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Uncovering the New Wireless Interaction Paradigm

The always connected, mobile consumer is closer to reality than ever before. Ericsson expects the worldwide number of mobile phones to exceed landline phones by 2002 and that there will be more mobile Internet subscribers than fixed Internet subscribers by 2003 (Ericsson Annual Report, 2000). The potential of advanced wireless networks far surpasses today's mobile extensions of PC and Internet applications. But these new applications are not yet clear. Leveraging competence in customer research and interaction design, the human-computer interaction (HCI) community is, therefore, in the perfect position to address a key need of this industry: new application discovery.

So far the focus of the wireless industry has been on developing the *technology itself* for next generation networks such as UMTS or W-CDMA—commonly referred to as the 3rd Generation Wireless Technologies (3G). The 3rd Generation wireless networks are more than an increment of previous generations: While the step from 1G (analog voice) to 2G (digital voice, short messaging) mainly marked significant progress for the quality of voice applications, 3G opens up a wider range

of possibilities. By summer 2001, 2.5G services, the transitional networks towards 3G, were already commercially available in some European countries. In July 2001 AT&T Wireless launched the first GPRS service, a common 2.5G technology, in the Seattle area. The first commercial 3G service was launched in the Tokyo metropolitan area on October 1, 2001.

As such networks become available, industry focus is going through an important transformation from tech-



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nology development to customer solution development. So far, voice communication has been the “killer app” of wireless communication. There wasn’t much reason to explore new application needs of customers. Today’s mobile phones have evolved to fulfill customers needs around voice communication pretty well. For customers to adopt advanced wireless services, value beyond voice needs to be offered. However, the first attempts in the quest for the “3G killer app” has not led to a clear winner. Why is it so hard to create innovative applications for this powerful technology?

In the following we will explain the 3G application design challenge and the opportunities that lie in this area for HCI practitioners. We will describe the distinct nature of the *3G Interaction Paradigm*, which we believe is more deeply influenced by the rules and conventions of culture than any other digital technology before. We suggest an approach that takes the interdependency of technology and culture into account and ultimately allows businesses to spot opportunities, avoid pitfalls, and develop successful applications in this rapidly developing market.

Application discovery for an emerging interaction paradigm

3G is the first digital technology that brings true convergence of voice and data communication to consumers. It supports voice and data in a “packet-based” mode of communication, allows high peak bandwidth, direct IP access, short response times and the capability for users to stay permanently online. That means that multimedia content can be delivered in real time with high levels of interactivity. However, this technical convergence brings along a shift in the interaction paradigm that is a significant challenge for the development of compelling 3G applications.

The landscape of today’s digital, interactive products is dominated by two main interaction paradigms:

- * Telecom: The phone paradigm
- * Personal computing: The PC/desktop metaphor paradigm

In today’s practice those paradigms drive rules and conventions for designers *and* users. Designers embody the rules of the appropriate paradigm into products and users will know what to expect and do (Figure 1).

The nature of the 3G technology challenges those conventions: From a purely technical perspective the third generation wireless networks can be seen as a convergence. However, user interaction with 3G solutions doesn’t clearly fall into either category. Which interaction paradigm should apply—telecom or computing? Is it a mix of both paradigms? Or something completely new? So, for instance, some of the following questions naturally arise:

- * Are interactions saved in files (PC) or do they last only until I hang up (phone)?

