Designing for the Living Room: Long-Term User Involvement in a Living Lab

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ABSTRACT
Living Labs provide a research infrastructure for long-term user involvement in Participatory Design processes. Users take part in software co-creation during context analysis, for concept development, reflecting on early-stage prototypes and evaluations in the field. In this paper we describe lessons learned from our Living Lab in the area of home entertainment, with 27 participants from 16 households, over a 2.5 year period. We show that this kind of long-term participation of users involves various challenges over the lifetime of the project. We highlight several aspects that need to be considered carefully when setting up such a Living Lab, concerning the selection of participants, maintenance of participants’ motivation, establishment of a trust relationship, and the coordination of collaboration.

Author Keywords
Living Lab; participatory design; long-term user study; domestic domain

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design; Documentation; Human Factors

INTRODUCTION
Participatory Design (PD), particularly what has become known as the Scandinavian approach, has sought to involve users in the co-design and development of computer systems, for many years. This was seen to have a number of benefits, not least the democratization of processes, the improvement of organizational knowledge and ultimately systems which ‘fit’ working life better [2,6,21]. Latterly, PD has moved beyond the work area and became a relevant topic for the domestic context as well. This shift arguably brings with it different choices and new problems concerning suitable users, time of user involvement, choice of adequate methods for the specific purpose, etc. [29]. This has, inter alia, involved the deployment of ethnographically oriented investigations in order to understand the domestic context (e.g. [28]), methods for exploring new design ideas with users (e.g. [5]), and approaches to understanding how users appropriate new technology and its impact on users’ habits (e.g. [14,36]).

One such approach is usually referred to as the ‘Living Lab’. We set up such a Living Lab to involve users across the entire life span of a development project in the context of home entertainment. The Living Lab concept itself refers to a methodology where new IT artifacts will be created and validated with users in an open and innovative development process that takes real use contexts into account [9]. The methodology has been deployed in a range of contexts, professional as well as domestic, but has arguably provided relatively few opportunities thus far for reflection on user typologies and their impact on different Living Lab stages [33]. We found no substantive descriptions of hands-on experience for the operationalization of such a research framework with which to begin our work. In this case study we address these topics and provide insights from our research project that may be helpful for others who are dealing with Living Labs.

RELATED WORK
In order to design for the living room, methods and insights from PD should help to create systems that match with users needs. In this section we reflect on previous work on PD and the meaning of Living Labs as an infrastructure, where co-creation can be applied in real life environments.

Designing with Users
Research around PD has explored various methods and tools that focus on the involvement of users in (re-)design processes [6,8,13,21,24]. Bødker et al. [6], for instance, highlight the mutual nature of learning processes between designers and users, suggesting that genuine participation requires a continuous user involvement to obtain a shared understanding of problems and needs. Many issues are related to that topic, however, including the organizational complexity, the heterogeneity of tasks and the balancing of different stakeholders’ rights and responsibilities.

Various specific methods for stimulating user involvement have been deployed in domestic (and other) environments. Gaver [11], for instance, introduced the concept of cultural probes, allowing participants to express and reflect in an open and creative manner. This concept was adopted in several ways, e.g. with technology probes that inspired
design for and with families [18]. Crabtree and Rodden [7] also experimented with different techniques to explore the home and highlighted the importance of self-documentation methods compared to full-time standard recording. Lindquist et al. [23] described the use of several self-documentation and design methods of a cross-generational long-term project and reflected on their aptitude for domestic settings.

Only a few studies provide insights into the long-term involvement of users for the design of home IT and reflection on this process from a design case stance. Sleeswijk Visser and Visser [34] argue that returning participants provide a more profound feedback, because they are already familiar with the topic and can reflect on it in a more detailed manner. Even so, how to achieve these results in domestic environments is not well-specified, nor are the contingencies associated with community creation and maintenance in these environments well-examined.

Concept of Living Labs

According to Eriksson et al. [9], the term, ‘Living lab’, was created by William Mitchell at the MIT Media Lab and considered to be an instrument for the study of users and their interaction with new IT-artifacts in real life environments. Depending on the context, the research goal, and the stakeholders involved, the concept is used currently with several different accentuations in user involvement. However, all directions have a common understanding of a Living Lab as an open and innovative research framework [1,26] with a strong focus on user-centric research methods, i.e. methods that can be applied in multiple real life environments for “sensing, prototyping, validating and refining complex solutions” [9]. Users take on an active role in co-creation of the design process by providing ideas and experiences from real use contexts and stimulate research due to long-term involvement. These properties can be seen as the strengths of the concept [31] and distinguish the Living lab from other research methods.

