Designs, Design Evolution, Emergent Design, Practices, Individual Practices, Social Practices

Overview

In this paper I introduce a set of concepts that I believe can be useful for understanding and analyzing the circumstances of co-creation and of everyday life phenomena from a design point of view.

I am proposing a set of concepts that are all linked to the phenomenon of *design*. The word "design" is used to convey many meanings: phenomena, processes, activities and outcomes. As this can easily lead to confusion, I will make an effort to clarify how the word is used in this discussion. In addition, I will discuss concepts such as *design ecosystem*, *design toolkit*, *design space* and *design platform*.

As a starting point, I propose that it is useful to consider the creation and emergence of *all kinds of structures and things* as *design processes*, and their outcomes as *designs*.

This gives us a common framework for seeing parallels between such different processes, and it makes it easier for us to consider the crucial roles of the ecosystem of other designs and of the different actors present in these design processes. It will also be easier for us to consider and design changes to these processes, if we have better tools for conceptualizing them in more unified ways.

Due to space constraints, I must concentrate on presenting my point, and I am not able to present the diverse other views and the intellectual history concerning these topics adequately well in this paper; I apologize for that.

What is "a design"?

The most common idea of design is probably connected to industrial production and to the creations of well-known designers. For example, we may recognize a famous design and even know the designer's name. Or, we may consider that a certain company is famous for paying special attention to the design of its products. In such a context, 1) a design is a description of a product that will be produced by a mass manufacturing process; 2) the design is created by a professional designer, who is typically educated in a design institution; 3) the design process is initiated and commissioned by the enterprise (the client) that will make and market the product; 4)

the designer receives instructions from the client and a compensation for her contributions.

While there are an infinite set of variations of this pattern in various fields of design activity, these 4 main points fit well a very large class of design activities taking place in the world.

However, there are many kinds of design activities and processes that differ from this pattern, and it is a key aim of this paper to highlight their significance.

Design literature and design professionals do not have a clear consensus of what constitutes design. There is no single definition of design that the field would accept unanimously. The attempts to define design tend to either focus on the pragmatic point of view of describing what professional designers do, or to attempting to create a more abstract definition that would embrace the much wider space where design is seen, and could be seen, to operate.

My approach belongs to this latter direction, and I admit upfront that I will take it to extremes, but for what I believe are good reasons.

The greatest difference in my position compared to most definitions of design is that I believe it is more useful to *connect the idea of what design is to the designs* that are created in various design processes, rather than to the characteristics of a creative intentional design process.

What this distinction means in practice is that *I believe it is meaningful to consider something that exists in the world and exhibits design as a design, regardless of how that design came to be.*

The other approach that focuses on design as an intentional creative activity will consider something as a design *only if it was produced by an intentional design process*, which always requires the involvements of human beings, and at least some extent of intentionality towards producing a design. This leaves out processes where humans are not the main actors and those where design-like results emerge without clear intention, as well as subjects the whole discussion to the ability to find out how the design came to be.

In this paper, I will call my approach as the *wide idea of design*, and the other one as the *narrower idea of design*.

Thus, according to both of these approaches, an industrially produced chair has a design. Instead, a spider's web has a design only according to the wide idea of design, while according to the narrower idea of design the design of the web is not intentional and thus does not count as a design.

The benefit of the wider idea to this discussion is that it enables us to discuss a much wider set of things as designs, and to consider a much wider set ot processes as design processes. This view is in my opinion a prerequisite for a realistic discussion of designs, because designs that exist in the world have their impact on it regardless of how they came to be. By separating the designs artificially into completely different categories based on whether they were intentionally designed complicates the analysis and obscures important characteristics of the systems that these interacting designs form.

While I am not the only one taking a wider stance to design, I believe that as I take it to extremes, I can not claim that anyone else agrees with my view at this point. Very wide understandings of design are exhibited for example in the following writings (Cross 2011; Dennett 1995; Krippendorff 2006; Nelson and Stolterman 2012; Papanek 1971; Steadman 2008), and some of them offer significant support to my position. Unfortunately, a detailed analysis of the differences does not fit into this paper.

Also unfortunately, I can not yet present a clear definition of what is a design. I have many questions in my mind regarding where to draw the boundaries of that concept. However, I can provide list of examples of things that I believe do have a design:

- a chair
- a human being
- spider's web
- marriage
- parliamentary democracy
- intellectual property law

- Einstein's theory of relativity
- Japanese language
- my personal digital ecosystem
- my practice of making breakfast

Thus, for the next sections of this paper, I can summarize that according to my position, in addition to such things as artifacts, also language, music, concepts, systems, practices, organizations, regulations and human beings count in my discussion as things that exhibit designs.

A chair is not a design, but it has a design. The design consists of characteristics such as

- structure or form
- properties, functionality or behavior

The design process

Based on the idea of design presented above, what then is a *design process*?

In my view, designs (as explained above) come to be through various kinds of design processes.

One kind of a design process is the intentional, professional, industrial design process described above. However, this kind of a process is responsible for only a minuscule minority of all designs in the universe.

Most design in the universe is *emergent* – designs have emerged through some kind of evolutionary process. Most people are familiar with the idea of Darwinian biological evolution, but evolutionary theories are also used to explain the formation of other, non-biological, aspects of our material reality. Cosmic evolution describes the evolution of stars and planets, chemical evolution describes the evolution of various chemical substances, geological evolution describes the evolution of continents, seas and various geological strata of our planet (Chaisson 2007; Christian 2011).

The current consensus appears to be that biological evolution became possible after cosmic, chemical and geological evolution created appropriate circumstances for the emergence of life. Biological evolution has proceeded very rapidly compared to the earlier evolutionary stages and altered the design and characteristics of the earth very much. After human beings appeared, as products of biological evolution, the most powerful evolutionary process has been cultural evolution, which has had even more rapid and profound impact on the earth (Bellah 2011; Boulding 1978).

These various evolutionary processes are all design processes. My position is that these *theories of evolution are theories of the evolution of design.*

A key aspect of all evolutionary processes is that they include mechanisms for reproducing designs and thus making them persist. All designs are built on and made possible by earlier persisting designs. All designs that can be reproduced and can persist, thus create new possibilities for further design that builds on them. This makes another key aspect of all evolution, the *accumulation of design*, possible (Dennett 1995).

As mentioned above, emergence of life required certain circumstances that were created by earlier cosmic, chemical and geological evolutionary design processes. Emergence of human culture required the emergence of the design of the human species and many of its design characteristics, such as a mind that is supported by a large and flexible and versatile brain, created by biological evolution.

The emergence of human beings made, arguably for the first time, intentional, or at least large scale cumulative intentional design possible (the extent of design and its intentionality among other species in the animal kingdom can be debated (Hansell 2009); however, it is clear that no other species has similar abilities to communicate and accumulate designs, which makes the design of humans so efficient and impactful).

Thus, for those in favour of the narrower idea of design, there was no design in the known universe before the emergence of human beings.

In my view, design did take place before humans, but human beings and their ability to design intentionally has been a great leap in evolution, as intentional and culturally cumulative design has made the evolution of cultural designs radically and dramatically faster than the mechanisms of earlier evolutionary processes.

Human communication, learning, division of labour, collaboration, specialization, and the ability to design in imagination as opposed to only trial and error are examples of characteristics that make human cultural evolution of designs different from earlier evolutionary processes, and so efficient and impactful.

Cultural evolution thus differs from non-human evolutionary processes because of special cultural traits and because of purpose and intentionality. However, all cultural designs have most probably not come to be as results of very purposeful and intentional design activities. Many characteristics of human life and practices share a common ancestry with other animals, and have deep history in our evolutionary origins. Equally, even the purposeful and intentional design activities produce designs that may or may not be adopted by the society, depending on their compatibility with various other characteristics of life and existing practices and needs that are subject to various evolutionary pressures.

Thus, even the intentional design of humans still exists embedded firmly within an evolutionary framework of cultural evolution.

Based on this, what can we say of design processes? We know all kinds of things about how intentional design works. We also have studied human history, inventions and many other aspects of society and its evolution. Biologists and ecologists are exploring how the designs of organisms and their behaviors and practices have come to be. Various sciences are considering the other evolutionary processes. However, due to the scale of the variety of designs and their origins, there are only a few things that we can attribute to all design processes:

- all designs come to be and persist within an evolutionary context
- all designs build on earlier designs that make them possible – design can not make sudden leaps over required steps

What is the significance of this wider idea of design to the study of intentional human design?

When we expand the idea of what a design is and what kinds of processes create designs, we can have a more open mind to seeing designs in society and to studying their design processes without the handicap of always having to find the intentional designer. If we do not worry about the intentionality and can accept various structures and forms as designs even if they have emerged in a process we can not understand, we can take them better into account as things that have the same kinds of impacts as intentional designs do. Even if a design has emerged without us knowing its designer or the details of the process that created it, we can still aim to take advantage of it as a building block, or as a model, and for example modify it. If we think of all such structures as designs, we may be able to better take advantage of the various parallels and analogies they and their various evolutionary paths may show.

My position is also that the wide idea of design is necessary because it lays an important foundation for our understanding of ability and need to design as a fundamental human charateristic and builds support for the idea that it is necessary to consider that human beings should have a fundamental right not only to enjoy culture but to design new culture, based on the culture that exists.

Practices as designs

The wider idea of design I promote here also considers that things such as social and individual practices are designs, regardless of whether they evolved through intentional design activities or emerged in some undocumented social or individual process.

That a practice can be thought of as a design is easy to accept in such fields as service design; it is not hard to accommodate the thought that the way how a service is delivered in the form of some practices is intentionally designed and exhibits a regular set of forms, that can easily be accounted for as a design.

While there is a lot of recent literature about practices (Reckwitz 2002; Schatzki, Knorr-Cetina, and Savigny 2001; Schatzki 1996, 2002; Shove, Pantzar, and Watson 2012), the contributions do not usually take a design point of view towards them. Notable exceptions: Korkman (2006), Shove, Watson, Hand, and Ingram (2007).

In any case, my position is that practices can and should be understood as designs, because 1) they show characteristics common to designs; 2) they have similar origins as other designs; 3) practices are the most significant arena where everyday life design by each of us takes place; and 4) it helps us to understand better how everyday life comes to be and what kind of complex co-creation activities and relationships these processes include.

Practice is a very worthwhile concept that helps us to understand better what people do and why, and why they do it in some particular way, and what are the roles of the artifacts that are employed within the practice.

Practices and artifacts have a tight relationship: artifacts have no role in life outside of practices. Every artifact comes into contact with people and used through their practices. An artifact that is not part of a practice of a person does not have any connection to the person. Practices also join artifacts to the purposes, aims, motivations and thinking of their users (Schatzki 2002).

By considering the emergence of practices both as social and invidual phenomena as a design process with intentional and emergent features helps us to get a better picture of the evolution and emergence of practices and thus also of the way how the roles of artifacts evolve in everyday life.