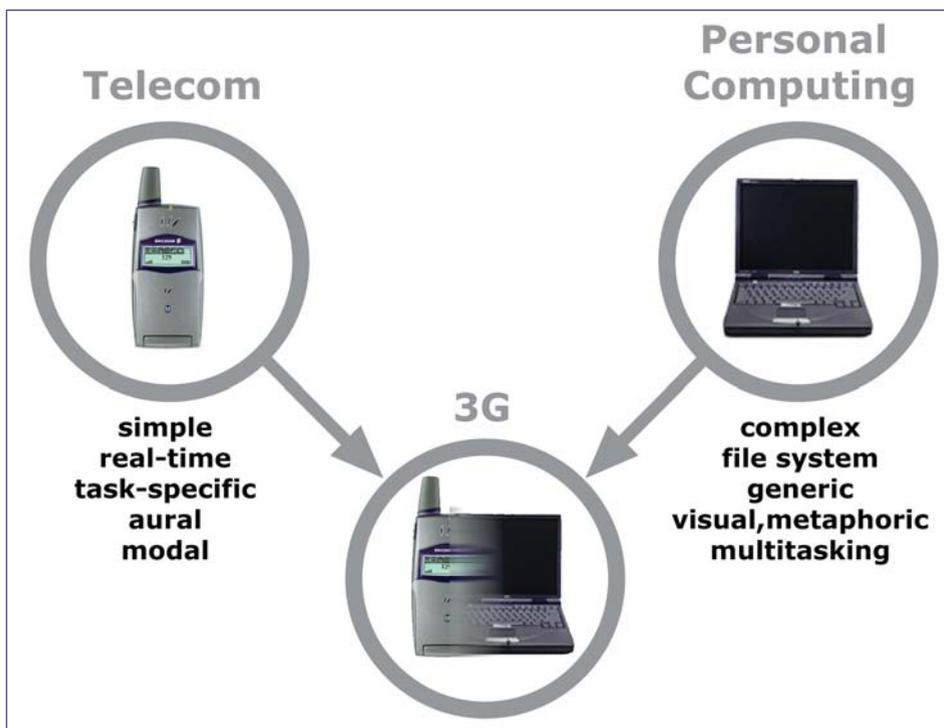


Figure 1: Today’s main interaction paradigms: Telecom & Personal Computing

- * Do they support an “Undo” function?
- * Can they be fixed through a restart?
- * Are changing applications available (PC) or is the functionality fixed (phone)?

In fact many design approaches to advanced mobile products today use modes to switch between the rules of telecom and computer and/or the Personal Digital Assistant (PDA). Existing PDA interfaces are clearly derived from the desktop paradigm and are mainly used as satellites of PCs. For example, the Ericsson R380 device features a phone mode (lid closed, vertical orientation, button operation) and a PDA mode (lid open, orientation horizontal, pen use) (Figure 2). Similarly, Nokia offers the 9210 Communicator with a similar hybrid approach.

While such strategies make devices approachable by leveraging established rules, many customers today do perceive those solutions “only” as a combination of PDA and phone. One reason for the lack of customer understanding about 3G comes from the fact that the rules of the PC and phone paradigms cannot easily create appeal that goes beyond those paradigms. To come up with applications that successfully communicate the value of 3G to consumers, the industry needs to start leveraging the unique rules of 3G. Hence, the opportunity for HCI practitioners in this market therefore does not only lie in creating interfaces and ensuring good usability, but in the exploration of the wireless interaction paradigm and discovery of new application opportunities.

Application discovery based on customer culture

Design approaches which focus on incremental improvement of products are very efficient if there is an existing set of design conventions to start with. However, in this case, to explore an interaction paradigm from scratch, an alternative source of information is required: the interactive culture of the mobile consumer.

Previous work has demonstrated that humans approach unfamiliar, interactive technologies based on what they know from interaction with other people (Reeves, Nass, 1996). The rules of human interaction are defined in the shared values, beliefs and protocols—in a culture. Culture here can be national culture (the French), professional culture (medical doctors), or subculture (Harley drivers). Culture-based design is the key to discovering appropriate rules and designs for applications and products with little or no defined conventions.



Figure 2 : The Ericsson R380 Smart Phone

As we reported previously in this publication, understanding the *Culture of Interaction* (Sacher & Margolis, 2000) of a customer group enables us to design interaction that connects to concepts and protocols already existing in that culture. Design approaches that use ethnographic discovery techniques have been applied in industry to explore the culture of the work place (Suchman 1995) as well as leisure activities such as new car features that fit the North American camping culture (Leinbach, C.). Wireless technologies are connected to our personal culture in a even more fundamental way. Mobile devices go with us from home to work and to leisure places. As a conduit of social interaction they become a part of our identity—full of personal meanings and individual experiences.

In the next section we will give an example

of how a culture-centric approach was used to explore and develop a 3G service concept for U.S. teenagers.

BuddySync—a 3G service for teens

The authors started this project in 1999 with a team of anthropologists and designers by conducting ethnographic studies with teenagers.