However, several studies (e.g. [10,25]) emphasized the fact that context exploration and long-term co-creation were often neglected in current Living Labs. Moreover, Living Labs with a focus on domestic or private sectors conceive the notion of ‘real use’ environment in different ways. They either collaborate with users in real world testbeds or in controlled artificial environments in test centers. For example, MIT PlaceLab [19] and Phillips HomeLab [30] have conducted short- and mid-term evaluations in large scale controlled domestic settings. In contrast, Bergvall-Kareborn & Larsson and Schuurman et al. conducted evaluations in more naturalistic contexts and collected in-situ feedback on user experience, usability aspects and appropriation processes [4,32]. Living Lab Skagen [20] involved their users in an early design step for idea generation. They conducted multi-day workshops with first prototypes and discussed these under real world and under lab conditions. Obrist et al. [27] investigated their users in their homes for several weeks at the beginning of the design process to get a deeper understanding of the context and the users needs. In contrast to MIT PlaceLab and Phillips HomeLab, these studies usually involved smaller user samples. There are, nevertheless, relatively few studies that exploit the full potential of the concept – relatively long-term and ‘naturalistic’ studies insofar as they involve the use of technologies in daily routines [22,25,35] – and fewer which describe in detail the processes of co-creation that do, or do not, take place. Few studies reflect on the difficulties and challenges one has to deal with when building up and running a Living Lab effectively. Schuurman et al. [32] are an exception, providing a SWOT (strengths, weaknesses, opportunities, threats) analysis in the context of mobile TV. Living Labs, they argue, are time and cost intensive in realization and limitations in the design of new technology; users can be over-accepting of early prototypes, and reluctant to use prototypes in public places. In [33] they investigated different user typologies, their roles and aptitude for Living Lab processes. They supplement the concept of the ‘lead user’ [1,9] with additional categories, such as ‘Pro-Ams’ or ‘bystanders’, that can help us better understand how users work in different stages of the design process. From a more general stance, Bergvall-Kareborn et al. [3] derived five key principles (continuity, openness, realism, empowerment of users, and spontaneity) for success the concept design. Certain features e.g. trust, transparency and user acceptance were emphasized, but their handling in practice less well described. Papers that present evaluation studies and point out corresponding limitations provide further insights. For example [4,22] described how prototypes in everyday life have to compete with other devices and services. Outside influences can affect user behavior as well as acceptance. In this regard, Lieve's et al. [22] emphasized the importance of added value to the user.

SOCIALMEDIA EXPERIENCE AND DESIGN LAB

Our case study is based on a four-year research project. The aim of the project is to develop a cross-platform framework including TV, PC and Smartphone to support a more flexible and integrated media consumption and use of social media applications.

Motivated by this, we designed a Living Lab research framework and involved stakeholders from industry, academia and participating households. We named our Living Lab SocialMedia Experience and Design Lab (SMEDL), because user experience and the design of home entertainment concepts are strongly related to each other [16]. A close collaboration with users in their real life environments and their continuous involvement in the
design process during the entire research period was an elementary aspect of this Living Lab concept. For this purpose SMEDL consists of two environments: a real world testbed and an artificial lab setting. Both serve to collect qualitative as well as quantitative data by using various research methods. SMEDL.Local is a real world testbed including households from the region of Siegen, Germany, which makes up the core of our Living Lab. This setting provides an entry into the domestic field to explore real world contexts in detail as well as in-situ feedback and user experiences from long-term field studies. Households were equipped with various devices (TV, Media Center system, smartphone) that could be used in their everyday life. Within SMEDL.Local we can investigate the integration and appropriation processes of new hard- and software, media usage behavior, social practices and its changes over a longer period of time. In contrast, SMEDL.Stat as a stationary controlled test setting reproduces a standard living room at our university and is used for short-term evaluations and first user tests. In this environment we can measure concrete user behavior and gain comparable data.

METHOD

This study based on our previous research in our Living Lab, drawing on user studies conducted within SMEDL (see figure 1). Data comes from three diary studies with interviews after each study, observation protocols and notes from two creative workshops during the concept design, an online survey, data and observations from two user tests and one field evaluation, with protocols, audio and video recordings. Data sets were supplemented by notes with individual experiences and observations from two social events, home visits, casual meetings with participants in our free time and regular exchange with users via email, instant messaging and phone.