Practices are both learned and imitated from others, as well as developed by individuals. Practices have an *individual* and a *social* dimension. Practices are social when they are shared with others, but when an individual participates in the shared social practice, she must by necessity perform an individual version of that practice, as no two people can possibly perform any practice exactly the same way. Thus, the development of the ability to perform and thus reproduce the practice individually is a prerequisite for the individual to be able to participate in the social practice at all. In addition to the repertoire of social practices, people also develop their own individual

practices that may or may not be socially shared, or are shared to a greater or lesser extent.

Social innovation is largely about the *spreading of novel practices among some communities*. This may happen so that individuals develop various protopractices that are imitated and further developed by others, and through both intentional design and evolutionary emergence, some forms of the practice, supported by appropriate artifactual design, emerge as new social practices that count as social innovations.

Among individual practices, there are probably large numbers of practices that are in diverse forms many times reinvented by disconnected individuals and that do not persist as social practices in their communities, and may never be even seen by others.

The so called *lead users* (Eric von Hippel 2005) are people who have strong special interests to develop new practices as well as influence the development of the artifacts that can support those practices. In the same vein, *if we are able to develop our sensitivity to the evolution of individual and social practices that takes place in society, also when we can not clearly find appropriate "lead users", we can maybe identify promising opportunities for new artifact or service designs to better support the novel emerging forms of practices.*

Defining the design ecosystem

Based on the concepts introduced above, *design ecosystem* is a new term I introduce to describe the conceptualization of a topic of interest together with the context where the topic of interest exists or happens. *A design ecosystem is a unique, specific and particular set of interacting and connected designs. The designs to be included in the consideration can be for example artifacts, practices, people, networks, organizations and communities. The components of the ecosystem typically have a diversity of dependencies, connections and flows between them. The most important components that organize design ecosystems are typically the practices of their human participants.*

As the design ecosystem is an instrument of study, the knowledge interest of its user will need to determine how the boundaries of the study will be determined.

For example, if we want to study everyday life of an individual, the design ecosystem of everyday life is a system that consists of the various designs that the individual interacts with, with all their dependencies and connections. We can select a narrower topic, for example an individual's kitchen or cooking ecosystem, or an individual's media ecosystem, and include in this design ecosystem those components that are relevant to this topic of interest. When studying a design ecosystem with a tighter focus such as "cooking" or "media", it appears as unnecessary highlighting to keep repeating the word "design" if it becomes clear from the treatment that a kind of design ecosystem is being discussed.

The topic of interest could also be tied to some other kind of entity – we could study the design ecosystem of a group of people or an enterprise.

Why is the design ecosystem a useful concept?

The design ecosystem is an intellectual instrument for studying things and the activities they belong to together in a way that, through the inclusion of practices as the designs that organize the ecosystem, also opens up the reasons for their connections and dependencies as well as the motivations, purposes and intentions of the people involved.

If we consider the everyday life of an individual, it is a continuum that evolves continuously throughout the individual's lifecycle, from birth to death. When a child is born, she is born into a design ecosystem, established by her parents. Gradually she develops her own capacity to form and evolve her own design ecosystem.

The design ecosystem is in itself a complex design that evolves as a mix of intentional, externally imposed and emergent changes. Generally people strive to maintain continuity within their ecosystem, in order to be able to sustain important practices and avoid wasting work and design efforts, and to be able to direct their efforts to activities according to their own priorities. As part of such strategies, people acquire and furnish homes that support their own lifestyles with appropriate selections of artifacts and other resources. When new practices or new artifacts enter the ecosystem, their inclusion requires changes and adaptations. As components of

the ecosystem have various dependencies, it is sometimes complicated to replace existing components with new ones, as their features and interfaces to other components may not be exactly similar.

The importance of understanding such dependencies and systemic connections between components has grown dramatically because of digitalization. *Digital components have a dual nature as flexible and rigid at the same time*, due to their digital programmability. Because they can be programmed, they can in theory be designed to be *extremely flexible and infinitely customizable*. However, as their functionality depends on very strict conformance to a linguistic grammar and their programmable *flexibility depends on the ingenuity of the software designers to express the intended flexible ideas in strict conformance with the available software platform* (e.g. a specific version of a specific operating system), they are also tied very rigidly to *design rules* established by their design ecosystem.

Digital components are thus much more deeply and dependently connected to each other than non-digital ones, and their ability to deliver their expected services depend significantly on their ability to communicate and work with other components in the ecosystem.

These dependencies are also a significant source of power for those parties who are in a position to decide about the designs of those components that function as the enabling gatekeepers for other designs: the *design platforms*, e.g. operating systems (Windows, OS X, iOS, Android) and key internet services such as Google search, Google Maps, Amazon, and Facebook. Platform owners may have the power to decide alone dictatorially which features, which services, or even which partners they support and allow to contribute to the customer's design ecosystem. For more about platforms in general, see Gawer (2009).

Design toolkit and design space

When someone engages in design, their ability to design depends heavily on what earlier designs they have available to them as raw materials for their design. The more sophisticated, capable and useful designs they can build on, the more

sophisticated their own designs can be. Such existing designs in any design situation form the *design toolkit* for further design. The concept of design toolkit is in widespread use, but here I claim that it is useful to consider that *every design situation always relies on a specific design toolkit*, and that its characteristics can be analyzed to gain a better understanding of the design situation.

When someone engages in design, *the abstract, theoretical space of possible design outcomes that are possible to achieve, forms the design space* in that particular situation. The design space can change, extend or contract by introduction of new designs into the design toolkit, by their removal, by the introduction of constraints or freedoms, or the addition or removal of resources or capabilities (Botero, Kommonen, and Marttila 2010).

In the context of everyday life, the *central design activity of individuals is the design and adaptation of daily practices to changing circumstances, as well as the longer term design of various life projects* (Shove, Watson, Hand, and Ingram 2007). In these activities, *their design ecosystem effectively forms their design toolkit, and at the same time largely determines their design space.* Certain individual components of the design ecosystem, e.g. *the design platforms, have much significance in determining the qualities of the design toolkit and the design space.*

Design ecosystems as landscapes for co-creation

The discussion of design in the beginning of this paper can now be connected to the topic of co-creation. When we are discussing something like the creation of consumer products or services, it appears from the point of view of an individual as an offering to extend their design ecosystem with a new component. In order for them to include it in their ecosystem they will need to always make space for it and adapt their ecosystem to connect to the new offering. Hence the acceptance of an offering always entails also a reciprocal act of adaptation and thus, design.

If I decide to have a dinner in a new restaurant or to buy a new mobile phone app, these offerings will not become part of my life without some kind of adaptation of my practices. Hence even the smallest change requires some kind of a creation effort from my part. How much, and how convenient and how motivating this is for me,

depends on the compatibility of the offering with my unique and idiosyncratic design ecosystem. If the offering is more complicated, for example something where more significant design is meaningful, the importance of compatibility and avoidance of wasting earlier design effort and redoing of work increases.

Thus, the design ecosystem of an individual forms a unique landscape where her creative actions always take place, and where the makers of the offering have to tread carefully and avoid disrupting existing designs, couplings and practices, and instead find ways to support and strengthen the sustainable and fruitful evolution of the ecosystem and its resources.

List of references

Bellah, Robert N. 2011. *Religion in Human Evolution: From the Paleolithic to the Axial Age.* Harvard University Press.

Botero, Andrea, Kari-Hans Kommonen, and Sanna Marttila. 2010. "Expanding Design Space: Design-In-Use Activities and Strategies." In *Design & Complexity: Design Research Society International Conference*, eds. David Durling et al. Montreal, Canada: DRS, p. 18. http://www.drs2010.umontreal.ca/proceedings.php.

Boulding, Kenneth E. 1978. *Ecodynamics: A New Theory of Societal Evolution.* Sage Publications, Inc.

Chaisson, Eric. 2007. *Epic of Evolution: Seven Ages of the Cosmos.* New Ed. Columbia University Press.

Christian, David. 2011. *Maps of Time: An Introduction to Big History, With a New Preface.* 2nd Revised edition. University of California Press.

Cross, Nigel. 2011. *Design thinking: understanding how designers think and work.* Oxford; New York: Berg.

Dennett, Daniel Clement. 1995. *Darwin's dangerous idea: evolution and the meanings of life.* New York: Simon & Schuster.

Eric von Hippel. 2005. *Democratizing Innovation.* The MIT Press.

Gawer, Annabelle. 2009. *Platforms, markets, and innovation.* Cheltenham, UK; Northampton, MA: Edward Elgar.

Hansell, Mike. 2009. *Built by Animals: The natural history of animal architecture.* OUP Oxford.

Korkman, Oskar. 2006. *Customer Value Formation in Practice: A Practice-theoretical Approach.* Svenska Handelshögskolan.

Krippendorff, Klaus. 2006. *The semantic turn: a new foundation for design.* Boca Raton: CRC/Taylor & Francis.

Nelson, Harold G, and Erik Stolterman. 2012. *The design way: intentional change in an unpredictable world.* Cambridge, Massachusestts; London, England: The MIT Press.

Papanek, Victor J. 1971. *Design for the real world: human ecology and social change.* London: Thames and Hudson.

Reckwitz, A. 2002. "Toward a Theory of Social Practices: A Development in Culturalist Theorizing." *European Journal of Social Theory* 5(2): 243–263.

Schatzki, Theodore R. 1996. *Social practices: a Wittgensteinian approach to human activity and the social.* Cambridge: Cambridge University Press.

Schatzki, Theodore R. 2002. *The site of the social: a philosophical account of the constitution of social life and change.* University Park: Pennsylvania State University Press.

Schatzki, Theodore R., K. Knorr-Cetina, and Eike von Savigny, eds. 2001. *The practice turn in contemporary theory.* New York: Routledge.

Shove, Elizabeth, Matthew Watson, Martin Hand, and Jack Ingram. 2007. *The design of everyday life.* Oxford: Berg.

Shove, Elizabeth, Mika Pantzar, and Matt Watson. 2012. *The dynamics of social practice: everyday life and how it changes.* Los Angeles [i.e. Thousand Oaks, Calif.] ; London: SAGE Publications.

Steadman, Philip. 2008. *The evolution of designs: biological analogy in architecture and the applied arts.* Rev. ed. London ; New York: Routledge.

3. Design Ecosystems and The Design of Everyday Life
Introduction of a Conceptual Framework of Design Ecosystems (2013)

Kari-Hans Kommonen

Aalto University, School of Arts, Design and Architecture, Media Lab,

kari-hans.kommonen@aalto.fi

Abstract

The design of everyday life can be studied by considering that it consists of practices that take place in a context that can be understood as a design ecosystem – a system of artifacts, resources, connections, flows and dependencies, organized by the owner's practices. This paper elaborates these concepts and discusses also the concepts designs, design toolkit, design platform, design space, and personal digital ecosystem. I also present and highlight the importance of making a distinction between social and individual practices.