The insights from the fieldwork revealed the central role of immediacy, social aware-

Messages simply appear in their original form and disappear after they are read. Through people icons on screen teenagers can talk or, when they need more privacy, exchange short handwritten notes, or scribble notes together with the shared note feature (in real time)—an informal and spontaneous implementation of a shared workspace (Figure 3).

It also became apparent that teenagers (probably more than adults) vary their com-

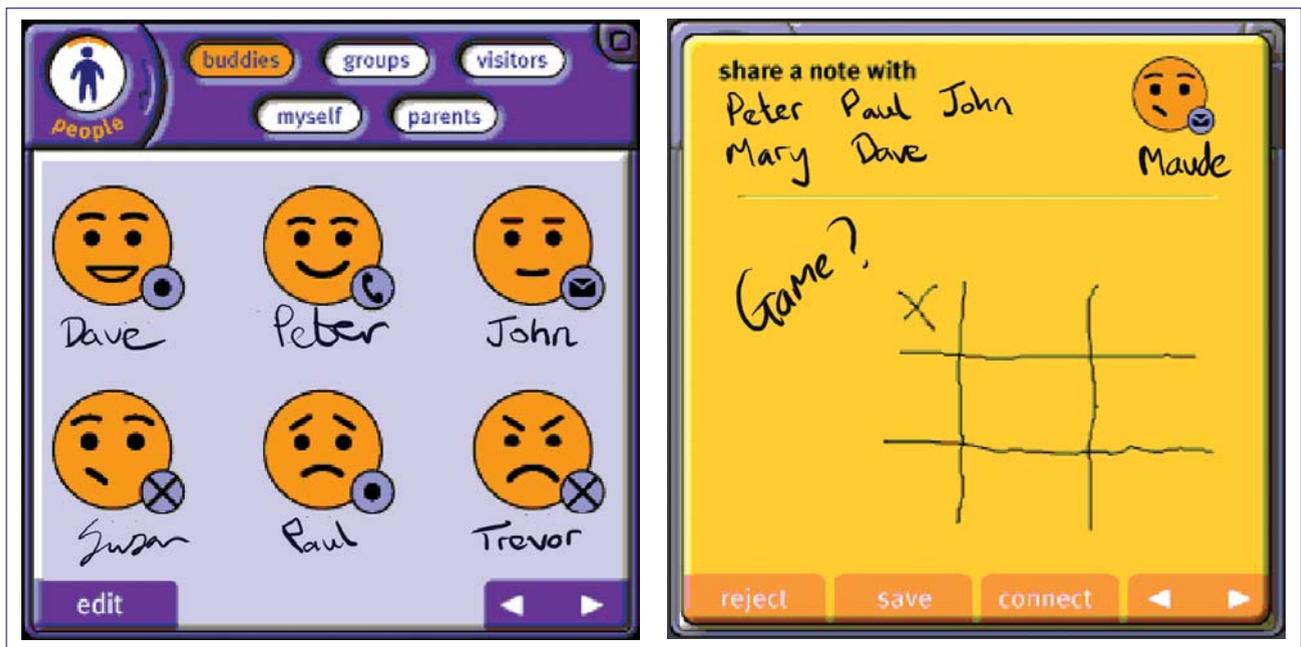


Figure 3 : BuddySync screens with social proxies and shared notepad session

ness, and group communication. It also showed that existing communication tools like phone, PC, and Internet are at best a trade-off between immediacy and distribution. While individuals preferred the phone for speed and immediacy, groups found it cumbersome. The capability of email to send and reply to groups was valuable, but it was lacking in immediate feedback.

The 3G wireless technology can go beyond those limitations. It supports real-time voice or chat and handles group messaging, all through a personal device that creates privacy. The design concept that was based on the findings—BuddySync—is geared towards immediate interaction with people. There are no representations of messages in lists, no documents or applications—as in the PC world.

munication style depending on the recipient and social context of the communication. The structure of the social grouping was highly consistent: Close Friends, School Friends, and Parents (Figure 4). The BuddySync interface reflects and leverages this threefold structure and allows teenagers to avoid conflicts and stick to the right style of communication:

- * Always connected with close friends through iconic faces (social proxies) that show moods and contact preferences in real time.
- * Organize group activities with school friends with a powerful group section.
- * Speed-Dial the parents to check in to show responsible behavior with real voice to create trust (Figure 4).