For the analysis of the predominantly qualitative data we applied a Grounded Theory oriented approach, at least insofar as ‘theoretical sampling’ and ‘constant comparison’ were utilized [12]. Empirical data was continuously analyzed throughout the project. In respect of substantive data, reported elsewhere [15,16], diary studies, creative workshops and user tests, coded interview or discussion transcripts were triangulated with additional video material, observation notes or entries of diaries in order to confirm coded excerpts or to expose conflicts in the participants’ statements. For the purposes of the analysis we describe here, however, we went no further than ‘open’ coding of the users’ behavior, challenges and constraints as well as the contingencies that arose at different stages in the process.

DESIGNING THE DESIGN PROCESS

Below, we identify interesting phenomena and challenges regarding user acquisition, context analysis, designing with users, field evaluations and the communication with participants.

User Sample and Motivation

To find appropriate participants to set up a small-scaled local real world testbed (SMEDL.Local), we started a call for applications via local newspapers and radio. Applicants had to fill out an online questionnaire with information about their demographic background, technical equipment, and personal motivation for participating. We further conducted 30-minute telephone interviews with each of the 32 applicants to find out additional socio-demographic facts, more about their media usage, technical experiences in dealing with Media Center systems and smartphones, and gain some insight into how communicative and self-reflective applicants might prove to be. Based on this, we focused on applicants who lived in the proximity of our university to reduce the costs and time of later home visits. In order to involve users with varying levels of experience and with different household structures, which is important for a heterogeneous design domain, we clustered applicants into four household structures: couples with or without children and single with or without children. In a first round we selected 8 households, two from each category, with 15 participants in total (6 male, 9 female). One of the two households of each category was very experienced and the other less experienced with smartphones and Media Center systems.

In a second step, we asked the households to recruit friends or colleagues who were also interested in participating. We aimed at a sample consisting of both participants that knew...
each other and those who did not. The reasons for this had
to do with our interest in seeing how users communicate
about their media usage and how new integrated social
functions could support the establishment of new contacts.
In the second round, we selected 8 additional households
with 12 participants in total (8 male, 4 female), 5 of them
with higher and 3 with less technical experiences. The final
structure of SMEDL.Local consisted of 27 participants (14
male, 13 female) divided into 5 couples with children, 5
couples without children, 2 singles with children and 4
singles without children.

Selected participants at the outset were strongly motivated
and interested in the next steps. Apart from the fact that the
households were equipped with new devices, we identified
further reasons for participating depending on the participants’
technical experiences, personal attitudes and individual expectations: curiosity, self reflection on their
media usage behavior, learning, participation, communication and new contacts. One participant
described his motivation quite enthusiastically: “I can
express my visions and discuss novel concepts together with
others, in the hope that some of my ideas will be
implemented. If not, it does not matter. Anyway, if the
system is available on the market, I can tell my friends that
I contributed to it.” (male 31, couple without children, high
technical experience). However, during the project
progression, participants’ motivation and their willingness
to participate, changed depending on whether their
expectations were satisfied.

Understanding Users

Within the first phase of our project, after compiling our
sample, we started empirical work, focusing on exploring
and understanding current media usage behavior and social
practices in domestic environments. The advantage of
SMEDL.Local lies within a profound understanding of
household structures and their media usage behavior to
identify requirements for new integrated social media
concepts. To understand the daily media usage of our 27
participants and to increase their understanding for our
research activities, we conducted a three-week diary study
(Diary Study I) between February and May 2010 [16]. We
designed boxes that contained one media diary for each
participant in the household, a camera and some sweets for
motivation. The diary contained semi-structured pages on
which the participants were told to document every single
media usage with information about the usage context.
Furthermore, we included several special pages to
understand more about the participants’ regional, national
and international social networks, pastime activities and
additional insights on how they live. With the camera,
participants could document aspects of their media usage to
give us more visual insight. The diary study was also
supposed to help to establish a trust relationship between
participants and researchers. After the three-week self-
documentation process, we collected the boxes and
conducted additional interviews with each participant in the
household to reflect on their current media usage, on the
relevance of specific media (TV, PC/Internet, mobile
phone) and the diary study itself. During the entire project
progression we equipped the households with new
technology twice (Rollout I & II). To understand how the
new technology was appropriated and how media usage
changed, we repeated the diary study after each
intervention. Diary Study II was performed between
December 2010 and January 2011 and Diary Study III
between July and August 2012.

