Personal but not private: Appropriation as change in multiple artifact ecologies

Susanne Bødker
Department of Computer Science
Aarhus University
bodker@cs.au.dk

ABSTRACT
This paper addresses appropriation of smartphones, as they are interconnected with other artefacts in the artefact ecologies of the users. Empirically the paper presents a recent interview study of iPhone appropriation and relates to empirical studies done when the iPhone was new. The paper focuses on how the iPhone has continued developing, and what has happened when, now, the iPhones are increasingly embedded in artefact ecologies with other devices and software, across activities, etc.? What in the iPhone and the artefact ecology at large supports or hinders such change?
The paper concludes that the iPhone, in use, is personal and shared with the family, but it certainly is not private. Hence, Apple’s design choices seem to contrast and contradict the development of routines within people’s personal sharing with others, with consequences for the wider artefact ecology and its maintenance.

Author Keywords
Appropriation; change processes; sharing; artefact ecology, sustainability, end-user development.

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

INTRODUCTION
“Tools are fundamental to action, and through our actions we generate the world. The transformation we are concerned with is not a technical one, but a continuing evolution of how we understand our surroundings and ourselves—of how we continue becoming the beings that we are.” (Winograd & Flores [28])

It may be difficult to remember that smartphones like the iPhone has only been with us for about ten years. It is uncontroversial to say that the iPhone has changed the way we are with, and think about mobile phones, phones at large, and wider computational technologies. This is true whether seen from the perspective of research or from that of everyday life. Making sense of what the iPhone (or any smartphone) is, and does in this multi-situation, happens through a blending process [12] that involves personal computing and mobile phones; texting and instant messaging; point-and-click based interfaces and touch interaction; GPS device and internet capable computer etc.

This list is close to inexhaustible (see also [4]). Blends and artefact ecologies are concepts that have previously been used to analytically embrace the use and development of particular artefacts, such as the iPhone, in multiple activities and situations with multiple users, who appropriate the artefacts for their individual and shared uses. [5] in particular presented an analytic model to address the dynamics of artefact ecologies. They focus on one artefact at a time, while addressing how configurations that this artefact is part of, change over time and use, within and across communities as discussed by [8, 9].

iPhone use and appropriation has been studied over the past years, in particular regarding the early use. [3, 4, 5] discussed expectations and anticipation of the new iPhone. Furthermore, [11] gave smartphones to users and studied the phone function as it developed in initial use, and [19] looked at iPhone purchases from an experience point-of-view. [18] studied stories that are told regarding smartphone proliferation in the American society and pointed out that there are two very simplistic stories at play: A happy, integration one, and one which focuses on dis-integration of smartphones from everyday life. [13] studied family situations and rules for use of smartphones, [25] brought up the relevance of understanding why and how people engage in non-use of technology. All of these point towards patterns with or without agreed upon rules of use and ‘non-use’ in shared everyday situations.

With this time perspective in mind, the current study addresses use of the iPhone as it has continued developing. The study focuses on what has happened when, now, the iPhones are increasingly embedded in artefact ecologies with other devices and software, across activities, etc. What in the iPhone and the artefact ecology at large supports or hinders such change?
Looking at e.g. Danish Statistics 2016 [26], we see that the artefact ecology of Danes is changing: In 2011, 79 pct. of families had digital cameras whereas in 2016 this has been reduced to 59 pct., MP3 players have dropped from 50 pct. in 2010 to 33 pct. in 2016. The use of online services has spread and 90 pct. of the population have used the internet to send or receive email in 2016, 85 pct. have paid bills and used internet banking, 67 pct. have been reading news online, and a similar number (69 pct.) use social network services, such as Facebook, etc. This is not a stable situation even though [3, 4, 5] in their previous studies found that users’ initial exploration of the iPhone was later replaced by a more steady (but not static) state of use.

Activity is the starting point for artefacts and, historically, operations from earlier generations are crystallised into next generation artefacts and/or artefacts are representations of certain modes of acting in the activity [6]. Bærentsen [1] made an analysis of the historical development of the hand gun (see also [20]), from the perspective of how new organizing principles (war formations), new technologies (e.g. gun powder and cartridges), training of soldiers, new affordances, etc. all have developed in a dialectical relationship and left traces in hand guns as they have developed historically.