The evaluation of a complete prototype of BuddySync confirmed that teenagers perceived it as being different from phone and the PC and more than a combination of both: A product with a distinct identity that supports and enhances their way of interacting in new ways. Technology potential turned into tangible value and utility to consumers—only possible through 3G.

Lesson learned about the wireless interaction paradigm

Over the last three years the authors and their teams have used anthropology-based research and interaction design to explore new wireless opportunities. Interviews with participants like students, business professionals, homemakers, etc., allowed observations of the emerging wireless interaction paradigm across

a variety of customer groups and applications. While many fundamental human-computer interaction principles that evolved from the desktop computing or telecom world (e.g. consistency, forgiveness) do apply to wireless products, there is a number of recurring themes that can be seen as the first sign of a distinct 3G Wireless Interaction Paradigm. So far those phenomena have played only a minor role in human-computer interaction, as they are less significant in the desktop context.

Immediacy

Wireless services are perceived as most valuable if they resolve an immediate need in an immediate fashion (e.g. reserve a train seat from the taxi). Due to the constraints of mobile devices and situations, users will delay less urgent tasks until a more convenient interaction is possible (e.g. shop for a book). Applications that will not fulfill an immediate need efficiently will not be able to convince. Additionally, mobile users have higher expectations towards speed and responsiveness of UI's compared to the desktop context. A particular challenge for design practitioners is the simulation of immediacy in user testing!

Locality

Despite the fact that the 3G networks will eventually be a global infrastructure, the focus of wireless users is on very local needs (e.g. find the nearest photo lab). This contradicts with conventions of Internet information retrieval where searches typically start with a global view and users drill down to specific topics. In mobile situations it is more appropriate to start with local content. This requires systems to understand the local context and users to communicate their location, which can raise significant privacy concerns.

Use Appearance

Mobile interaction often happens in presence of other people. Users are concerned about how they look while using

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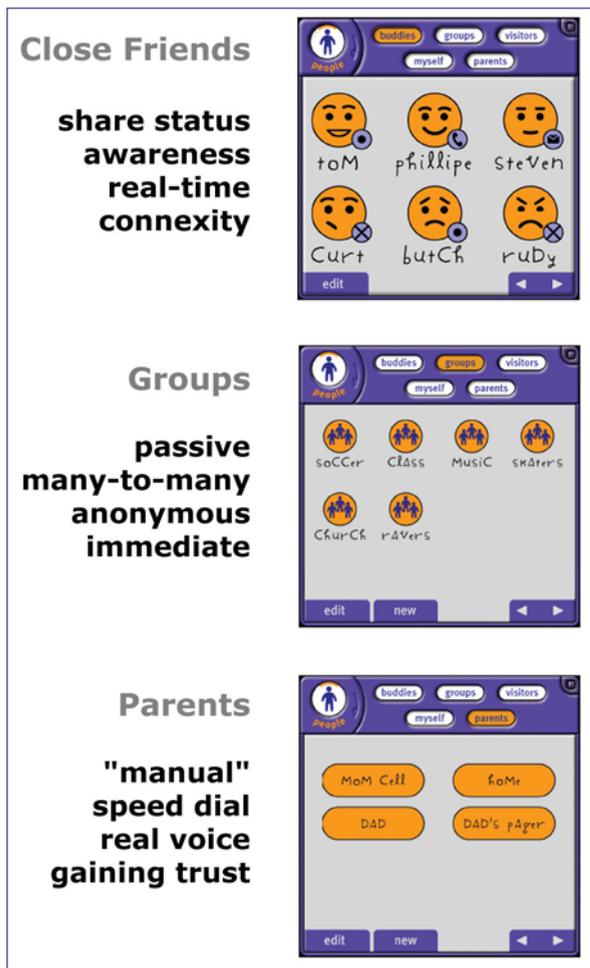


Figure 4: The BuddySync interface reflects existing social structures

a device or application. Implicitly or explicitly every interaction design leads to physical gestures—which can look cool, tense, or silly. If such gestures lead to an awkward appearance, the application is very likely to be rejected. This aspect of interaction design is a new phenomenon as most existing software interaction happens in office cubes or living rooms. It will need to be addressed by looking at software and hardware interaction in context. Industrial design aspects need to be integrated early in the process.