While the motivation for completing the diaries was
relatively high in the first study, we realized that this
assiduousness subsided with the second and third study, and
most of the participants were obviously perturbed when we
asked them to complete the diary again. During one home
visit, a participant rolled her eyes and welcomed us with the
words “Oh no, not again!” (female 44, single with
children, low technical experience) when she spotted the
documentation box we wanted to hand over. The point here
is that, from the subjective point of view of participants,
nothing much had changed in their media usage behavior
over the course of the study, despite the fact that other data
demonstrated that changes had in fact taken place [15].
When we asked the same participant in the interview about
any changes regarding the new devices we had introduced,
she answered: “I always do the same. Because until now
the Media Center system doesn’t offer much new.”
Although she was aware of the new devices, for her, no
changes happened when using same functions (e.g. browser
games, Internet) on different devices (PC at the desk or TV
screen). Her daughter, nevertheless, claimed that her
mother’s usage behavior had changed insofar that she now
used the Media Center system much more: “When I come
home from school I use the Media Center system to watch
animes on the Internet until 8 p.m. then my mother chucks
me out.” (female 17, single with children, low technical
experience).

In our view the content of the interviews gave us a much
deeper and more precise insight into the participants’ media
usage behaviors than the diaries did. Nevertheless, for many
participants keeping the diary was a very helpful resource
when it came to reflecting on their own habits when
prompted during interviews.

Designing Together

One important aspect of our Living Lab is the active
involvement of the participants during the entire design
process. Following Diary Study I and an initial analysis of
the collected data, we conducted two creative workshops
together with Living Lab households [16]. The aim was to
coop- develop and discuss first concepts and ideas for an
integrated and flexible usage of TV, smartphone and PC.
Relating to the superior project goals and the results of the
diary study, we moderated the workshops based on
predefined topics. Due to the large amount of registered
participants (18) and the wide range of technical experience
between them, we decided to arrange two workshops. The first workshop had 8 participants with higher technical expertise and the second 10 less technically adept participants. In the first workshop we began with a brainstorming session along the predefined topics where the participants had the opportunity to discuss current usage behaviors, problems and how new concepts could be designed. In the second part of the first workshop we discussed concepts and mock-ups we had developed subsequently to the diary study. Because of the participants’ lack of experience in workshop two, we omitted the brainstorming part and gave a demonstration of current smartphones and media center devices.

The separation of the technically experienced users from the less experienced was motivated by the assumption that less experienced users might be embarrassed or otherwise reluctant in front of others whereas very experienced users might be bored in discussion. However, as a result of scheduling difficulties, two less experienced users were invited to the first workshop and we observed an unanticipated and interesting behavior. The more experienced users had a clear conception of new concepts based on their know-how. Their ideas, however, were strongly oriented to current marketable products-realizable, but not necessarily highly innovative. In contrast, the ideas of the less experienced users were either outdated, or they were utopian and not yet realizable. Even so, and against our expectations, interactions turned out to be synergistic, with experienced users being excited by ‘blue sky’ thinking and less experienced users by learning more about real prospects.

After the workshops we concreted first concepts and developed a low-functional early stage prototype. We invited our Living Lab participants to our stationary lab (SMEDL.Stat) and conducted 13 individual user tests (User Test Prototypes I), where we put the application design and the underlying concept up for discussion. Besides a scenario-based walkthrough, participants could contribute their suggestions in a subsequent open interview with the designer. Afterwards we analyzed the tests, redesigned the application in regard to the users’ comments and implemented the functionality. Another 13 user tests (User Test Prototypes II) were conducted after finalizing the implementation of our applications. This time we conducted both single and group tests to better observe the users’ roles and their interactions. Depending on the households size a maximum of three participants (adults and children) were involved in a test. The procedure of the tests was similar to the first testing phase and the aim was to identify substantial usability issues before setting up the applications in the field.

We have determined that experienced participants were very confident when they got in touch with our prototypes and tried to appropriate them in an exploratory way, whereas most of the less experienced users were nervous and inhibited when dealing with the applications, because they where afraid to break something or to do the given tasks wrong. We even observed this in User Test Prototypes II, although the participants and the researchers had by then known other for almost two years.