[3] borrowed the definition of appropriation from [11] who defined it as “the way that users evaluate and adopt, adapt and integrate a technology into their everyday practices”. They described how, through use, idiosyncratically and in collaboration with others, people make the iPhone and its app-world their own. In doing so, ‘the interviewees have expanded their scope of what activity is enabled by their iPhone’ [3]. According to [3] appropriation happens in the social context first, and only later at an individual level, and that once appropriation has happened on the individual level, not only specific apps, but the whole idea of using a mobile device to accessing the world of apps becomes ‘second nature’ to the user. All of these analyses further illustrate a fundamental tension between the change/ appropriation process on the one hand and the artefacts on the other. This change process is both technical and social. They emphasize what [24] recently called a fluent ontology, where the focus is on the change, the process, over the objects of artefacts, while the analysis pay attention to how the objects also, at the same time, both supports and hinders such change (talked about already by [22]).

The current study, hence focusses on how artefact ecologies have come to work for people, with the iPhone as a centre piece. The study focuses both on other devices that have been put to use together with, or as substitute for the iPhone, on apps and applications/web services that are used on multiple devices including the iPhone and on activities where the iPhone has come to be used by several people together or interchangeably. In particular the paper extends the simple model of the dynamics and development that happens for a single artefact [5], when the iPhone is introduced into an existing artefact ecology. The paper, accordingly, presents an analysis of how we became and become ‘the beings that we are’ with smartphones, to connect back to Winograd & Flores [28].

**EMPIRICAL SETTING AND BACKGROUND**

The current study draws specific inspiration from three previous analyses of iPhone use [3, 4, 5] that came out of a study where twelve iPhone users were interviewed and five were re-interviewed after a year. It draws from this both methodologically and by extending the findings:

In this work, that is almost 10 years old, users ranged in age from 19 to 62. At the time of the interviews, four of the interviewees had owned their phones for 2-3 months, while two had had iPhones from when they were officially introduced. Five had completed an academic degree, four were in high school or college, and three had undergone vocational training. One had been a very long-term Mac user, two were Mac users before purchasing their iPhone, and four purchased Macs after acquiring their iPhone. Four were current PC users. They all volunteered, or got volunteered by friends, through a request on Facebook.

In [3, 4, 5], various elements of the interviews were addressed, such as expectations and anticipation of the new iPhone and its use and interviewees’ exploration of their iPhone. The main expectation of the interviewees was to get a new cool telephone that would also support text messaging, and hence substitute their previous cell-phone.

In the beginning [5], many of the interviewees still used e.g. a separate calendar, camera, music player, together with the iPhone. But that changed over time as users were exploring the app store and phone and pursuing recommendations from media or friends. While phoning was a concern early on, as people consolidated their use, it was mainly important for people to be reached through the iPhone whereas they rarely used the iPhone for phone calls. Fundamental concerns (in particular size of the iPhone) that users had early on, disappeared as people started appreciating other aspects of the iPhone. The internet connectivity, web-browser and apps turned the iPhone into a general-purpose computing device, where the interviewees would expect to e.g. find an app for train and bus schedules when visiting a new city, but also to occasionally receive and make calls. Idiosyncratic uses and understandings of the iPhone developed [3, 5]: One interviewee used the iPhone for reading poetry in boring classes. Another used the iPhone as a “router-on-wheels” when car-pooling to work.

[5] presents a dynamic model of the development of use of the iPhone in a somewhat simple artefact ecology (Figure 1): They presents three states of the artifact ecology. “In the unsatisfactory state the current artifact ecology no longer lives up to the users need, and a change is needed. In the excited state a new artifact is added to the ecology, perhaps replacing an old. This state is characterized by heavy exploration. The roles of the artifacts are reassessed. This
leads to a stable state where the new and old artifacts have found their role—perhaps and old artifacts have been obsoleted. At some point the artifact ecology will become unsatisfactory again, and the process repeats.”

**Figure 1. Bødker & Klokmose’s model [5] (reproduced with permission).**

We will return to this model later while discussing questions raised in the current study, e.g. how use of the iPhone has continued developing, and what has happened when iPhones are increasingly embedded in artefact ecologies with other devices and software, across activities, etc. What in the iPhone and the artefact ecology supports or hinders such change?

### The current study

In contrast to the previous study, the interest in artefact ecologies and sharing led the current study to a focus on users who live together with others and who own more than one device of which one is an iPhone. People enrolled themselves through a call on Facebook, asking for people who were living with others and regularly having several devices on their WIFI. In parallel to the last study, the youngest interviewee was high-school student. However, at the upper end, the interviewees were generally younger than last time (Table 1). The interviews were carried out in Danish or English face-to-face or through Skype. These interviews, in parallel to the previous ones, lasted between 25 and 45 minutes and were recorded, transcribed and translated.

Only one of the interviewees was using their first iPhone, the others have all had 3-5 smartphones of which half have had one that is not an iPhone. Hence, the qualitative interview protocol focused on artefact ecologies and less on e.g. expectations before acquiring the first iPhone. However, many of the questions were the same, addressing activities, apps, what is the newest app, etc.