Key words

design ecosystem, practices, designs, design toolkit, design platform, design space, personal digital ecosystem, design of everyday life, individual practices

1. Introduction

Design as a field tends to perceive the world through design projects – anchoring the point of view to something that is being designed, such as a product. In the industrial system, a product is designed to appeal to and to fit into the lives of as many people as possible [17]. The focus is on the product, and the numerous users and their needs

must be in various ways approximated in some way into a manageable set of requirements that can guide the design. However, the reality is that in the end, when that product finally reaches its users, every one of them is a different individual and has a life that is always unique, and thus potentially poses a unique set of circumstances to the product. This makes little difference to the success of traditional material industrial products, but it is very significant for the usability and usefulness of digital products, because they are often intimately connected to their environment and need to be customized according to the users' preferences and practices. Because of that, it would be important for design to transfer its point of view from the single product observed as it leaves the factory to the user's whole environment where the product will eventually operate.

From an individual's point of view, a single product is just a component in a very large system of artifacts in her life that are connected by her activities, or *practices* [26, 28–31]. An artifact is mobilized by the user to perform some functions, as part of a practice, and often in connection or collaboration with some other artifacts. For example, there may be a flow of material or information between the artifacts. The function of one artifact may be dependent on a service provided by another one, and in turn support the function of another one, and so on. For an individual, the most important qualities of the artifact relate to how well it performs in its role, how smoothly and reliably it contributes to the performance of everyday life practices, and adapts to the idiosyncratic arrangements and preferences of its owner. The artifact is one within a multitude, a component in a system, performing a role that likely requires it to satisfy various dependencies and to support and serve others. If it succeeds in these, it will solidify its position as a building block that is relied upon, and if it fails, it must be fixed or replaced in order for the owner to be able to continue performing those practices.

To study this system around an individual that supports her everyday life practices, I suggest that *design ecosystem* is a useful concept that can be used as an *instrument of inquiry*. The *personal design ecosystem* consists of various *designs* and is in itself a complex, emergent design. It includes artifacts, such as products; infrastructures, such as buildings and networks; connections and dependencies between components; flows of material and information; resources, such as materials, information, food reserves,

bank accounts, or databases of media, emails, addresses; and as the elements that organize the ecosystem: the individual's practices. As the ecosystem concept is an instrument of inquiry, the boundaries of and the criteria for inclusion in the ecosystem are not in any way absolute, they depend on the knowledge interest and hence the definition of the person who invokes the inquiry.

The need for a more holistic and ecological approach to the study of artifact constellations and related design concerns has been proposed by other authors. For example Nardi and O'Day define an "information ecology" as "a system of people, practices, values, and technologies in a particular local environment. In information ecologies, the spotlight is not on technology, but on human activities that are served by technology" [19]. Tungare et al. have studied "personal information ecosystems" and "the evolution of personal information management practices" [35, 36]. Also Stolterman's research group has studied such personal ecologies or ecosystems and in their latest article call them "device landscapes" [14, 21, 27, 34]. The approach I propose here is compatible with these approaches, but has its own logic and foundation, and as such does not directly build on them. Hence I will first present my own concepts and then discuss the relationship of my approach with these others. I have also presented a complementary discussion of these concepts in another paper [15].

As explained above, the design ecosystem becomes especially interesting as a consequence of the digitalization of everyday life, and I will discuss this in the last part of the text. However, I will begin the exploration of design ecosystems with a non-digital example, and I will also use this example to highlight the role and nature of practices as the key element that organizes the designs in our life and environment. Other concepts I will discuss with this example are designs, design toolkit, design platform, and design space.

2. Practices in the kitchen

As noted above, the design ecosystem is a concept that can be adapted to the study of many phenomena, by adjusting the boundaries and the criteria of inclusion. For example, if we want to study activities that relate to cooking and try to understand

the artifacts that play a role in this, we can define the ecosystem of interest as the "kitchen design ecosystem" or the "design ecosystem of cooking".

I want to use kitchen and cooking as an example, because it is a very familiar environment with familiar activities and artifacts for everyone, in spite of many cultural differences. Cooking and culinary culture is also a very fertile context for highlighting the great diversity and idiosyncrasy in everyday life, and the meaning and significance of personal preferences [3, 25, 31]. Each of us knows that almost no two people have the same culinary preferences, and at least I have never met anyone who would have the same as I do.

As a result of the significance of personal preferences, no two kitchens (that are not just left unused) are furnished, equipped and resourced in the same way. When a building with many apartments is constructed, the kitchens may originally be similar, but as soon as the future inhabitants of the apartment begin to turn it into a home for themselves, they start to customize the kitchens in various ways – furnishing it with furniture and equipment that they prefer, by equipping it with dishes, pots, pans, utensils, appliances, tools and various kinds of reserves of foodstuffs that they need for their own cooking.

In Finland, most apartments, when sold or rented to new inhabitants, contain a kitchen equipped with a fairly standard set of basic equipment related to cooking (in addition to the standard infrastructure that every room in the apartment also has, such as electricity, lights, heating etc.), things such as running water, faucet, sink, and sewer; stove; fridge, maybe a freezer; and closets and drawers. This basic equipment in effect turns the room into a kitchen, and is expected by the inhabitants to be provided together with the apartment. Normally, people also expect that the kitchen is not customized much further than this by the previous owner, because they want to exercise their own preferences and bring their own additional artifacts into the kitchen to make it their own and appropriate for their own kitchen practices. Quite often it also happens that, in order to get a kitchen that fully meets their preferences, they actually renovate also the basic furniture and equipment of the kitchen. [31]

While the equipment that people furnish their kitchen with forms a unique combination compared to the kitchens of others, many of the components in the

kitchen are also found in the other ones. The differences may be subtle, based on differences in taste, or more substantial, related to some special form of cooking. Generally however, the equipment is selected from the consumer market from a selection of goods that is supplied by the global industry, and while the particular combination of such commodities is unique, the same products are used in many other kitchens around the world, as components in some other unique combination.

However, what really is unique in every individual's cooking are the cooking practices. If two people are given the same equipment and raw materials and asked to prepare some food, for example a hamburger, they will most certainly prepare it differently and produce a different kind of result. Most of us probably have the experience of enjoying a certain kind of dish prepared by different cooks, with a different outcome. In fact, it is extremely difficult for someone to prepare a dish exactly like someone else, without making a great effort in observing and imitating the actual cooking process of that person. We are very familiar with the idea that there are common dishes that share the same basic design (such as "a hamburger"), but we also expect that they will be prepared to some degree differently by each cook, and we often exchange recommendations on where to find the best tasting implementations of each particular dish.

Within the kitchen ecosystem, it is also easy to realize the significance of the practices as the essence of what the kitchen with all its artifacts is expected to support. While a stove, a frying pan or a fork may be beautiful objects, the main role of artifacts like these is to support cooking practices. For example, if I decide to prepare fried eggs for lunch, I need all the abovementioned artifacts, as well as eggs, a spatula, oil, salt, a plate and a knife. If one of these is missing, I may try to substitute it with something else (e.g. oil with butter), or decide to change my menu and make something different.

While these are the most immediate artifacts and materials I need, they are connected to other designs. For example, the stove is electric, so it needs electricity that is delivered to me by the electric company through their network. The eggs and oil I get from a store and store them in my fridge (eggs) and on my table (oil), where they are in reserve until needed for cooking. The fridge depends on electricity, like the

stove. To be able to buy electricity and the raw materials, I need money which I get from my salary.

All in all, to be able to perform the practice that is in my focus here, to prepare eggs for lunch, I need to have a number of artifacts and materials in place and to be able to make them collaborate according to a pattern I know. I take the frying pan, place it on the stove, turn the heat on, pour some oil in the pan, take the eggs out of the fridge, break them onto the pan, and begin frying them. And so on. The successful performance of this practice requires that the artifacts perform their parts in the practice. The pan must be ready to receive the oil and the eggs, it must tolerate the heat and transfer it to the oil and the eggs, it must not stick into the food, and it must release the food when it is ready, and be easy to clean afterwards. The stove, the pan and the spatula, as well as the other components in this practice, must collaborate according to the way I want to use them. If they do not, I will probably replace them with something else that functions better according to my expectations and needs.

We are used to thinking about objects such as the frying pan as isolated entities, but as this example suggests, most artifacts are in fact connected to many others, when they become part of some practice. And when we begin to think about it, and follow the situations where an artifact is used for something, it most likely always happens in the context of some kind of practice that does involve other components, and where the success of the artifact depends on its ability to be compatible or collaborate with other artifacts, to support us to achieve our goal with our practice.

The "eggs for lunch" example presents a very cursory description of a very simple cooking practice. Cooking is an interesting area for the study of practices because there are vast resources of various kinds of descriptions of cooking. For example, there are many cookbooks that give recipes that explain the practices how to cook various dishes. People make notes of their own cooking, and parents write recipes and notes regarding cooking in order to pass on their specific family tradition to their offspring. There are many cooking programs on television, and a great number of cooking blogs on the internet. People exchange stories about their own cooking, and of the cooking of others. This is clearly a very popular area of everyday culture.

Many scholars writing about design and/or evolution have suggested that it is important to realize that design is a basic human activity, that in fact, the ability of the human species to design intentionally and to accumulate design within a culture that can be transferred to future generations, is the most significant factor that makes our species different from others. In the words of Victor Papanek:

> *"All men are designers. All that we do, almost all the time, is design, for design is basic to all human activity. The planning and patterning of any act toward a desired, foreseeable end constitutes the design process. Any attempt to separate design, to make it a thing-by-itself, works counter to the fact that design is the primary underlying matrix of life. Design is composing an epic poem, executing a mural, painting a masterpiece, writing a concerto. But design is also cleaning and reorganizing a desk drawer, pulling an impacted tooth, baking an apple pie, choosing sides for a backlot baseball game, and educating a child."*
> [24]

Several others [4, 17, 20] speak in a similar tone, highlighting the universality and ubiquity of intentional design as a fundamental human phenomenon. The other point worth noting is that the examples of design given by these writers do not always include the making of a physical, material artifact as the result of design. While it tends to be easiest for us to recognize design from material artifacts, there are also many immaterial designs, such as plans, social systems, rituals, songs and so on.

Design literature (e.g. those mentioned above) discusses design mostly as a phenomenon and as an intentional activity, but there are very few attempts to define what is *a design*. Often it appears to be implicitly just assumed that designs are outcomes of design activities. However, there is a common understanding that design also can be used to refer to the set of characteristics that define the structure and functionality of something, regardless of whether it was created by an intentional design activity. For example, things that result from biological or cultural evolution are often discussed as designs (e.g. [5, 6, 11, 13, 32, 33]). My position is that things that exhibit a design can be considered to have a design, regardless of what kind of process created that design. In many cases we have only the resulting designs available for study, with few reliable means to confirm the details of the processes

that created them. Due to the elusiveness of the topic, I am not able to present a proper definition of what is a design, but generally a design defines structure or form, and properties and functionality. A design can exist in the form of some description, without being implemented as an artifact; also something can exist and embody and manifest its design without there existing a separate description of the design anywhere. The same design may be implemented in many artifacts through some process of copying or reproduction. (For further discussion of what designs are and what are designs, see [15].)