One interesting realization from our PD studies was that the participants had a divergent understanding of their project’s role. While some of them saw themselves as potential users who were interested in providing requirements for the applications to satisfy their individual needs, others liked to see themselves more as a designer. As an example, one female, less experienced participant, who worked as an architect, wanted to apply herself as an expert in visual design but was not interested in using the applications later on. In an email she wrote: “I can not contribute in the community/Facebook/new stuff – my friends have no palate for it and me neither. […] I guess I am a prime example of a dinosaur in your young social community […] For the development I could possibly help a bit with my viewing patterns […] I can perceive no sensibility for this topic.” (female 47, single, low technical experience).

Setting Up New Technologies

After the first user studies, we undertook the first technical intervention (Rollout I). The main objective of Rollout I was to equip our Living Lab households with up-to-date hardware, so that they could get familiar with it and prepare themselves with basic knowledge of contemporary home IT. In a later phase, our software was developed for this hardware platform. We equipped each household with a Media Center system and an Android-based mobile phone. Households with a tube television were additionally equipped with a high definition flat-screen TV set. As software we set up the Windows Media Center so that the users could watch live TV using our system.

We planned to carry out Rollout I in April 2010. Prior to that we had informed our households about it and they showed great excitement and anticipation about the coming equipment. However, the actual rollout happened 4 months later, because the ordered smartphones were out of stock. During these 4 months we continuously received emails and phone calls from our households asking about the delivery status. While we still felt great anticipation from them, we also sensed some impatience due to the long wait. After we finally received all the equipment in August, we contacted the households by phone and fixed appointments for home visits. We came with the hardware as planned and set it up during our visits. After that, we gave a brief introduction to the system and its functionalities, but didn’t ask them to do any specific tasks or force them to use the system. Whether or how they might use it was totally up to them.

We invested a huge amount of time carrying out Rollout I. To arrange an appointment with each household was not easy. In most cases we were not able to fix a date on the first try. This was either because we were not able to reach them, or they were unsure whether they would have time in

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evening or canceled the settled date some hours before. The installation in each household took at least one hour. For some households we had to pay them more than one visit to finalize the installation. For example, in four of our households, we had to set up additional equipment on a second visit for the hardware to work.

Even after the rollout, maintenance required a huge amount of management effort. Almost every household had at least one piece of hardware that had stopped working; these were mainly the input devices, such as the remote controls or the wireless keyboards. In each case we had to pick them up, send them back to the retailer, deal with the warranty issues, and bring them back to our households after we received the replaced or fixed pieces. We also observed an interesting phenomenon during our home visits. Participants, especially with low technical experiences, tended to ask us for help installing or configuring their own hard- or software. Although not directly related to our project, we always tried our best to solve their problems. Another household had problems with the TV-signal. We tried to fix the problem remotely, but we had to visit them several times to get it running and although it was not a problem of our hardware, we fixed a broken signal cable. Unfortunately, some of our households saw us as a 24/7 help-desk rather than as research motivated.

**Testing in the Field**

The objective of Rollout II was to deploy our software prototypes on the hardware that was already running in our Living Lab households. The prelude of Rollout II was the launch of our SocialMedia community (see ‘Implementation Social Network’ in figure 1) in the middle of 2011. The social network served as central channel for our households to communicate with each other, and also a basis for further software development. The actual Rollout II happened in early summer of 2012, where we installed our prototypes in each household. We sent an email containing the download links to smartphone apps and FAQs to each participant as a first step. We then fixed appointments for remote installation with each household.

The installation itself was less smooth than anticipated. Although the prototype ran quite stably in our pre-test, we faced a lot of unpredictable difficulties in the real world environment, e.g. incorrect display ratio of TV image, no or unstable TV-signal. We called a halt after four installations to solve these issues and resumed our rollout some days later. Because of these difficulties, the planned rollout was postponed from 2 weeks to 7 weeks.