The transcriptions were coded and used, first in a grounded analysis where statements were marked and gathered from the bottom up, with a focus on the possible tensions in and between experiences. Secondly, the same transcripts were marked up according to the below outlined understanding model. The quotes used were translated for the paper, but the interviews were worked on in their original languages.

---

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technologies</strong></td>
<td>iPhone 5, four previous iPhones and Android telephones, two Macbooks, iPad, iPod</td>
<td>iPhone 5 for four years. First smartphone, iPads and SmartTVs in family.</td>
<td>iPhones for 6 years; this is number 3. Old telephones used by young members of the family. Has iPad and PC.</td>
<td>iPhone for three years, used by husband before, Work Nokia phone and PC. Two iPads at home.</td>
<td>iPhone 6S+ (for two years) iPhone 5, iPhone 4s and an iPhone 3g before. Macbook, game device.</td>
<td>iPhone 6, Had iPhone 5, iPhone 4, and a HTC that used to be her uncle’s. First phone: Sony Ericsson. Has a PC for school work.</td>
</tr>
<tr>
<td><strong>Living arrangement</strong></td>
<td>Co-housing with three other adults</td>
<td>Lives with husband and two young children</td>
<td>Lives with two children (school-age). In a relationship</td>
<td>Lives with husband and young child</td>
<td>Married, has lived in several countries in recent years.</td>
<td>Lives with parents and younger sister.</td>
</tr>
</tbody>
</table>

**Table 1. Interviews**

**RELATED WORK**

As mentioned earlier, studies of artefacts such as smartphones have been carried out over the past years, from various angles and based on various theoretical discourses: [11, 18, 19, 25] all point towards patterns with or without agreed upon rules of use and ‘non-use’ in shared everyday situations. The connection between smartphones and other artefacts are in focus when [15] worked with smartphones and cars. [7] studied the use of smartphones in art galleries with a focus on how to engage visitors in art curation. This study presented findings e.g. regarding people’s general lack of desire to use iPhones when together with others in art
galleries, and their explanation in terms of emerging implicit and explicit rules of using (and not using) technology while together with other people whether in the home or in other (social) situations.

[10] carried out a study of users’ 100 days of iPhone use combining recordings of the actual use with qualitative and quantitative analyses of these videos. The analyses focused on detailed switching between apps, in particular situations, as such switch unfold over time and together with others. [23] explored how people juggle and structure their use of various messaging services, in particular WhatsApp, with respect to who they talk to and about what. Focussing on communication apps, the paper addresses user’s idiosyncratic communication places and the rules that users develop to juggle these places with their different contacts.

In various ways, all of this work points towards the need to study the emergent, current (smartphone) technology as both software and hardware, moving between activities where the phones have different roles, in isolation or in combination with other technologies be these e.g. cars, TV sets or computers of more classical kinds.

Technologically, it further seems that there is an increased convergence between physical devices. In these, activities happen somewhat interchangeably in artefact ecologies of iPhones, iPads, smart-TVs, music players, computers, cars, etc. These devices also connect to IOT devices such as light bulbs, thermostats and loudspeakers in interconnected networks across WIFI, Bluetooth etc.

Addressing further complex use settings, [2] addressed the use of mobile technology across the spheres of work and life as well as across boundaries of place and time. Shared use in the home (as discussed by e.g. [17]), heavily relies on the trust that exists between members of the same household. On top of devices, such as the iPhone, shared applications and services have become complex, and lead to subtleties of shared use.

The sharing, coming and going of devices and apps across activities and users, in particular in the home, makes maintenance work an interesting matter, similar to the what was studied by [16]. This work comprises both back-up and security [14, 21] and relevant questions are: Who undertake such activities in the home? What are they? And how do they change over time?

With the above background the next section will summarize the research questions to be analyzed and discussed.

RESEARCH QUESTIONS ASKED

Based on the challenges coming from the theoretical foundation, and the related work, the analyses below will address the following research questions:

1. What happens when the iPhones are increasingly embedded in artefact ecologies with other devices and software, across places, home-work, etc.? The appropriation and change of these technologies are important as it has happened, and is happening among individuals, groups or communities with whom users engage through the technology, and an important question for the analysis is the possibilities and hindrances of appropriation in the technological design as such?

2. Does the convergence not least known from communication [23] generalize and is it also reflected in changing use? How is the technological convergence of overlapping software and hardware also reflected in changing use?

3. What implicit and explicit rules of using (and not using) technology do users have while together with other people whether in the home or in other (social) situations? How are these developed and applied while together with other people, in the home or in other (social) situations, and how are such supported or hindered technologically?