Blurring of “Personal” & “Work”

Mobile devices are being carried around between home, work, and leisure places. Hence mobile users expect applications to be useful for personal and professional purposes.

Users will go through every feature and evaluate the nomadic trade-off in terms of hardware and software. The desire to remove inefficient features is high compared to the desktop computer where an underused feature can be ignored. An optimized feature orchestration that takes hardware and software implications into account is crucial for wireless solutions.

Connexity

Being wireless often means being remote from a group, family, or office colleagues. The desire to check-in and share—“connexity”—has high priority. Such check-ins happen randomly without a special purpose. Consequently users evaluate mobile services by their “connexity potential.” This applies

*Wireless applications must support users
in managing communication across
different groups.*

However, this does not mean that both worlds always coexist in harmony. Wireless applications need to support users in managing communication across different groups. This applies particularly in cultures where social protocols differ significantly, for example Japan. The distinction commonly used in the IT industry between professional and consumer applications, which goes as far as having specialists for each, is harder to maintain in wireless.

Nomadic Trade-offs

In our studies we observed users applying a distinct feature assessment model. Humans have a special sense for the right combination of tools to take on the road—assessment of the nomadic benefits vs. the nomadic demand. In the case of a mobile device the nomadic demand of a feature not only means weight and size but also memory, battery consumption, and added complexity to use.

not only to communication related applications (e.g. messaging, chat), but also to applications that by nature are not directly related to communication (e.g. imaging, music). This phenomenon can be challenging because its fuzzy nature is hard to capture with task- or performance-oriented analysis approaches. It requires researchers to look at groups of users in natural situations over longer periods of time and outside of conventional lab settings.

Human+Context Interface

As wireless devices start to include imaging capabilities, users desire to not only share conversations and messages, but also their environment and other people around them. Remote participation, sending a picture instead of words, or “letting the music speak for itself” can replace cumbersome entry of text or recording of voice messages. By definition the purpose of a “human interface” so

far has been to connect a human to a machine in order to capture all her ideas, utterances, gestures, etc. The context has not played a significant role, as it was mostly the same office cube, lab, or living room. To address the desire of mobile users to include the situation the “human interface” needs to extend into a “human+context interface”: An input and interaction mechanism that is able to capture the user within her unique situation.

Progressing or stumbling into the wireless business?

With the arrival of the next generation wireless networks the demand for new services and products will increase rapidly. This is a challenge and an opportunity for the HCI community.

Applying the rules of the PC or the phone paradigm alone to new applications has not led to breakthrough innovations. At the same time there is a natural hesitation to leave familiar ground behind. Buzzwords like the “Wireless Web,” “Mobile Commerce,” or “Internet Phone” have made connections between wireless and already existing technologies but do not necessarily clarify the situation. While there is pressure on designers in industry to “make interfaces ready for wireless,” the lack of comprehensive knowledge about the underlying interaction paradigm makes this job difficult. In the worst case this situation pushes designers into a reactive, improvisational loop rather than into a creative process, that focuses on the true opportunities of 3G.

On the other hand the iterative, user-centered approaches practiced in HCI could give this discipline a central position in the wireless application discovery efforts. However, this requires that we leave behind conventions established in the desktop and Web paradigm and experiment with new methods, types of use, and design techniques.

Anthropology-based research techniques and exploratory design studies allow us to learn about emerging mobile cultures around the globe and develop strategies that leverage characteristics of the wireless interaction paradigm. Over time, we trust that this orientation will generate a body of knowledge and techniques that let us uncover a comprehensive picture of this paradigm.

Important human interface principles of the personal computing paradigm such as direct manipulation and the desktop metaphor took decades to evolve—both in the work of designers and the reality of consumers. The Internet had been around for many years before the Web made the value of this technology tangible to business and mainstream customers. The earlier the players in the wireless industry understand and leverage the unique new rules of the wireless interaction paradigm—rather than spending time seeking connections to the old rules—the sooner we will see breakthrough services and products on the wireless market.

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