In the following home visits, we realized that most of the participants neither used the installed TV prototype nor installed the mobile application, although the FAQs provided a detailed description. We also developed and rolled out a feedback application [17] to report critical incidents or feature requests in-situ with the smartphone, but this application was also not installed or used by most of the participants. One reason for this lack of interest was the one-year period between the first and second Rollout where nothing much had happened. Another demotivating factor was the instability of prototypes and some of the participants blamed themselves when something went wrong: “The biggest problem was that, when it doesn’t respond, you think that the reason that it has stopped working, is because you did something wrong to it.” (female, 39, single with children, low technical experience). Although we informed the households that the prototype might not be stable and might crash, the users’ patience for the prototype-malfunction turned out to be very low. One participant uninstalled our system and connected their old receiver to watch TV, because the prototype was not stable enough and the user experience was such that his wife and daughter could not just “easily” watch TV using the prototype. Another participant argued that “[a] field test, to my opinion, only makes sense when the solution works as promised and does not continuously crash. I would like to give you feedback, but it’s no fun. When I come home, I just want to watch TV and it must work. When I have to wait for it to boot up again, then I have to sign in to watch, I have no interest at all” (male, 32, couple without children, high technical experience).

The project had the goal of developing innovative home IT solutions, rather than just re-implementing existing functions of other commercial systems. On the one hand, the lack of certain functions led to user frustration in integrating it into daily routines. On the other hand, the ambition of innovative ideas, such as how to flexibly consume TV content on various platforms, has received positive comments from the users: “When I lie in bed in the night and still want to watch something (...) When this is theoretically do-able, then it would not be bad at all!” (male 51, couple with children, low technical experience).

**Staying in Touch**

Participants of our Living Lab were continuously informed about the current project status and the next steps within the field in a formal way by email and during official appointments. However, participants expected more transparency and information in a shorter space of time, e.g. results of empirical studies or evaluations and monthly emails on the project status, so we introduced a regular newsletter which focused on this information.

Informal communication also played an important role within the project. Participants identified with the Living Lab, they talked to their friends and colleagues about it and showed them the official project website. However, they were disappointed because the website did not offer any details about project staff. Participants opened up and gave us insights into privacy but in return, they also wanted to know more about us- how we thought; what interests and hobbies we had, and so on.

Households who did not know each other were also interested in getting in contact with other Living Lab households. They wanted to know their reasons for
participation and how they used the technologies. The organized workshops provided an opportunity to get into a conversation with others, but participants did not always interact to their satisfaction. One participant described his perception as follows: “(...) during the workshops everybody was focused on the project discussion so that personal conversations did not arise out of the situation. The same applied to the user tests. Conversations with others were almost impossible, because the tests were executed one after another.” (male 37, couple with children, high technical experience).

In response to the users’ suggestions, we tried to create new spaces for informal conversations. We implemented a project-based social network site, where all project members, including the research staff and the participants from the Living Lab, could register and create their user profiles. The platform provided communication tools like chat or messaging and a discussion forum that also served as an information platform and help-desk in the way that users can support each other. We also used the platform to spread project related snippets from various external news portals. However, the usage of the platform was quite moderate and friend requests were not sent to the expected degree because participants did not want to become friends with people they had only met briefly. This is also a reason why they would not ask others in the community if they had any problems with our prototypes.

Furthermore, we arranged social events on neutral locations. The first event was a BBQ, but unfortunately, not all households could participate due to private commitments. Conversations between attendant households indeed arose hesitantly in this situation. For the second event, we organized an informal get-together in a bar. In order to ease the situation, as we knew from the BBQ that ‘ice breaking’ was necessary, we prepared a speed-networking round at the beginning of the event. Everyone had to talk to everyone for three minutes. After this, conversations continued automatically. Later on we observed increasing activities in our social network, friend requests were sent. Besides the positive feedback at the end of the event, one participant wrote a comment in the discussion forum. “To all who could not join: (...) The get-together was awesome, the atmosphere was great, the speed-dating (grin) was really interesting. I’m looking forward to the next one – it was a great idea!” (male 44, single household without children, low technical expertise).

Another participant argued that “the project should have started with an informal come together. Then you can get in contact with other households [...]” (female 42, couple with children, low technical expertise).

LESSONS LEARNED
Based on the above, we can identify some lessons learned. We discuss some of the challenges identified, specific points where this dynamic process of co-creation is problematic, and how such issues can be resolved.

Finding the Right Users
The user selection process was time consuming and entailed various challenges. The approach of involving users during a long-running project requires participants with social competences and well-marked self-reflecting skills. They needed to be willing to give researchers a deeper insight into their own and their family’s life and to be interested in the research topic itself. They needed time and readiness to participate in regular research activities after work and on weekends and they had to deal with the new technologies they received during the project. Retrospectively, we have to admit administering a questionnaire, combined with a telephone interview, was not the right way to proceed. A more personal face-to-face interview and a visit to applicants’ homes might have given some better indication about the participants appropriateness for the project. However, establishing a personal relationship might raise participants’ expectation to get chosen which makes it harder to decline an application for both the applicant and the researcher.