4. An important question is how trust and belonging together makes a difference to how people appropriate their iPhone as shared as well as private or personal? How does the personal and the shared develop with the iPhone?

5. Who undertake maintenance activities in the home and work? What are they? And how do they change over time, and how are the supported or hindered in the artefact ecology? [13, 21]?

OVERVIEW OF ARTEFACT ECLOGIES

Before getting to the detailed analyses of these questions, an overview of the artefact ecologies of the interviewees is in place to aid the analysis.

People who were interviewed live with others (be they spouses, children or roommates) who also have smartphones. Whereas some of these are not iPhones, all households have iPads. These are used by, or with, children in four of the five households where there are children. In three instances, iPads are mainly considered personal. In two households, iPads have been set up to accommodate for communal use in particular in the living room.

One of the interviewees (#7) has a smartwatch used to also to monitor exercise (biking) and activity. No other exercise devices are mentioned in the interviews. Bluetooth is mainly used with loudspeakers and headsets. A couple of households have more advanced sound equipment (SONOS). These are the main ways that people listen to music, most often through the iPhone. The car is used as a bluetooth device in two instances and mentioned by #7 who wants a new car with Bluetooth connectivity.

SmartTVs, Cromecasts and AppleTV’s are in place in most households (except one), and Netflix is by far the most mentioned streaming service. Watching flow-TV is done every day by one household (#1), and never by one.

One interviewee mentions an alarm system in her home that can be activated remotely from the iPhone (#4). Interviewees
generally have a laptop, half have Macbooks and the other half PCs.

Book-reading devices are not common (a Kindle is mentioned, only by #5) and interviewees prefer to read books and magazines on paper. Work and news reading get done on iPad, PC or iPhone. Reading news and professional reading *while on the move* is done, either in Safari or another web browser, or pdf files are saved and read in iBooks or a similar app.

Single apps mentioned by most interviewees are: Facebook (used by most interviewees, but also mentioned by #7 who made the deliberate choice to not be on Facebook) and Facebook messenger, online bank, Mobilepay (as the name says, a mobile, bank-supported payment app), email, camera/photos, map/GPS (both Apple and Google), and bus-train-travel-planning/ticket apps. Instagram is used to share pictures with friends mainly in closed communities, YouTube and Netflix, as described above. Many use also Snapchat, and, more limited, WhatsApp and Skype for international contacts. Tinder and work chat apps get mentioned with specific communication purposes (e.g. #1). Twitter is mentioned by a couple of people, but does not seem to be very actively used.

Apps for food recipes and for buying and selling used goods (children’s clothing) are used but the users generally do not mention the same app. Similarly, there are different ways of listening to music, from Spotify to services provided by the phone companies.

The calendar is used by many for work, and several express that they are semi-forced to do so. Indeed, this also means using the calendar for personal purposes for many, but it also seems that people manage otherwise in their families. ‘*We have one big family calendar at home*’ #6 or ‘*the family calendar is in MY head*’ #4. #7 describes how he used an app for family activities but got annoyed by all the notifications.

In [8, 9] a case is discussed where one participant with his partner collectively negotiate, share and manage devices or services. In the current study, there is both planned and occasional borrowing from others: Occasional, is when #3 borrows a computer with big screen from her son, or when #2’s husband brings her iPhone out cycling. Planned borrowing happens through shared devices such as iPads in the living room, smartTVs or TVs hooked up to Cromecast or AppleTV, a shared Nintendo Wii, etc.

Apple devices are connected together in various ways across devices and users. Some families actively use a set-up of connected family accounts, in other families, the adults have separate apple accounts, and some make active choices to NOT mirror iPads in living rooms and hook them up to messaging services etc. used on the iPhone. The Apple accounts are often used for both work and home apps and activities.

Certain parts of the everyday artefact ecology around iPhones have become integrated part of what people see as a smartphone. The camera is the clearest example: All interviewees use their camera on a regular basis. It is ready to hand, and people take pictures to keep, as well as not to keep (such as Snapchat), of their children and of their whiteboards at work. Some take pictures to share directly through Instagram and Facebook. #7 takes pictures at work to post on the work website. At the same time, pictures as such have become different. Some of the interviewees work with the pictures to sort and keep (e.g. #4), while others do not. Similarly, GPS/maps are so ubiquitous that people forget to talk about them when they get asked what apps they use.

Some interviewees deliberately delegate activities to particular devices such as when #1 talks about how he uses an iPod for music, because it matters less to him if that runs out of power, that it would if his iPhone runs out, when he is traveling for work.