Following this idea of design, also practices can be considered to be *designs*. The way I prepare my fried eggs is a design that I *reproduce* every time I perform the practice, more or less the same way. I have developed that practice over time, and because that design is so familiar to me, I can prepare the eggs without much *additional design effort*, unless there is something exceptional in the circumstances. The cooking related practices extend beyond the simple production of an artifact, some specific dish: we cook meals composed of many dishes, we plan them, we invite friends, prepare for it by furnishing our kitchen and stocking our reserves, and so on.

The design of a dish is not the same as the design of the practice of making a meal. When I design my lunch (of fried eggs), I do not start from scratch; I employ my *design toolkit* – for example my repertoire of recipes and the tools provided by my kitchen and typically make and adjust the plan as I cook. It is a very lightweight design task, because most of the components in the final design already exist, thanks to the toolkit I have accumulated over the years of my life. However, if I do not know how to fry eggs, or I lack something in the kitchen (e.g. there is no frying pan, or no electricity), I must design some new solution, or learn it from someone else or some resource, like the net or a book.

In the case of a more elaborate practice, for example a dinner party, the immaterial dimensions of the design effort and result become more evident: who should be invited and how, when should it take place, should there be some other program besides the meal, what should the meal contain, how to orchestrate the preparation of the dishes, how to make the guests feel welcome and relaxed, and so on. The artifacts, the meal, will play an important role, but the whole event and the process of

making it happen are a complex design that I need to take charge of, but which will also get significant design input from my guests.

The dinner party is also a good example of the significance of being able to influence the design of that event at a very detailed level. When cooking just for myself, I may be willing to accept less than delicious results, but in the case of the dinner party bad outcomes will make me unhappy and embarrassed, and I will do my best to secure beforehand that I can not fail, and I expect my artifacts in my design ecosystem to perform reliably and flawlessly to support me to achieve my goal. In general, people tend to pay attention differently to different kinds of things in life – that is part of what makes us individual and unique. However, most people have many areas of life where they are very particular about the design of their activities and where the details are of utmost importance.

Another aspect of practices as designs that can be explored through the dinner party example is the difference between a *social practice* [29, 30] and what I call an *individual practice*. "A dinner party" is a social practice – a well known and understood design for a certain type of event, within a certain cultural sphere. Most people in my environment will understand quite well what it means if I invite them to join me for a dinner in my home. However, when I host a dinner, I will design my own implementation of it, an individual version of that generic social practice. This I always need to do, because my own context is different compared to a generic idea of a dinner. An individual performance of a social practice must always be adapted to the personal context and circumstances of the individual in question, as well as to the time and space and social context where it is located. This means that even though there may exist a generic design for a social practice, the performance of an individual practice always requires some extent of adaptation and thus design.

This interplay between the generic designs – e.g. of social practices and of artifacts employed in them – and the particular designs – my own unique, individual and contextual adaptation and modification of the generic design – is a central characteristic of everyday life. We expect that a dinner party will be enjoyable because it is partly similar to other dinner parties, so that we know to some extent what to expect, but importantly also different and unique, so that it will not be

boring. The generic designs are part of our everyday life design toolkit that we acquire from our social environment and from the market, in order to organize and design our own life activities in a way that we want.

The kitchen is a special facility in my home, specifically designed and furnished as a generic environment to support many different cooking activities. The artifacts are chosen to accommodate the variety of foods and cooking methods that I foresee myself using, and of course, my apartment was already furnished with many basic components that are common for cooking in Finland, before I moved in. The pots and pans support the cooking of many kinds of dishes, and I have selected them to accommodate the normal variety of my personal cooking. The stove is a generic tool for heating any of my pots and pans that are meant for heating, and the fridge is a generic tool for storing any food that needs to be kept cool. With all these and other features, the kitchen functions as a *design platform* for cooking: it is an environment where various design activities can take place and where various new designs can be created easily. It provides services that are generally needed for cooking, such as frozen, cool and room temperature storage, ways to clean, cut and mix raw materials, heating, and so on. When I want to prepare a roast in the oven, I only need to acquire the meat and fresh herbs, as my kitchen already contains all the other ingredients and equipment for making it, and I have all the necessary knowledge and a generic design of the practice in my cooking repertoire.

The kitchen is an example of a design platform that I have largely composed myself. There are also design platforms that are designed by some other actor or vendor, that exist for the purpose of supporting further design activities with their services. Examples of such platforms are the monetary system; electricity grid; water and sewage system; public transport; schools and universities; the market; a mall; and so on. A building with its management functions can be thought of as a platform for living. When I buy or rent an apartment, I do not have to concern myself personally with the cleaning and management of the building, as the company that owns the building will take care of these on my behalf. I can concentrate on the design of my personal life and leave the common concerns of the building to the management company. (More about platforms: [8])

The final concept that I want to introduce still in the kitchen is the *design space* [2]. My kitchen, my resources (time, money, materials, available sources for materials and information, network of friends) and my abilities create and delimit a space of opportunities for design. When I consider making a meal tonight, I have to consider what I have in storage, what I might want to consider buying, whether the stores are still open, what I know how to cook, what I could learn to cook using my cookbooks, the internet and my friends' advice, what equipment I have available, what I can imagine, and the resulting options that may come to my mind and I can realistically consider to make, all together form my design space in that particular situation. My design space considering a dinner party will be probably very different, as there will be different considerations in terms of time, effort, desired qualities and so on. If I am travelling in a foreign city and staying at a hotel, my design space for cooking is probably extremely limited – maybe the room has only a water heater, which rules out most kinds of cooking. However, I may have a very broad and interesting design space for planning a delicious dinner experience, if I am ready to include restaurants in my design toolkit in that situation. The design space is thus a dynamically changing space that contracts and expands depending on the applicable constraints and the resources, capabilities and components that are available at any particular moment in my design toolkit.

3. Digitalization and digital technology

My kitchen design ecosystem is mostly based on non-digital technology. However, most other areas of my everyday life practices have, during only a couple of decades, become increasingly permeated by digital technology, in a transformation – a *digitalization* process of society – that continues in an accelerating pace [16]. In the sphere of everyday life, people acquire new digital devices and software that they use to take care of a growing share of functions within their practices. While the first digital device that entered homes was probably the digital clock, it is the personal computer that really began the transformation of everyday life practices, because it was the first programmable, truly multifunctional digital device that entered the home. After the time of the first personal computers, we have witnessed the transformation of almost all kinds of mechanical and electronic devices to be based

on digital electronics. For example, our telephones, cameras, media devices, temperature meters and scales are now increasingly digital.

The essential special characteristic of digital technology is that as at its core is always a programmable computer, it is flexible in its functionality – it can in theory be programmed to do anything that can be described as a program. A digital device thus always contains two essential, complementary elements: 1) the *hardware*, that consists of the computer that runs the programs, and its peripheral circuits that provide it with means for input and output of information, such as network connections and user interfaces; and 2) the *software*, the complex set of interacting programs that control what the computer does. Because of this programmability, the computer is a *metamedium*, as famously suggested by Alan Kay in 1977 [9], that can function like any other medium if programmed appropriately. This metamedium nature of the computer has enabled it to become the new core technology utilized in all areas of life, and to replace the earlier analog electronics, for example in all kinds of media and communication devices. When one type of technology can be used for a great variety of design configurations, the flexible solution can become enormously competitive through economies of scale and replace the earlier diverse static solutions. Thus, over the past couple of decades, most electronic devices quickly turned into digitally powered ones, housing a computer inside even when they may have maintained the same plain outward appearance.

When devices become digital metamedia, that creates a new potential: they can now support new functionality and flexibility in the form of further programmability. Thus a mobile phone has evolved from just a telephone into a multifunctional smart phone, a design platform that can be modified by installing new software applications into it. Televisions are in the process of becoming smart, by supporting the installation of new functionality as software components. And so on.

The proliferation of digital devices have thus created a significant novel design environment for humankind. A new software application can be designed, copied and distributed to millions of people in hours or days, without using and wasting any material resources. This lowers the costs of design, production and distribution and speeds up the cycle of *design evolution* significantly.

With new applications, I can turn my computer or smart phone into a calendar, an address book, an email device, a book reader and so on. When I start to use a digital calendar, I do not necessarily need a physical calendar any more. When my music becomes digital and is stored in my computer or music player's hard disk, I do not need to use my CDs and the CD player any more. In this way, the digital devices and their fast evolving software solutions take over increasing responsibilities of supporting my everyday life practices, and tend to replace and render obsolete the earlier material artifacts that performed the same function.

As these digital solutions all use digital information formats, it is technically possible for them to interact and exchange information, if they are programmed to do so. In fact, many applications are designed to work together. For example, in my mobile phone, when I want to make a call to a friend, I select my friend's name from my address book and make a call by pressing the call button, and the activity is taken over by the telephone application. When I receive an email from a friend about an event that includes a link to a Google Map, I can touch the link in the email and I will be transferred to the map. It is thus one of the important benefits of software that various software components and applications can be designed to work together. This means that every software application does not need to incorporate all of the functions that it needs to perform its services, if it is possible to get those services from some other software instead. In reality, all digital devices run many software applications that have many dependencies and information flows between them, and these devices are thus complex *digital design ecosystems* on their own.

The most important software in any digital device is its *operating system.* The operating system governs the whole device and provides many basic services to all other software on the device. Any other software on the device is thus completely dependent on the operating system's support. If, for some reason, the operating system refuses its support or is incompatible with the other software, that other dependent software will not be able to perform its services or in the worst case, will not run at all. This highlights the *dualistic character* of the digital environment: while it is inherently *flexible* in the sense that its functionality can be changed by simply modifying the software, it is at the same time completely *rigid* in the sense that software must follow very strict grammar rules and constraints set by the operating

environment. The flexibility can only be implemented within the boundaries of these rules and constraints. If the rules are not followed, for example when the software contains a bug or its binary code becomes corrupt through some data storage error, or if the rules in the environment are changed, the software will not function any more.

This total dependency gives the operating systems and their makers and designers a very unique position of power and control in the digital design ecosystems.

4. The personal digital ecosystem

I define the personal digital ecosystem as a design ecosystem that consists of the digital devices, software systems and digital data that a person uses or interacts with within her practices, as well as some other, non-digital elements that are integral for its functions and phenomena. It may contain things such as computers, mobile phones, digital televisions, network routers, cables, hard disks, printers, memory sticks, CD and DVD discs, screens, mice, remote controls, various software, data and external services. And like in the case of the kitchen, these are organized into a working configuration by the individual's practices.

Much like the kitchen that is preconfigured when I move in, also digital devices are typically preconfigured to some extent when they enter my life, most often equipped with an operating system and some basic standard software applications.

However, as digital devices are themselves already complex design ecosystems with a lot of built-in flexibility, when I begin to use them, I most often need to configure them and adapt them to my particular circumstances. Increasingly, these devices are expected to be customized to be administered by one person who has the ability to control all of the device's functions. This is a trend that relates to the increasing number of internal and external services that we use that require some kind of user account that is tied to the customer's identity. In the configuration process, the new device is tied to my internet connections, communication accounts, other devices in the network, and other local circumstances. As soon as I start to use it, I install my own data such as information about my social network, and my communication and

media preferences. After I have used it for a while, the system accumulates data from and through my practices; documents, logs, messages, and media.