We agree with Schuurman et al. [33] that the combination of diversified users can be useful, and we need to think beyond ‘lead users’ as the focus for enquiry. However, while they arranged the different user typologies primarily in the area of evaluation, we also had good experiences with our heterogeneous sample in the preceding design steps, e.g. empirical studies, PD workshops and user tests. Especially during workshops, non-experienced users contributed many interesting and innovative ideas due precisely to their lack of knowledge about marketable technology. We also identified another type of participant whose motivation for participation is not grounded in developing solutions that enrich personal usage behavior, but more in the participation itself and the desire to contribute with personal expertise even if there is no obvious interest in using the developed solutions. Those participants can, depending on their competence, contribute interesting and helpful ideas during the design phase but – and this bears emphasizing – their skills are variously displayed or volunteered depending on methods adopted. For example, where individuals with visual design expertise have much to contribute at specific points, there is little purpose in involving them throughout the process when they have no interest in using the prototypes.

Keeping Users Motivated
Retaining participants in a Living Lab over a long-term period is a big challenge. While changes in participants’ routines (e.g. workload, relocation, family status) are inevitable and may result in exit from the project, decreasing motivation is also an important aspect that may influence a premature departure. Keeping the participants’ motivation on the same high level over the entire life-span of the project is an essential task for the operator of a Living Lab.
We identified a decreasing motivation in several phases of the project. The participants’ expectations were high at the beginning of the project and their frequent involvement in various studies kept their motivation at a good level during the first half year. However, our participants got really impatient when Rollout I & II were delayed. The fact that we announced dates that we could not meet caused displeasure to many participants. Therefore it might be conducive to make such date arrangements more carefully and flexibly within a time frame as a cushion against unrealistic expectations. This is also relevant against the background of stability and usability of the rolled out prototypes as we could not fulfill the users’ high expectations on our applications. Although we never promised any stable and market-ready product, users were sometimes bitterly disappointed by the results. We dealt with the question about the reasons for these expectations and identified four essential aspects:

Comparing with other products: When we rolled out the devices, we installed a mature Media Center application (Windows Media Center) on the users Media Center system to introduce users to current marketable solutions. Non-experienced participants were pretty excited by the system and its “new” features and adopted them into their daily media usage. Due to the missing adaptability of this system, for our prototype we had to implement the basic functionality of the Media Center from scratch to build up a new platform for innovative concepts. As it was not the aim to re-implement an existing system, we focused on relevant basic features. For the users it felt like a retrograde step as many features they had grown to like were not available in the new system. These experiences confirm similar observations from [3,32]. Thus rolling out similar software beforehand should be done cautiously to avoid cannibalism. A possible solution could be to extend an existing application with new concepts instead of developing something completely new. However, this only works on the condition that there is a system that provides an appropriate way for adaptability or expandability.

Watching TV is relaxation: Most of the participants watch TV in the evening after work or on weekends and its purpose of relaxation is an important user experience for them. As the stability and the handling of our prototype was still immature, the system needs to be restarted after a crash and the response of the UI was also not as expected. The effect was that the users could not relax as they wanted and they quickly switched back to their previous solution, which underlines challenges of the domestic domain.

Waiting period: During the implementation of the prototypes, the users had almost no insight into the stage of development. Due to the long wait, they expected something huge. However, most of the implementation work we had done went into the development of the underlying framework and had no immediate effect on the user interfaces. Thus we determined a great disappointment on the part of users when they finally came to use our prototypes. For later design steps we decided to give participants more insights and information on current implementation work in order increase transparency.

Missing benefit: Several participants mentioned that the prototypes did not provide any apparent benefit with regards to their previously used solution. In the case of social network functions, for instance, this turned out to be quite a dilemma, as our small sample could not readily make maximum use of them. Equally, some users failed to identify the existence of some new features.

We agree with the reflection of Lievens et al. [22] that users have to feel attracted by a new system, but in addition, we also identified several influences with regards to the communication within the project as well as important social aspects. The implementation of a regular newsletter about project progress was well-received by all of the participants. In this context it was also of importance to give participants feedback from study results (How far do my statements contribute to the project? How do other lab members think and how do they consume media?). We think it is necessary to give participants the feeling that we need them. This can be done by sharing study results as well as by getting in personal contact with the participants and by conducting joint social activities.