In the interviews, there are clear fragments of artefact ecologies beyond one device: In particular people use SmartTVs/Google Cromecasts/AppleTVs with Netflix and other streaming services, sometimes also involving an iPhone, an iPad or a PC, and WIFI. Most seem to have Netfllix as the most mentioned service. TV for some is still flow, and others use apps and streaming services. This artefact ecology illustrates that people do not always care or understand what is hardware and what is software. In several instances, the interviewees talked about ‘watching Netflix on the TV’ without addressing how, and in at least one instance it never became clear in the interview how this was done, even after further questioning.

Interviewees use Messenger and iMessage, and people generally do not send many SMS/text messages despite these being without cost in Denmark. WhatsApp is mainly used internationally, similarly to the findings of [23] and Skype is used for work. Snapchat has recently been picked up by many and is replacing both messages and sending of random pictures.

It is not surprising that the current study shows a wider artefact ecology than [4, 5, 6]. The above examples, however, illustrate a much more complex situation where artefacts (both software and hardware, devices, apps, websites and programs on computers) come and go, use activities develop and diversify, rather than situations where one artefact at the time settles into the artefact ecology.

**CHANGE OF ARTEFACTS AND ARTEFACT ECLOGIES**

Based on this overview, the following section will move towards a more systematic analysis of change, addressing the research questions raised previously.

**Multi-multi artefact ecologies**

Summarizing the previous overview, some activities are distributed across devices, sometimes at the same time, and other times over time. Some activities, in particular
communication, gets spread over apps according to community of friends, rather than because of e.g. purpose.

Some apps and devices have clear trajectories across users and activities. Certain activities are delegated to certain devices such as the delegation of which devices (and apps) the children may use. The iPad is one such device as are handed-down old iPhones.

The interviewees have developed new sets of routines such as with ‘TV watching’ (Figure 2) where multiple devices and apps, even with overlapping functionality, have been appropriated for particular activities. Both regarding communication apps and ‘watching TV’ or streaming services, the interviewees have developed routines, that are community and situation dependent rather than actually depending on the various apps or media services.

Compared to [3, 5] the current study does not show very much explorative behaviour: #7 explores the app store, but most others learn about new apps to a limited extent and mainly through reviews in new magazines (#4), or at work (#1) if at all. This is in in contrast to [3, 5] which discussed extensively how the App store offered browsing and exploration. [3, 5] presented examples where people, in their extended families or groups of friends were sharing experiences with apps, an activity that is not found in the current study.

This phenomenon seems to have largely disappeared even though many of the interviewees get inspiration from friends for communications apps in particular. They acquire Instagram because their friends have it. They use Whatsapp because their friends abroad use that. A couple of interviewees mention that they get inspiration for apps from Facebook adds, and others read about apps in professional journals in particular (e.g. #1 and #5). Not only are apps less talked about e.g. over dinner, people generally seems to keep fewer apps on their phones, and to clean up more when they no longer use particular apps. In addition, the interviewees are simply less interested in exploration. In contrast to the previous study, the interviewees do not seem to participate much in everyday conversations regarding new apps and devices, all of which could be possible indicators that the users are no longer primarily learners who explore the technology, but rather users who have routines (until these break down for some reason or other), i.e. the iPhone is in a somewhat stable state in the vocabulary of [5].

Perhaps it is nonetheless somewhat surprising that the wider artefact ecology is not explored more, neither when it comes to IOT devices, reading apps, or for that matter sound and pictures in the home. In comparison with [3] it seems that certain new devices and apps do not find a place in the artefact ecologies studied: The iWatch is one example, and book readers (whether dedicated devises or apps) another. The interviewees do not seem to find their use interesting. Exploring, the next stage of appropriating, is found less, as discussed above, even though for some purposes, a variety of communications apps, and software and hardware for streaming have been appropriated by people and they have made them ‘all mine’ or ‘all ours’. This does not mean that the change process has come to an end, of course, but rather that at this interim stage of the general development of these multi-multi artefact ecologies, it seems to be some purpose have more focus than others, and that within these the inspiration from people close is important, and less so is exploration of the technical possibilities and e.g. the app store.

Convergence and divergence

A couple of the interviewees use the telephone a lot (either at work, or e.g. because of commuting in a car ‘Once I’m in the car going home I call my mother, and handle other matters and I normally talk until I’m home’ #3), most others don’t except for brief coordination (#6 ‘I call my parents to coordinate’, #6 ‘I calculated when I changed plan and I do not call more than two hours every week’). This way of looking at the phone as something used for contingency planning only, is quite parallel to [3] where several interviewees mainly saw the possibility of calling as almost an emergency possibility.

E-mail is something that get juggled across devices and applications, as per #5: “I do work and other stuff. I have my work email on it, and actually at the moment, my work email is forwarded to my personal mail account. But it is filtered so that I can keep some separation.” #6 says: “I only use email for a few things. I use both gmail and outlook, the latter for personal things, the former my spam account.”