Hence, when I start to actually use a device and its services, it becomes quickly adapted and connected to my ecosystem and thus its design changes from a generic one to a particular, idiosyncratic one (a process also called *domestication*, see [12], [23]). The same pattern applies not only to devices, but also to every new service and software application that I begin to use. The configurations that are continuously adjusted and customized to match the evolution of my practices and the accumulated digital data grow to become essential *resources* for my life and practices.

One big difference between the kitchen ecosystem and the digital ecosystem is the especially powerful role of the operating systems as the fundamental design platforms that everything else depends on the digital devices. The most popular end-user operating systems (Windows, OS X, iOS, Android) are under the exclusive control of their makers, and thus they implement designs and policies that these corporations define. For me, this means that the platforms are configured and operated according to some policies that I can not change, even if I would like to. Thus, my freedom to define and design my own ecosystem is more restricted than in the kitchen. For example, in some situations I can not decide which software applications I may use for certain functions, as the operating system owner will make those decisions for me (e.g. in conjunction with the iOS 6 upgrade, Apple removed the Maps application made by Google from their customers' phones and replaced it with their own Apple Maps application).

However, like in the case of the kitchen, my digital ecosystem is most importantly organized by my practices. The devices and the software in them are for all practical purposes dead unless I take them up and employ them in some of my practices. A device sitting idle on the shelf, or an app that I never start, do not have any significant effects or consequences for my life. For example, I use my phone, my email, or text messages because I need to communicate with some people. But these needs are usually connected to more complex practices that employ also other software and services. For example, I may plan to arrange an event for a group of friends to go to the theatre together. This plan is a project that may require me to use

several different components to realize: Facebook, email, Google Maps, the website of the theatre, the ticket agency, and a Doodle Poll (a web based service for selecting a date between a group of people), for example. These components do not provide any kind of coordinated event organization service to me; instead they each provide a service that I need to mobilize towards that end as a part of a composition, by employing them and operating them with skill and a design intention. I thus design ad hoc an individual practice that is adapted to my idiosyncratic need, context and circumstances, using these existing artifacts as my design toolkit.

One important area of contemporary digital practices are various media related practices. In my home, I have several shelves of non-digital media, such as LP records, CDs, cassette tapes, videotapes, slides and books. They testify that various media, both commercial and self produced have over the years had great significance for me. Lately, a very large share of all new media that I create, receive and use has turned into a digital format, and it is manipulated, stored and viewed exclusively with digital devices. This is an area of the digital ecosystem that is being transformed especially fast. Both my practices and the equipment (devices, software, services) I use change significantly every year, through many small and large, often unpredictable, mostly externally determined events. These changes are not always easy to manage, because the products provided by the industry do not usually take into account the whole of my ecosystem. It is not easy to manage the collections of media that result from many different media systems that do not share any common media and metadata management, archival, cataloguing or backup features. It is a real and serious concern that due to such difficulties, many families risk losing some of their important digital memories.

5. Discussion

How does the digital design ecosystem differ from the kitchen ecosystem, and why is it useful to think about the digital environment as an ecosystem? The key differences are:

1. the designs in the digital ecosystem are tied to other components in their ecosystem more strongly (the function of a component depends on the

function of another one) and deeply (the dependent functions are essential for the general functionality of the components)

2. the evolution of the digital ecosystem is extremely fast due to both internal and external changes, and because of the strong and deep dependencies, changes in one component often create strong pressures for other components to change as well

3. the digital platforms are being employed in very comprehensive and integrative ways to all kinds of practices, which means that their effects, benefits as well as risks and problems are more totalitarian than those of the non-digital ones

4. personal digital ecosystems evolve into very idiosyncratic designs, which makes it impossible to manage and solve their design issues successfully with external generic designs; as they grow, and their design complexity grows, they demand increasingly local design efforts – which are increasingly carried out by the owners themselves

It is useful to consider the digital environment as an ecosystem because:

1. because of such high degree of ecosystemic integration, it is essential to understand the wider ecosystem to achieve a general understanding of the ways how people use digital technology in everyday life

2. when designing digital products that will end up as components in the diverse personal digital ecosystems, it is important to foresee the ecosystemic connections, as well as the evolution of the ecosystem, and design to support them

3. for the owners of digital ecosystems, it is useful to become aware of the nature of the digital ecosystem, and to understand the risks and dependencies it creates, and the design, maintenance and management requirements that it creates for the owner

4. for the society, it is important to realize that the everyday life of the citizens is fast becoming digital, and turning their ability to live their everyday life according to their preferences quickly highly dependent on the software and service evolution that is controlled by a handful of large corporations

Compared to the other ideas regarding digital environments by other authors mentioned in the introduction, the design ecosystem idea is in my view a useful foundation because it is on a higher abstraction level and thus more generic and applicable in the same form to all kinds of ecosystems – for example natural ecosystems [22] and business ecosystems [1, 18].

Compared to the term "ecology" [19] or "landscape" [34], I believe that the evolutionary history of the concept [10] and the earlier meanings and uses of the term "ecosystem" fit the use that is being discussed here best, and it thus carries along most support through analogy, especially when with the design ecosystem concept I have established a "common ancestor concept" for such various, more specific, types of ecosystems.

In the field of ecology, the term "ecology" itself is not used to describe an *environment* in the same fashion as it is used in the ICT literature (e.g. "the library as an ecology" [19]); instead, there the term refers to the *study* or the *set of knowledge* about something within its environment (e.g. "the ecology of a bacteria" [7]). However, in other areas where ecological thinking has been developed (e.g. ICT, human ecology, organizational ecology, media ecology, etc.), the term "ecology" often refers to an environment with all its entities, which is described as an ecology of a certain kind. This usage justifies such use of that word also in the current context, but I propose that here "ecology" should be used to refer to the generic nature of the environment when great specificity or analysis of the dependencies between the entities belonging to it is not required, whereas "ecosystem" should refer to particular, specific, situated and real systems with some boundaries, criteria of inclusion/exclusion, connections and dependencies. For example, "the contemporary digital ecology" could refer to a totality of digital entities, while "my digital ecosystem" would refer specifically to those components that I have in my use, configured in specific ways and mobilized through my practices.

Also, while the approach, concerns and insights of Stolterman, Jung, Ryan, and Siegel [34] are by and large very compatible and close to mine, there are some important differences. They have chosen to focus on interactive devices as the basic units of analysis, while I talk about digital designs. They ground their decision on the finding that people generally consider their devices as the "things" they use, even though the devices may host and take care of many different software systems and functionalities. I agree with the relevance of this finding, but it also seems to be so that as the complexity of the whole ecosystem grows, there are more breakdowns and other circumstances that require people to acquire clearer understanding of the inner complexity of their systems, as they have to act as the system managers and maintain the continuity of their practices across multiple cycles of upgrades and device and software changes. People seem to be already quite knowledgeable of various software components and applications they need to purchase, install, upgrade, backup and transfer between devices, as well as pay attention to files, databases, messages, address books and so on. Also, many of the actions, problems and concerns take place within one device, in interactions between software components, or between only very specific components in different devices; and finally, the evolution of the software environment within any device may be so rapid that the device changes its functionality – for the good or the bad – very fundamentally over a short period of time. Thus, it appears to me that an ecosystemic approach needs to be able to dig deeper into the nested design ecosystems also within the devices, which my focus on designs as opposed to devices allows.

To conclude, I reiterate that the owner's practices should be considered as the main organizing structures that establish order and connections within personal digital ecosystems. The artifacts are employed in practices and have in each practice a limited role based on what contribution they can make. I believe that it would be important for designers to realize that 1) *practices are the central field where everyday life design takes place daily*, with the various *digital tools forming their design toolkit*, and that 2) their *designs should aim to become trusted and persistent building blocks* within the *personal digital ecosystem*.

In order to succeed, designers should therefore strive to design for 1) *ecosystemic awareness, competence and sustainability* – so that their designs contribute to the *functionality and sustainability of the whole ecosystem*, through *desirable performance* instead of hostile takeover and lock-in; as well as 2) *designability* – so that their design supports *further design and reliable adaptations by the owner.*

6. References

[1]   Botero, A., Karhu, K. and Vihavainen, S. (2012) *Exploring the Ecosystems and Principles of Community Innovation*, Media in the Ubiquitous Era, A. Lugmayr, H. Franssila, P. Näränen, O. Sotamaa, J. Vanhala, and Z. Yu, eds., IGI Global, pp 216–234.

[2]   Botero, A., Kommonen, K.-H. and Marttila, S. (2010) *Expanding Design Space: Design-In-Use Activities and Strategies*, Design & Complexity: Design Research Society International Conference Montreal, Canada, 2010, pp 18.

[3]   De Certeau, M., Giard, L. and Mayol, P. (1998) *The Practice of Everyday Life*, University of Minnesota Press.

[4]   Cross, N. (2011) Design thinking: understanding how designers think and work, Berg.

[5]   Dennett, D.C. (1995) Darwin's dangerous idea: evolution and the meanings of life, Simon & Schuster.

[6]   Everett, D.L. (2013) *Language: the cultural tool*, Profile.

[7]   Fliermans, C.B. and Brock, T.D. (1972) *Ecology of Sulfur-Oxidizing Bacteria in Hot Acid Soils*, Journal of Bacteriology, vol. 111, no. 2, Aug 1972, pp 343–350.

[8]   Gawer, A. (2009) *Platforms, markets, and innovation*, Edward Elgar.

[9]   Goldberg, A. and Kay, A. (2003) *Personal Dynamic Media*, The NewMediaReader, N. Wardrip-Fruin and N. Montfort, eds., MIT Press.

[10]   Golley, F.B. (1993) A history of the ecosystem concept in ecology: more than the sum of the parts, Yale University Press.

[11]   Gould, S.J. and Lewontin, R.C. (1979) *The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme*, Proceedings of the Royal Society of London. Series B. Biological Sciences, vol. 205, no. 1161, Sep 1979, pp 581–598.

[12]   Haddon, L. (2011) Domestication Analysis, Objects of Study, and the Centrality of Technologies in Everyday Life, Canadian Journal of Communication, vol. 36, no. 2, Aug 2011.

[13]   Hansell, M. (2009) Built by Animals: The natural history of animal architecture, OUP Oxford.

[14]   Jung, H., Stolterman, E., Ryan, W., Thompson, T. and Siegel, M. (2008) *Toward a framework for ecologies of artifacts: how are digital artifacts interconnected within a personal life?*, Proceedings of the 5th Nordic conference on Human-computer interaction: building bridges New York, NY, USA, 2008, pp 201–210.

[15] Kommonen, K.-H. (2013) *Design Ecosystems as the Landscapes for Co-Creation*, Proceedings of the CO-CREATE 2013 - The Boundary-Crossing Conference on Co-Design in Innovation, Espoo, 16-19 June, 2013. Espoo, Finland, Jun, 2013, pp 728.