Building Trust Relationships
The living room is a private place, where residents feel secure and where they relax. Entering the domestic domain for research requires one to be sensitive and empathic when dealing with the users. Furthermore to making users open up to researchers is an artful business and we should not underestimate the need for social skills among researchers as well as participants.

Our experiences have shown that both formal and informal communication, as well as specific empirical methods are of importance in this context. The deployment of self-documenting methods helped gain user insights and formed a first common ground for further interactions. Regular conversations and discussions were also relevant in building up trust. It was important to value each and every participant and take his/her statements seriously, even if they were of varying benefit or significance for the project. This also applied to discussions, e.g. during workshops, when participants went off topic. While interviews are always purposeful from the point of view of the researcher, these purposes are not necessarily shared by interviewees. We learned over time the need for a relaxed, friendly and ‘social’ attitude on our part. In doing so, user motivation was positively influenced as well. Rollout II revealed the importance of a trust and friendly relationship in relation to giving feedback. Participants who felt they were ‘on the same wavelength’ as us, gave us substantially more feedback from their experiences than others. Moreover, they were not ashamed to give us prompt feedback.
concerning their problems with our software, and give us their honest opinion, not least about our own failures.

At the beginning of the project only one staff member was responsible for the communication with the households and the field studies. With Rollout I and the occurrence of the first technical problems, it was necessary that households were contacted by different staff members. This resulted in participants being confused about who was working in the project, who was part of the academic staff and who was a student assistant. We improved the transparency by introducing our social networking site and by arranging social events. Nevertheless, a permanent contact person that participants can come to is important in building a trust relationship. Communication on a personal non-project-related level also played an important part in this context. Giving the participants insight into our own lives (e.g. interests or hobbies) in exchange for the obtained data from the field, created trust and emphasized that we, the researchers, are also only ordinary people.

All these aspects seem to be trivial, but our findings indicate that they are rather important for long-term collaborations in Living Labs. In this context, we can confirm the general conclusions concerning trust, transparency and user empowerment mentioned by Bergvall-Kåreborn et al. [3] that we extend with our own practical insights into the process of building that is entailed, and what the relevant parameters might be.

Coordination of Collaboration

The coordination of several collaboration steps, e.g. workshops, user tests, interviews etc. turned out to be quite time- and resource-consuming. We often had the problem of making appointments at the university or the participants homes and it was impossible to bring all 27 participants together at the same time. However, appointments were also often canceled right before the meeting or participants did not appear or were not at home. For example, one household failed to turn up for a date four times. This often led to delays in the project progression and should be considered in the planning process.

Unpredictable technical problems, device errors and other external influencing factors were additional barriers which we had to deal within a real world context. We always tried to fix problems as soon as possible. While most of the households appreciated that, some of them saw us as a 24/7 help-desk and called us in all urgent and less urgent cases. We assumed that a strong network of participants could reduce non-prototype specific enquiries such as how to customize a web browser on the TV or to update the Smartphone, which could be solved among the users themselves by sharing existing knowledge. Therefore, a common exchange platform and informal get-togethers are supportive for getting in contact with other participants. Due to this, ‘getting to know each other’ should be supported right from the beginning of the project, if ambitions for a participants-driven help-desk can be realized. Sharing knowledge and providing help, in this context as in others, requires more than mere technical competence.

CONCLUSION

In this work we presented our experiences from a 2.5 years long-term Living Lab study with 27 participants from 16 households in the context of the development of new concepts for home entertainment. We drew on various empirical data from our research and identified phenomena and challenges in dealing with users during a long-term collaboration process in real world contexts. We tried to follow principles of co-creation but the dynamics of the project meant that this was sometimes more problematic than we anticipated – despite best intentions. Our aim was to show how co-creation for designing with users can be problematic for contingent reasons and that the lessons we learned were arrived at over time. We categorized these aspects concerning finding and selecting participants, their motivation, the establishment of a trust relationship between participants and researchers, and the coordination of user involvement over the entire project progression. Even if some of these aspects are already mentioned in related work [3,21,22,32,33] we could neither find any recommendations for application nor any investigations and reflective descriptions that focus on the entire process of user involvement during a long-term Living Lab study. We have not, however, considered contexts where divergent interests span commercial, industrial or public policy partners as well as researchers. That additional complexity awaits further research.

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