[23] found that “users create complex, personalised app ecosystems that often include a variety of communication apps, many with highly similar features. These similar apps fulfil distinct communication roles within the ecosystem as users develop divergent use.” Not only do emails, and messages get juggled across hardware and software, depending on who the interviewees communicate with. Media convergence is also expressed in the language as when #4 talk about watching iPad above, or when it is unclear how actually Netflix get watched on the TV (whether it is through an iPad or iPhone/computer or directly on a smart-TV – Figure 2).

In the current study, for most of the interviewees it is this kind of personalized and activity-based ecology, more than differentiating e.g. between cell phone network, mobile data network and WIFI, that matters. Partly this is a result of the subscription plan that people in Europe, or at least in Denmark have mostly, where endless amounts of mobile data and band-with as well as SMS and phone hours are prepaid at a rather low cost. Interviewees are, hence, not particularly interested in e.g. WIFI hotspots, and it is not a particular concern whether their documents and pictures are placed on their hard-disk or in the cloud. It is actually mainly privacy concerns that tend to prevent people from using storing pictures in the cloud (both #3 and #4 do not use cloud...
solutions for pictures and #4 describes the work she does to back them up on a hard-drive).

Convergence in the current multi-device, multi-user, multi-application situation is both a matter of classical media convergence where ‘television’ and movies are watched across applications, situations and devices, and it is a matter of new forms of delegating communication to different apps and devices depending on who gets communicated with. The different types of networks and their band-with and cost is a very marginal issue in this respect (with the exception of making actual long-distance phone calls), and people move between WIFI and mobile networks without much concern.

Some of the interviewees juggle multiple telephones: #4 has two telephones, and #3 can transfer work calls to and from her landline work phone to her iPhone. #4 turns off the work phone when leaving work, and #3 does not transfer calls when she is on holidays. #4 always carries her private iPhone, also in work meetings: “Always. It may be muted, and hence sometimes it takes 10 minutes before I respond.” Interviewees, as in these examples, worry about bringing their work technologies into home situations, whereas the opposite is less the case. It seems that home technologies, such as private phones, have penetrated the work-life boundary because handling life as such has become logistically complex, as also pointed out in [2]. In the interview study presented her, it is mainly messaging and emails that cross these boundaries, with actual phone calls as rare but also even more penetrating this boundary.

Rules are part of driving the change of the artefact ecology in terms of changes of the ecology from one place and time to another: The leaving in and leaving out of the iPhone in particular routine situations is one example of this, and these detailed everyday changes may well reflect a larger change in calling people in the home. As seen from the perspective of how the actual iPhone or its surrounding artefact ecology may support the development of situations with rules, as they come and go in family and work life, there is not much to be gained currently. Interestingly, metaphorically, all ways of e.g. shielding the user and users off from calls and activities are all about either flying, meetings or sleeping, none are about setting up patterns for particular situations beyond that. And even less support is to be had for multiuser situations.

**Personal but shared?**

In order to understand, how people share artefacts in their artefact ecologies, ownership and privacy are important since after all, the iPhone is mainly marketed and used as a personal device, even though the interviewees have somewhat changed and appropriated this personal device for sharing in various ways.

The iPhones are mainly personal in the sense that they have one main user how most often carries and uses the phone, and how also mainly have accounts of various kinds, and credentials attached to the phone. But, just like [3], iPhones are shared with spouses when needed and with young children for games and entertainment. #2: “The children play on my iPhone and my husband uses it, like last night when he was out cycling and his phone was out of power. But one day one of my colleagues answered my phone and that gave me the creeps – it is very private.” Within the family, this sharing is very much ‘need-based’ as discussed by #5: “My wife and I stick to our own devices, mainly because we can.

---

**Figure 2. Watching TV – many artefact combinations**

As mentioned, cloud-based solutions seem to worry people mainly for privacy reasons. Accordingly, different kinds of situations seem more important for convergence, and how convergence changes, than specific devices, applications or infrastructures.

**Situations together**

[2, 13] discuss how people generally juggle technologies across work and home life situations, and also in the current study this happens, in some types of situations more than others.

The dining table seems to be the place and time where families have rules, for bringing or not bringing device and for what one does with these. In some households, the rules also extend to the bedroom as also discussed in [8, 9]. #5 mentions not bringing computer home and not always reading email. #4 says: “We do have a few rules. Not at the dining table! When the child is home we go to the kitchen to text. When the child watches the iPad we watch as well, so there is no placement in front of the iPad.” #2 similarly says: “At home we leave the phones in the kitchen while we eat. Unless everybody is VERY tired. Then the kids are allowed to bring the iPad to the table and they eat more quietly.”
But I do occasionally use my wife’s phone when mine is not available or the battery is flat.” Several interviewees (e.g. #2) mention how they only bring one phone for family outings. Lending your phone to your children may also lead to unexpected situations. #2 describes how her children happened to call an important business associate at 6 am on a Sunday morning. ‘He took it quite well.’