[16] Kommonen, K.-H. (2002) *Design for Society in Transformation*, Special Issue of Japanese Society for the Science of Design, vol. 9, no. 3, 2002, pp 83–88.

[17] Krippendorff, K. (2006) *The semantic turn: a new foundation for design*, CRC/Taylor & Francis.

[18] Moore, J.F. (1993) *Predators and prey: a new ecology of competition*, Harvard business review, vol. 71, no. 3, Jun 1993, pp 75–86.

[19] Nardi, B. and O'Day, V. (1999) Information Ecologies: Using Technology with Heart : Chapter Four: Information Ecologies, First Monday, vol. 4, no. 5, May 1999.

[20] Nelson, H.G. and Stolterman, E. (2012) *The design way: intentional change in an unpredictable world*, The MIT Press.

[21] Odom, W., Blevis, E. and Stolterman, E. (2008) *SUSTAINABLY OURS: Personal inventories in the context of sustainability and interaction design*, interactions, vol. 15, no. 5, Sep 2008, pp 16–20.

[22] Odum, E.P. and Barrett, G.W. (2005) *Fundamentals of ecology*, Thomson Brooks/Cole.

[23] Pantzar, M. (1997) Domestication of Everyday Life Technology: Dynamic Views on the Social Histories of Artifacts, Design Issues, vol. 13, no. 3, 1997, pp 52.

[24] Papanek, V.J. (1971) Design for the real world: human ecology and social change., Thames and Hudson.

[25] Pink, S. (2012) Situating everyday life: practices and places, SAGE.

[26] Reckwitz, A. (2002) *Toward a Theory of Social Practices: A Development in Culturalist Theorizing*, European Journal of Social Theory, vol. 5, no. 2, May 2002, pp 243–263.

[27] Ryan, W., Stolterman, E., Jung, H., Siegel, M., Thompson, T. and Hazlewood, W.R. (2009) *Device ecology mapper: a tool for studying users' ecosystems of interactive artifacts*, CHI '09 Extended Abstracts on Human Factors in Computing Systems New York, NY, USA, 2009, pp 4327–4332.

[28] Schatzki, T.R. (1996) Social practices: a Wittgensteinian approach to human activity and the social, Cambridge University Press.

[29] Schatzki, T.R. (2002) The site of the social: a philosophical account of the constitution of social life and change, Pennsylvania State University Press.

[30] Shove, E., Pantzar, M. and Watson, M. (2012) *The Dynamics of Social Practice: Everyday Life and How It Changes*, SAGE Publications.

[31] Shove, E., Watson, M., Hand, M. and Ingram, J. (2007) *The Design of Everyday Life*, Berg.

[32] Smith, J.M. (1995) *Genes, Memes, & Minds*, The New York Review of Books.

[33] Steadman, P. (2008) The Evolution of Designs: Biological Analogy in Architecture and the Applied Arts, Routledge.

[34] Stolterman, E., Jung, H., Ryan, W. and Siegel, M.A. *Device Landscapes: A New Challenge to Interaction Design and HCI Research*, Journal of Korean Society of Design Science, vol. 26, no. 2, pp 2 – 29.

[35] Tungare, M. (2007) *Understanding the Evolution of Users' Personal Information Management Practices*, Human-Computer Interaction – INTERACT 2007, C. Baranauskas, P. Palanque, J. Abascal, and S.D.J. Barbosa, eds., Springer Berlin Heidelberg, pp 586–591.

[36]   Tungare, M., Pyla, P.S., Pérez-Quiñones, M. and Harrison, S. (2006) *Personal Information Ecosystems and Implications for Design*, Technical Report #cs/0612081.

4. Are the Users Driving, and How Open is Open?
Experiences from Living Lab and User Driven Innovation projects (2013)

Kari-Hans Kommonen, Andrea Botero (kari-hans.kommonen@aalto.fi, andrea.botero@aalto.fi)

Media Lab, Department of Media, Aalto University, School of Arts, Design and Architecture

Abstract

This article reflects on the experiences of three projects in Helsinki, Finland, that aimed to develop organic connections between technology development and local communities of people. Based on the experiences, we argue that although Living Labs present a commendable ideal of "co-creation and user driven open innovation with communities", the way they are typically set up and designed (focused on supporting enterprises, with very restricted access to the eventual user innovations) makes it hard to realize this ideal. We argue that to turn the ideal into a realisable proposition, developments in three directions should take place: 1) a distinction should be made between "user involvement" and "user driven innovation", 2) efforts in research and facilitation should be directed more ambitiously from simply realizing the former towards supporting the emergence of the latter, and 3) new terminology and more explicit discussion and policies regarding the "openness" of Living Labs should be put in place. The article concludes with recommendations for future Living Lab activities.

As the number of Living Labs has grown to the hundreds[6], there are almost as many definitions for what the concept Living Lab means (Almirall, 2008; Følstad, 2008; Orava, 2009). Central to the "ideal" concept of Living Lab is the opportunity to develop a more proactive role for users and user communities in driving developments and to do it in open ways[7]. We consider this definition by Feurstein et al. as fairly representative of many current initiatives:

> *"[Living Lab] is a systemic innovation approach in which all stakeholders in a product, service or application participate directly in the development process. It refers to a research and development (R&D) methodology in which innovations are created and validated collaboratively in multi-contextual, empirical real-world environments." (Feurstein, Hesmer, Hribernik, Thoben, & Schumacher, 2008)*

However, based on our experience, both the "ideal" of Living lab as well as the theoretical descriptions represent exactly that: an ideal that has not yet been realized in practice.

To proceed towards the ideal, we believe it would be beneficial for those involved in Living Lab activities to make a clearer distinction between *user involvement* and *user driven innovation*. This would make it possible to develop approaches to further both of these activities better. In addition, there seems to be a conflict between *two meanings of open innovation* that we believe Living Labs need to address consistently.

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[6] The European network of Living Labs alone list around 250 Living Labs in their site http://www.openlivinglabs.eu/. There are also similar developments in China and other parts of Asia.

[7] For example the current definition in Wikipedia mentions both "user empowerment" and "open environment" as qualities of the Living lab approach (http://en.wikipedia.org/wiki/Living_lab). Similar rhetoric is found in the European Commission report "Advancing and applying Living Lab methodologies. An update on Living Labs for user-driven open innovation in the ICT domain." (2010) (http://ec.europa.eu/information_society/activities/livinglabs/docs/pdf/newwebpdf/living-lab-brochure2010_en.pdf)

To elaborate this argument, our article reflects on the experiences of three projects in Helsinki, Finland, that we have participated in and that have aimed to develop organic connections between technology development and local communities of people. We will discuss these projects to evaluate and summarize some of the experiences, in the light of the role that communities play and could play in innovation processes and technology co-creation.

Setting the stage

Over the past decade, our research group[8] has initiated several projects to find ways to facilitate how people could influence the development of tools, systems and services for their own digital practices. Because of this interest, we have also been part of several initiatives that aimed to develop the Living Lab approach in Helsinki. While both our own research agenda and the Living Lab approach share many aims and characteristics, the approaches have also some differences. It is also worth noting that while the three projects presented here had different aims, they all shared a basic premise: the vision that new technology could and should be developed in close collaboration with people.

Helsinki Living Lab (HLL)

The Helsinki Living Lab (HLL) project (2007-2008) had the objective to develop user-driven innovation know-how in Arabianranta region, the district where our university is located. The strategy followed was of involving close to 20 different actors (from universities to small companies and resident communities) in concrete cases that experiment with Living Lab approaches to innovation and design. The

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[8] The Arki research group in the Media Lab of the Aalto University School of Arts, Design and Architecture studies the digitalization of everyday life, tries to make sense of the positive and negative potential that creates, and attempts to develop means for design to further the realization of the positive opportunities in society. See http://arki.mlog.taik.fi

ultimate aim was to develop a service concept based on the experiences. The project was initiated by the local development agency (Art and Design City Oy) with funding from the Finnish Funding Agency for Technology and Innovation (Tekes)[9]. Our role in the project was to contribute to the development of the Living Lab concept in this context and to its working methods. Within some of the cases, we developed and experimented with different tools and means to approach Arabianranta residents and stakeholders as co-designers.

One case that we worked with illuminates some of the contradictions we want to bring forth particularly well. In this case, we developed a set of activities for collaboratively mapping everyday practices (Botero, Naukkarinen, & Saad-Sulonen, 2008). The work helped to understand how a specific product, at beta stage in that moment, related to the current everyday practices of the users, and specifically aimed to envision new features and development directions for the product; something both we and the users involved believed would be highly valuable for the enterprise we worked with, according to the presumed mission of the Living Lab.

However, during the course of the project it became evident that the company involved was first and foremost interested in "user testing" specific product features. While they thought the results of our work with users were interesting, they were not planning to or even prepared to consider more far-reaching propositions. There was no way for the resulting insights to be incorporated in further iterations and no particular provision in the company's development process for responding in an agile way to even the minor development ideas that resulted. Furthermore, as the work was done under strict non-disclosure agreements, the results we have been able to publish and share represent only a small part of what could be generally useful. As the originating company did not have a compatible interest, and as the results could not be shared with any other actor that might have an interest to realize them, most of the ideas and insights that the users created for new products or features, and more importantly the related practices that where identified (the "user innovations"),

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[9] Tekes is the main public funding organisation for research, development and innovation in Finland, financed by the Ministry of Employment and the Economy. See http://www.tekes.fi/en

did not result in any new products or business opportunities for the company, nor in any practical benefits for the participating "user innovators".

As a result of the whole project, a concept for the Helsinki Living Lab was presented[10] and elaborated. In general terms, it can be said that this has strengthened the potential of the area as "living lab". In fact, Arabianranta continues to be marketed as such, but just what really that means in practice is far from clear, not only from the point of view of the participating institutions, but it is also evident in the mixed feelings that arise in the local community[11].

User Driven Open Innovation Booster (UDOI)

After the experiences with the HLL project, we were part of a larger consortium project called User Driven Open Innovation Booster (UDOI) (2008-2010), aimed at bringing together businesses and research institutions (around 15 of them) to develop, pilot and deploy service innovations in collaboration with user communities. This time, user collaborations were not limited to Arabianranta.

Initially the project had an ambitious goal of developing a networked living lab system and developing the core competences for User Driven Innovation for supporting R&D activities in Finland; as this was a core part of a new scheme for developing R&D activities with private and public funding called Tivit[12]. After a long design and planning process in which we actively participated that created a plan that the participating actors considered feasible, the project direction was changed. This

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[10] In particular through the initiative of Helsinki Living Lab promoted by Forum Virium, ADC Oy and the regional development office of Helsinki. Further information on this development can be followed in the website. http://www.helsinkilivinglab.fi

[11] For an overview of how the area is presented as a Living Lab see: http://www.openlivinglabs.eu/helsinki.html To review some earlier mixed feelings of the local community related to their neighborhood as a "test bed" see e.g. Kangasoja (2007).