In [9], the role of friends and family members in the shaping of an ecology was discussed from the way participants were using devices handed down to them, be they old laptops or smartphones, handed down to adults from their fathers. In the current study there are similarly hand-me-downs, mainly when young children get phones from other family members (#2, #3) and the young #6 who accounts for an entire ‘genealogy’: “I have had an iPhone6 for a couple of months. Before I had an iPhone5, and iPhone4 and a HTC that I got from my uncle. My first Sony-Ericsson was new, and so were the iPhones.”

Whether using a work or a private phone, it seems that there is a sphere of the personal where people let their family use their phone. It is different with roomies (#1) where the work argument takes importance as a way of delimiting the use of the phone (it is my private phone because it is my work phone). The Apple ecology is however mainly one where all devices are somewhat owned and used by the same user. These tensions between this singular design, and the multiple devices are rather deliberate in the empirical material, and it is causing problems regarding how people seem to prefer to use the iPhone, and to the ongoing appropriation process.

Maintenance work
It generally seems that iPhone users are aware to update their phone when they are told to. Some have the strategy of waiting a little with systems update, to let others find out if the updates are flawed (e.g. #1, #6). Several have had bad experiences of not updated apps and hence they make sure to update these. An example of a bad experience is not being able to by a bus ticket because the app was not up to-date (#4). #5 says: “#5 ‘Software update, I don’t recall when, I tend to delay updates that involves plugging in or restarting.’”

Being asked about backup, it seems that people use iCloud and are to a varying degree able to manage multiple devices on this platform. E.g. #5 uses paid iCloud whereas #4 deliberately took steps to avoid that. The main concern for backup is with photos where e.g. #2, #3 and #4 express concern for loosing pictures (either their own of those taken by spouse or children). E.g. #4 has a procedure for backing up both iPhones in the family on an external drive, as mentioned above.

Cleaning up and backing up is done by the adults, and families deploy various strategies for what they put on which devices. #4: “I clean up the iPads but I also use them most. The iPad that the kids use only has apps, on the other we use the web browser, and they mirror neither each other nor our iPhones. First my iPhone was synced with the children’s iPad but then text messages popped up on the iPad and that was too annoying. One thing was that the kids and the nanny could read them, but even worse it sometimes meant that I did not get the messages on the phone.”

All the interviewed but for #7 generally express that they are not spending time on searching and exploring the app store for new apps. This is largely a thing of the past: ‘I did it a long time ago’ #6. Generally, the app store is perceived as messy and uninformative and ‘Browsing the super-marked isles is a more pleasant experience’ #5. The interviewees do not use a lot of apps, and they also delete apps that they do not use. Most of them are explicitly annoyed that the iPhone comes with apps that cannot be deleted. While the health app is used by a couple of interviewees, more of them would want to get rid of it. #2 describes how she, on and off, gets rid of the Facebook app because it annoys her that she ends up using it all her time on it. At the same time, it has been necessary for her work in periods. Also #7, who does occasionally browse the App store, is ‘more concerned with deleting apps’ and keeping the iPhone tidy and in style with the otherwise tidy design.

Maintenance work consists of updating, backing up and cleaning up, and this gets handled by the adults on their personal devices and on those shared in the family. In contrast to earlier studies of who maintain family technologies [13] there were in this case no example of it being the teenager in the family who does the work. In [3] the App store was discussed as having an extensive role in progressing the use of iPhones, this is not at all the case today, whereas it seems that users often read about apps and possibilities online, in magazines or on Facebook. Circles of friends or relatives also do not get mentioned as sources of inspiration and one can only guess whether this is because a new iPhone or app has become more of an everyday event since the previous study? From the previous study to this, it seems that the app store has outlived its role of inspiring new uses of the iPhone and the artefact ecology around it. The automatic propagation of updates across devices on the same apple account does not seem to help either, since the different devices are rather deliberately set up differently.

SUMMARY AND DISCUSSION
Currently the iPhone is part of multi-activity, multi-context, multi-user artefact ecologies, yet it is also both designed as a single-user device and also used as one in terms of both phoning and many personal apps, from email readers, message-services to e.g. calendars. The Apple ecology deals with all devices as owned and used by the same user, hence both data and messages are propagated across all devices on the same Apple account.

The artefact ecology
The interviews indicate that for many users, this artefact ecology is in a somewhat stable state, where people explore very little when it comes to apps and the App store, and where also situations where iPhones and iPads are shared,
are rather well-defined and stable. In contrast to [3] appropriation in the social context no longer happens very actively, except when people find inspiration in e.g. magazines, further removed from their own social circles than in [3] where they actively shared and discussed with friends. Individual exploration of the App store does not happen much, and people more than ever, seem to know and expect that they can find apps for particular purposes if they need them.

Change towards both personal and social, idiosyncratic use, where people populate the iPhone with their own local uses, happen, however, as both convergence and divergence, such as the situations where message app is determined and dependent on groups of friends, and where TV watching happens across devices and apps, depending on who is watching together with whom and where.

Private, personal or shared
The mixture of personal and shared devices, partly owned and managed also by different members of the household, challenges the current trend of design by Apple, of using face recognition for security, in particular since the interviewees had a more nuanced understanding of how and when they share with others. This way of thinking is quite in line with how IT security is thought in many work places, and also in line with how Apple seems to think about their devices, when they propuse using thumb or face recognition as a way of opening the device. But it is certainly not very accommodating towards how most families seem to handle their personal space: The phone is personal and can be used in the family, but it is not private and hence, it would be a problem if it cannot be opened by others. In this manner, the current design efforts regarding the iPhone seem to contrast and contradict the development of routines within people’s personal space of sharing with others. It seems that new and more elaborate work-arounds can be expected, and possibly even that users will stay away from the most recent designs.

Also issues of sharing are in focus with respect to cloud services, backup, and propagation of contents across devices – text messages that pop up on devices where this is less appropriate, concerns for who gets access to pictures and documents, not to mention worry that these may not be backed up. All of these matters are actually not very transparent to the person(s) who take on the maintenance work of the family, and people seem to develop their own idiosyncratic routines for this.

Interesting, it seems that one could understand Apple’s design model, and that of Weiser [27], as a continuum from many, differently formatted, pick-up-and-use artefacts (Weiser’s ubiquitous computing vision) to many personal devices (Apple’s model), where as it happens, users in actual use try to force Apple’s model towards Weiser’s vision, without being able to push their use all way there (Figure 3). It is certainly not clear from the study, that they want to push all the way. In addition, the iPad are, in the examples, used slightly more as pick-up-and-use, but also here users struggle with the personal elements when it comes to e.g. updating. Hence, in both instances, the Apple model does indeed constrain and hinder the push towards the more shared, even within families.

Figure 3. Between Weiser and Apple

Dynamics
With this analysis, the Bødker & Klokmose [5] stages (Figure 1) seem too simple, because stability and unrest are caused not only by the single artefact, but also by trajectories of change of other artefacts being used and appropriated in certain ways, simultaneously or not, as well as by less visible components such as cloud services and the App store as such. However, the intermediary stability that we witness is not a result of users or designers not wanting change.

The tensions between this singular design, and the multiple user is rather clear in the empirical material, and it adds to the problems regarding how people seem to prefer to use the iPhone, and to the ongoing appropriation process. Hence, even in this respect the Apple model does not seem to hit the sweet spot desired by users.

Interestingly these matters also raise questions regarding sustainability of artefacts, in these complex ecologies, e.g. how the hand-me-down of artefacts may be supported, how re-use of artefacts may happen when some stay in the ecology with limited function, no updates, etc.? And how e.g. temporary lending of artefacts, such as iPhones, may be supported, also in the ways in which both iPhone artefact ecology and App store is set up? It is however not obvious that such sustainability is of interest to e.g. Apple who would probably rather sell a new phone or iPad. However, the matter is interesting from the perspective of research. Hence, the current change-oriented analyses of artefact ecologies point towards a promising framing of design for shared appropriation and sustainable artefacts, issues that will be addressed further in upcoming research.

CONCLUSION
To comprehend the development or artifact ecologies including the multiple ones that currently surround iPhones, it is necessary to move the analyses beyond the development of the singular iPhone in use. Stability as well as unrest is caused, not only by the single artefact as it is used and causing tensions and breakdowns, but also by trajectories of change of other artefacts being used, and appropriated in certain ways, simultaneously or not, as well as by less visible components such as cloud services and the App store as such.

The analytic shift of focus from the artefacts to the process of change and appropriation allows for understanding how
specific choices made in the design of each artefact, be it hardware device or software app, or infrastructural components from cloud services, to mobile internet plans and app stores mutually support and hinder change towards what users want, in many ways. And certainly, what users want can be understood only in a dialectical tension with what they can get, which is then in turn undergoing change, though not always the changes that the users prefer.

REFERENCES