[12] Tivit Oy is a company set up by Finnish industry and research institutions to develop industry driven R&D with specifically allocated public funding from Tekes; see: http://www.tivit.fi/en/ . UDOI Booster project: http://www.flexibleservices.fi/en/node/24

was mostly due to lack of sufficient industrial interest to participate in the funding, which resulted in a drastic budget cut (around 75 % from the original 4.3 MEUR, still with 13 partners). The project's goals were scaled down and focused away from living lab development. Instead, funders insisted that the activities should support targeted user involvement, to produce direct input for selected cases provided by participant companies in the larger Flexible Services research consortium.

From the point of view of our research interests, the refocusing changed the nature of the project completely, and effectively stripped the project from realistic opportunities to research and develop user driven innovation activities in practice. There was no space for investing in building more long-term partnerships with user communities, nor for exploring ideas that would come from sources different than the already pre-established ones. We continued facilitating user involvement in three cases (e.g. Naukkarinen, Sutela, Botero, & Kommonen, 2009; Naukkarinen, Sutela, Botero, & Hyyppä, 2010) and reflected on user involvement in innovation in general (e.g.: Botero, Vihavainen, & Karhu, 2009; Botero, Karhu, Vihavainen 2012). However, the user "driven" dimensions of the whole endeavour became very thin.

Emerging Digital Practices of Communities (ADIK)

In contrast to the previous two projects, the Emerging Digital Practices of Communities (ADIK[13]) project (2004-2007) was initiated by our research group, with mostly public funding, but also with support from two large companies[14]. It studied different ways in which new digital tools give room to the emergence of new practices and, conversely, how people through their practices transform and complement these new tools. Our approach was to engage in collaborative work with communities of people that could have practices that in our judgement could, if

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[13] The acronym derives from the Finnish name of the project. Further information about it can be accessed at https://reseda.taik.fi/Taik/jsp/taik/Research.jsp?id=28237

[14] Like the two other projects, ADIK was funded by Tekes, the Finnish Funding Agency for Technology and Innovation, with support from Nokia and Elisa.

facilitated with new technology, evolve to include new features that would take advantage of some digital capabilities[15].

From the point of view of User Driven Innovation, one of the communities we worked with, an association of Active Seniors, is especially interesting. They are a community that has been formed specifically for the purpose of creating a social innovation: a collective housing arrangement and an alternative way of growing old together that the seniors called Loppukiri[16] (Botero & Kommonen, 2009a, 2009b; Botero & Hyysalo, forthcoming, Dahlström & Minkkinen, 2009). This background meant that they were positively predisposed to a design collaboration, as they had already embarked on a long term design mission regarding the organization of their own future lives, and were well prepared and interested to consider also the design of the technological circumstances within that new future lifestyle.

During several years of the collaboration (which in fact started already before the ADIK project, in 2002), we explored their current and possible future practices through many types of activities and prototypes, and finally as one of the results, developed a prototype information system that the seniors call the "Everyday Life Management System" of their house. This system was in effect co-designed with the seniors and mostly implemented by our team. It has been put into use in the community since they moved into their common housing arrangement as a way to facilitate some of their novel practices, e.g. the organization of the process of preparing their common daily meals and dealing with the shared spaces (Botero & Kommonen, 2009b; Botero & Hyysalo, forthcoming).

We believe that their case sheds light on the dynamics of new forms of social collectivity, which challenge our established modes of politics and tradition (Maffesoli, 1996) and the possibilities of organizing collaborative production

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[15] The approach is largely inspired by the Scandinavian Participatory Design experience (See e.g Greenbaum & Kyng, 1991)

[16] Loppukiri means "last spurt" in English.. In practice it means a co-housing arrangement with 58 small flats and large shared facilities where inhabitants aim at growing together old. A video describing our collaboration with Loppukiri can be found at http://vimeo.com/15256102

activities that might represent more accurately real sites of collective innovation. Through their activities, this community is experimenting and creating models that can be appropriated and further developed by other communities and the Finnish society in general[17].

As this project was completed already when we participated in the Living Lab projects presented earlier, we attempted to bring these communities and the community and practice driven approaches utilized in this project also into the other two projects. Unfortunately, we were not successful in that, for a variety of reasons, mostly because of the strong focus on producing results specifically for the participating companies.

In spite of this, the initiative of the seniors, Loppukiri, is often presented by the Living Lab proponents as a prime example of Living Labs – a position we agree with – but, ironically, it has been developed completely outside of any "Living Lab" projects and without any Living Lab funding. Equally sadly, despite its strong appeal as an example of successful Living Lab activity, it appears that none of the various current Living Lab funding opportunities would offer any instruments to support them.

Users – involved or driving?

A key idea in Living Labs, which we characterize as *user involvement*, seems to be to connect technology developers to communities in order to introduce, in some way or another, the realism of everyday life into the development process. This can happen in various ways – for example through user testing, ideation, user centered design – depending on the ability of the living lab customer, the company, to incorporate such contributions to their product development process. Our experiences from HLL and UDOI are examples of how these types of "Living Lab" initiatives were geared

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[17] As a matter of fact there are already more than 6 other groups in the country engaged in planning, developing and replicating some of the ideas developed by the seniors. For more information about their project visit: http://www.loppukiri.fi/yhteystiedot.htm

towards organizing and streamlining user involvement activities for a narrow product development process, which also resonated well with the expectations of most of the participating enterprises.

These involvements are thus *producer driven*; a company defines the interest and the aims, users are involved as informants and recruited for the purpose, and the process and its results are closed from external participants. This development is congruent with what in marketing and management is usually referred to as co-creation and customer centric approaches (e.g.: Prahalad & Ramaswamy, 2004). A focus on user involvement takes advantage of and links Living Labs to the extensive body of knowledge developed around users as important sources of innovation (von Hippel 1988, 2005). Furthermore, Living labs have been able to tap into the experiences of the user-centered design movement (as developed in fields like Human Computer Interaction) and their breath of methods for user studies. In this kind of *producer driven user involvement* the challenge for a Living Lab seems to be more about their ability to develop and market these types of services to companies and to increase the participant companies' capacities to take advantage of user involvement. This is an important goal and a beneficial activity in the sense that it may increase the quality and fit of industrial products. However, such harvesting of product related input from people does not necessarily further user community based innovation.

In contrast, the more ambitious ideal of Living Labs, as environments for *systemic user driven innovation and co-creation* appears to require a different set of starting conditions. Unfortunately, a Living Lab where communities are also empowered and not simply used as a resource does not seem to be an easy extension of user involvement activities. This might be because having new actors "driving" the agenda does not necessarily fit comfortably into the same circumstances. Communities, or users and their interests, are not initiating or driving developments in any Living Labs that we have experience of, and while interesting experiments are taking place in Cornellà (Colobrans, 2010), Malmö (Björgvinsson, Ehn, & Hillgren, 2010, 2012) and Milano (Cantou, Corubolo, Simeone, 2012), we are not aware of any systematic user driven approach of creating innovations that would be in use with effective results in Living Labs.

There are many factors influencing this; we believe four reasons are particularly salient:

- the main interests driving the development of Living Labs are not focused on seeking and facilitating innovations that interest people as much as innovations that interest companies;

- within their practices and processes, enterprises have typically no suitable place of entry for external innovation (e.g. a radical proposal initiated by user communities) to enter the product and business development cycle; they are not looking for such input and have generally no mechanism to make use of something that does not fit as an improvement into an already existing product line;

- Living Lab projects invest most of their funds to organizing services for companies and extremely little – if any – on research and development of ways to discover and facilitate innovation by users and communities (actors that are not organized as a firm); and finally:

- most participating actors simply do not perceive or worry about a distinction between user involvement and user driven activities – for many, any means of including the user in the innovation process justifies calling it "user driven".

In reality, this lack of support and interest for the more radical aspects of a Living Lab approach does not stop true user driven innovation from taking place, as e.g. von Hippel describes (2005) and Loppukiri testifies. It is spontaneously initiated by people who have strong interests to further developments that are important to them.

Unfortunately for the communities and the society, as this activity does not fit into the framings, agendas and mechanisms of the current institutional support systems,

such as Living Labs, it can not benefit from the significant resourcing[18] that is designated specifically for this purpose by society. Hence, it could be a worthwhile proposition for a new generation of Living Labs to consider opening new initiatives to find means to support developments that have true user driven origins.

Open – but how open?

One obstacle for building a more collaborative infrastructure in Living Lab settings, in the contexts we are aware of, is the confusion related to the degree of openness of the activities. This we attribute to a problem of terminology. While most Living Labs are described as *open innovation* environments, this term is very ambiguous and has a specific meaning for the business management community that might differ from an intuitive reading of it. For example, to Henry Chesbrough, whose writings have been central in defining and popularizing the concept, Open Innovation is:

> *"… the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology."*
> (Chesbrough, 2006a)

According to this view of Open Innovation (OI) the inflows and outflows of innovation are expected to happen through the trading of intellectual property (IP) between organizations. Because of this, an OI approach actually increases the incentive for companies to gather IP and protect it by methods such as patenting, in order to make it as valuable as possible also when it is not used internally (Chesbrough, 2006b). The word "open" is used to contrast this approach with a "closed" one where a company creates all the knowledge it requires to innovate by itself without relying on outsiders, and respectively holds on to its own inventions and does not try to sell them to others (Botero, Karhu, Vihavainen 2012). Openness

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[18] According to our rough estimate, the yearly funding available for Living Lab activities in the world runs in tens of millions of euros (in August 2012).

here does not mean that the protected innovations are available to anyone for free; instead, they are available to be purchased or licensed by selected, agreeable parties, at a cost. The open innovation approach encourages firms to build networks where firms support each other with intellectual property that they can license and mobilize in their products. This, we suggest, could be called *commercial open innovation.*

Another, perhaps for most people more intuitive, understanding of the concept of open innovation leads one to link it to the type of openness that is promoted by other "open" initiatives, such as *open source, open access, open culture, open data* or *open content*, where the emphasis is on the free revealing and free sharing (c.f. von Hippel, 2005; Baldwin & von Hippel, 2009). This understanding of openness means that the essential information concerning the innovation is available to anyone interested in it, freely without discrimination and at no cost, and they are able to use it as they see fit. This has been called *open collaborative innovation* by Baldwin and von Hippel (2009). We propose that to highlight the contrast between the commercial open innovation and that where everything is publicly and freely available, a good term for it could be *public open innovation.*

This confusion of terms makes it difficult for various actors to have a shared understanding and expectations of Living Lab activities. In many cases people and other actors who are engaged or recruited to collaborate with living labs may believe that they are contributing to a greater common good with their efforts (cf. the dilemma we described in the Helsinki Living Lab case). However, eventually they find that they are working within a context where some company will own the innovations they helped to create, and in the worst case, they may not even get access to them if the company fails to create usable, affordable and sustainable products from the work. Even in the case that one company can produce one solution, an ensuing design improvement cycle by several actors would be more beneficial for the further rapid evolution of the solution (cf. Hyysalo, 2007; von Hippel, 1988, 2005). Hence, the current modes of operation that severely restrict access to the innovations are not in the best interest of the user innovators.

User involvement as described above is not easy or cheap. Although this aspect is not often described in the publications that document such cases, researchers that

aim to involve people in "user studies" know that it is not at all trivial to find, recruit and motivate people to participate in research and development, as it typically requires them to devote time for it, and usually without any meaningful compensation, as the benefits of involvement might not be clear at the onset, or as the initial expectations are not met during longer term involvements. Equally, this kind of work takes a lot of time and effort from the organizations that get involved in it. If the substantial effort of a first experimental activity does not produce meaningful results, the involved actors, whether they are so called "users" or organizations, are not easily persuaded to participate again. Hence, unproductive experiments deplete the resource base and budding interest quickly. This is a difficult problem for current Living Labs to solve. How to ensure the creation of sufficient benefits for all participants, so that the processes can become sustainable and actually grow?

We suggest that especially when the role of users efforts and contributions is significant, they should be upfront guaranteed in explicit terms that the process will be governed by open shared innovation models that allow them or anyone else to proceed with developing the innovations based on their own work. This will become a significant issue if Living Labs are to become successful in developing true User Driven Innovation activities. People will invest a lot of time and effort in R&D only if they know they have the opportunity to work with those kinds of partners that can help them to reach concrete results.

At the same time, as we have noted earlier, innovation by user communities exists and thrives, but most enterprises are not generally able to join it and make use of it. Thus, for the ideal of the Living Labs to become reality, also enterprises will need to evolve and specifically develop their sensitivity and capabilities to embrace such external innovation.

Conclusions

In one of our interviews of the Active Seniors, one of them expressed their position and motivation for being involved in development activities in a nutshell by saying that instead of objects of research, they want to be actors, shaping their own life. As

the contemporary society is moving forward from the industrial era of mass production towards mass customization and individually tailorable products and systems, this potential for people to be empowered actors of their own lives is growing. The emerging technology and the global information environment are all compatible with the development of vibrant user driven innovation phenomena. Even the large funding agencies, such as the European Commission, have recognized the potential of the ideal, and have embarked on the Living Lab bandwagon as the way to transform innovation processes towards user driven directions.

However, as the current Living Lab activities are typically designed to satisfy the perceived needs of the industry as opposed to the needs of people, they are by design constrained to remain mechanisms for user involvement. Also, their general closed participation and IPR strategies are not fair or productive from the users' perspective, as giving their innovations into the Living Lab may turn them into the IPR of some participating company that is not able or willing to turn them into useful solutions for the innovators, and it may exclude the essential competition and evolution in the design space.

We propose that in order to realize the ideal of a "user driven open innovation ecosystem", next generation Living Lab activities should shift their focus and priorities from how to realize the interest of companies to how to realize the interest of the users. Instead for being only mechanisms for involving users in *producer driven product development*, "Living Lab V2.0" could also become *innovation accelerators for users and their communities* – institutions that have mechanisms in place that support and facilitate motivated and innovative people to develop their innovations rapidly with their peer designers, user communities and with interested enterprises.

This requires that they should:

- develop instruments that fund activities that are initiated and driven by strong user interests, without requiring them to be tied to specific corporate interest or sponsorship

- develop methods, practices and tools as well as shareable resources (such as open source software infrastructure and modules, organized cumulative

research data, and open data resources) to support these types of activities, e.g. based on already existing models provided by many online and offline communities

- be guaranteed to operate based on principles of public open innovation and free revealing of the results of user-developer collaborations – both knowledge and software – and be open for the participation of any actors that may be able to move the innovations forward into concrete solutions

The type of work we have done in the projects with communities (e.g. ADIK with the Active Seniors), taking their own practices and their future potential as starting points, seems to offer a fruitful direction for innovative technology development, and could be a basis also for systemic user driven initiatives. We believe that such an approach, if operated according to principles of public open innovation, would create attractive knowledge and collaboration initiatives and would create also commercial opportunities that are more compatible with growing trends of openness for companies. The support from Living Labs should be directed to those companies that are ready to embrace external innovation and join open collaborative innovation processes.

The organizations funding the Living Lab developments have typically been at various levels of government, pursuing a strong interest to develop support for businesses in the form of practical activities quickly. Thus, the funding has been directed to implementation of activities as opposed to research and development. However, as there are no working examples of how to accomplish the goals in a systemic fashion, we believe that in addition to launching new implementation projects that proclaim to realize the ideal, there is also a need to engage in critical and focused research into the phenomena of user innovation and unrealized user interests, as well as in the development of the methods, tools and practices that genuinely "user driven open innovation processes" would require, to turn the ideals into reality. A real user driven innovation ecosystem could have many kinds of significant societal benefits that are well worth the investment.

Acknowledgements

References

Almirall, E. (2008). Living Labs and Open Innovation: Roles and Applicability. *The Electronic Journal for Virtual Organizations and Networks.* Volume 10, "Special Issue on Living Labs". Retrieved from http://www.ve-forum.org/Projects/264/Issues/eJOV%20Special%20Issue%20on%20Living%20Labs%202008/eJOV10_SPILL3_Almirall_Living%20Labs%20and%20open%20Innovation.pdf

Baldwin, C. Y., & Von Hippel, E. A. (2009). Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation. Harvard Business School Finance Working Paper No. 10-038; MIT Sloan Research Paper No. 4764-09. Available at SSRN: http://ssrn.com/abstract=1502864 or http://dx.doi.org/10.2139/ssrn.1502864

Botero, A., & Hyysalo S (Forthcoming 2013) Aging together: steps towards evolutionary co-design in everyday practices. *CoDesign: International Journal of CoCreation in Design and the Arts*, 9(0), 1–18.

Botero, A., Naukkarinen, A., & Saad-Sulonen, J. (2008). Mapping social practices through collaborative exercises and visualizations. In *Proceedings of the 5th Nordic Conference on Human-Computer interaction: Building Bridges (Lund, Sweden, October 20 - 22, 2008). NordiCHI '08, vol. 358*. ACM, New York, NY, 419-422. DOI=http://doi.acm.org/10.1145/1463160.1463209

Botero, A., & Kommonen, K.-H. (2009a). Coordinating Everyday Life: The Design of Practices and Tools in the "Life Project" of a Group of Active Seniors. In *Proceedings of COST 298 Conference: The Good, the Bad and the Challenging.* (pp. 736-745). Slovenia: ABS-Center.

Botero, A., & Kommonen, K.-H. (2009b). Aspects of social media design and innovation in a project for aging together. In C. Mueller & M. Lewkowicz (Eds.), *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., Vihavainen, S., & Karhu, K. (2009). From closed to open to what? An exploration on community innovation principles. In *Proceedings of the 13th International MindTrek Conference: Everyday Life in the Ubiquitous Era* (pp. 198-202). Presented at the Mindtrek, Tampere, Finland: ACM / Mindtrek.

Björgvinsson, E., Ehn, P., & Hillgren, P.-A. (2010) Participatory design and "democratizing innovation" in *Proceedings of the Participatory Design Conference 2010 Participation the Challenge*. ACM.

Björgvinsson, E., Ehn, P., & Hillgren, P.-A. (2012): Agonistic participatory design: working with marginalised social movements. *CoDesign: International Journal of CoCreation in Design and the Arts*, 8:2-3, 127-144

Cantou D., Corubolo M., & Simeone G., (2012) A Community Centered Design approach to developing service prototypes in *Proceedings of the ServDes 2012 Conference.* Presentes at ServDes, Espoo Finland. SDN

Chesbrough, H. (2006a). Open Innovation: A New Paradigm for Understanding Industrial Innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open Innovation: Researching a New Paradigm.* Oxford: Oxford University Press. ISBN: 0-19-929072-5.

Chesbrough, H. (2006b). *Open Business Models: How to Thrive in the New Innovation Landscape.* Boston, MA: Harvard Business School Press.

Colobrans, J. (2010, February). De la triple hélice a la innovación social: ¿Qué está ocurriendo en el citilab de Cornellà? *La Factoría*, (45-46). Retrieved from http://www.revistalafactoria.eu/articulo.php?id=520

Dahlström, M., & Minkkinen, S. (2009). *Loppukiri. Vaihtoehtoista asumista seniori-iässä (Loppukiri. Alternative living in senior age*). Helsinki, Finland: WSOY. ISBN 978-951-0-34906-9

Følstad, A. (2008). Living Labs for Innovation and Development of Information and Communication Technology: A Literature Review. *The Electronic Journal for Virtual Organizations and Networks.* Volume 10, "Special Issue on Living Labs". Retrieved from: http://www.ve-forum.org/Projects/264/Issues/eJOV%20Special%20Issue%20on%20Living%20Labs%202008/eJOV10_SPILL7_Folstad_Living%20Labs%20for%20Innovation%20and%20Development.pdf

Feurstein, K., Hesmer, A., Hribernik, K. A., Thoben, K.-D., & Schumacher, J. (2008). Living Labs: A New Development Strategy. In J. Schumacher & V-P. Niitamo: *European Living Labs: A new approach for human centric regional innovation.* Berlin: Wissenschaftlicher Verlag Berlin. ISBN 978-3-86573-343-6

Greenbaum, J. & Kyng, M. Eds. (1991) Design at work: cooperative design of computer systems. Hillsdale, New Jersey: Lawrence Erlbaum

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

Kangasoja, J. (2007). From virtual visions to everyday services. Evolution of the Arabianranta local ICT model. In J. Kangasoja & H. Schulman (Eds.), *Arabianrantaan! Uuden kaupungin maihinnousu. Arabianranta-Rethinking Urban Living* (pp. 142-157). Helsinki, Finland: City of Helsinki Urban Facts.

Maffesoli, P. M. (1996). *The Time of the Tribes* (1st ed.). Sage Publications Ltd.

Naukkarinen, A., Sutela, J., Botero, A., & Kommonen, K.-H. (2009). Designing locative media for creative misuse: learning from urban intervention. In *Proceedings of the 13th International MindTrek Conference: Everyday Life in the Ubiquitous Era* (pp. 124-127). Tampere, Finland: ACM. doi:10.1145/1621841.1621865

Naukkarinen, A., Sutela, J., Botero, A., & Hyyppä, K. (2010). *Augmenting the streets and aging together – learning from everyday interventions.* UDOI Project. Retrieved from: http://www.flexibleservices.fi/files/file/pdf/UDOI_everyday-3.pdf

Orava, J. (2009). *Living Lab -toiminta Suomessa (Living lab activities in Finland).* Online publications of the Regional Centre Programme 3/2009. Retrieved from http://www.innovaatioverkosto.fi/cgi-bin/webio-f?id=204&saitti=innovaatioverkosto

Prahalad, C. K., & Ramaswamy, V. (2004). *The future of competition: Co-creating unique value with customers.* Boston, MA: Harvard Business School Press.

von Hippel, E. (1988). *Sources of Innovation.* Boston, MA: The MIT Press.

von Hippel, E. (2005). *Democratizing innovation.* Boston, MA: The MIT Press.