

Context Awareness and Mobile Phones

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Abstract: This paper investigates some aspects of how context-awareness can support users of mobile phones, in particular the calling party. The use of mobile and stationary phones is discussed in relation to situational properties of a phone conversation, especially with regards to who might benefit from context-awareness in this context. An initial hypothesis is that mobile phone users communicate context information to each other (verbally) to a much higher degree than do stationary phone users. Mobile phone users could benefit much from context awareness technology, in particular when about to make a call, if they can receive context information regarding the person they are trying to reach prior to establishing the call. We argue that such technology should require low amounts of explicit user interaction, and could lead to less disrupting calls in inappropriate moments, as well as less frustration for the calling party when a call is not answered.

Keywords: Computer mediated communication, Context awareness; Distributed context awareness; Mobile phones; Third-generation mobile networks

1. Finding the Appropriate Context of Communication

There are many social conventions that determine the ways in which we initiate communication with other people, and technological advances have provided us with numerous possibilities for communication. However, when technology disallows people to follow traditional rules, other strategies have to be developed. One interesting example is the organisational structures that developed as a result of the use of a non-context sensitive technology such as the telephone. A large organisation might have a manned switchboard service in order to distribute incoming calls. Important, and hence busy, persons may have a special secretary or assistant who will answer the phone and choose the proper action: to let the call through, to call back later, to encourage some other form of communication such as to book a meeting, etc.

In many ways, such an organisation works as a more or less effective information filter owing to its hierarchical structure. With the coming plethora of communication devices, people in everyday life are almost as likely to be overloaded with communication. Finding the counterpart to the secretary or assistant is therefore of considerable interest, even to the normal user. New sensor technology combined with proper

software could, for instance, automatically gather context information from the surroundings of a phone, and use this as a filtering mechanism to support the *recipient* of a call [1].

An alternative to the use of adaptive context-aware devices that take on the role of a secretary is to address the original problem, namely that the phone call as such is placed, or rather received, out of context. Creating technology that decides what is or is not important is, at least in most cases, much harder than presenting proper information to the users and letting them decide. If this burden of deciding is always placed on the receiver of a message there is little done to help the communication overflow [2], but if it is placed on the sender it can be done as a part of the activity of placing the call itself. Providing the calling party with information about the current context of the person they are trying to reach, *even before they make the call*, makes it possible for them to decide when to initiate the communication and how, and to determine what channel to use (e.g. phone, email, paper note, etc.).

1.1. Awareness revisited

A number of systems have been developed for supporting awareness and informal communication, both for research and commercially. Examples include video windows such as Port-holes [3], online instant messaging services such

as ICQ (www.icq.com) and mobile awareness devices such as the Hummingbird [4]. Many such awareness systems provide cues about who is around, if they seem to be busy, etc. and thus proactively work as a reminder, or rather a triggering mechanism for initiating communication with someone. In the absence of such cues, something else must trigger the communication.

Interestingly, Portholes was used as an information tool, offering users “a lightweight means of finding out the availability of a colleague”. Even though that was not its primary purpose, Portholes did function as a way of distributing context awareness in order to better select an appropriate communication channel. However, besides being stationary, Portholes’ video streams used a large amount of bandwidth, and it did not provide ways for selectively distributing context at different levels of abstraction depending on the requester.

2. Phone Technologies

Current phone technologies provide very little context information to the user. At the network level, there is Caller ID, which allows one to see the phone number for an incoming call. Many mobile phones allow for explicitly selecting a predefined context such as “meeting”, “silent”, “outdoors”, etc. Each context, or profile, is associated with certain notification cues [cf. 5], such as different phone call melodies, sound levels or vibration. In addition, there is a possibility to allow certain phone numbers to override the current profile, e.g. to give an audible signal even though you are in a meeting. This is a way to filter incoming calls. Besides their limited usefulness, these techniques are only available to the person being called, not to calling party, introducing an information/communication asymmetry. The very existence of this asymmetry could be uncomfortable for the callee: “Why isn’t he answering? Perhaps he saw that it was me on his Caller ID? Doesn’t he want to speak with me?” [cf. 6].

2.1. Mobile and stationary phone use

Current mobile phones have inherited much of their design from their stationary counterparts, e.g. the design of the user interface, the nature of the ring signal, etc. Talking on a phone has become a well-established social act that is easily

recognised and understood by others watching. However, mobile phone use differs substantially from stationary phone use [7].

Stationary phones are typically associated with places, while mobile phones are associated with persons. While the context of a place is relatively static, the contexts of most persons are not. When calling to a stationary phone, one can often derive much of the context of the person one is calling from factors such as the phone’s location, time of day, etc. but this does not hold true for a mobile phone to the same extent.

At the beginning of mobile phone conversations, it is very common to both ask about and describe one’s own contextual situation [7,8]. This might include one’s current activity, the place or location, who else is present, what they are doing, etc. Besides describing your own context to the other person through the phone, it also quite common to repeat loudly the other person describing their context, so that, for instance, people in a group get a sense of who is calling and why. As stated by Kopomaa, “Expressing the context of the present situation has become a convention in mobile phone communication” [7, p79]. We believe that this behaviour is much more common with mobile phones than with stationary phones, and this has certain interesting implications.

2.2. Applying context

Rahlff et al. [6] propose a model for contextual feedback in human conversations. They distinguish between communicational feedback, i.e. checking whether a message has been understood, and situational feedback, which is about the (changing) environment and state of the person being called. In face-to-face conversations both these types of feedback are used, but in teleconversations such as on the phone, the contextual feedback is reduced to almost zero, though some context could be inferred from ambient audio or the tone of the speaker.

In current telephone conversations, most contextual information has to be gathered, abstracted and transmitted by humans, verbally. However, we believe that there is a great opportunity for incorporating context-awareness technology into mobile telephony systems. Context sensing could support the recipient of a call, by automatically changing the phone’s profile according to its context [1]. We suggest extending this by distributing context information to

the calling party, even *before* the call is placed. The availability of such functionality in the telephony networks and handsets could lead to fewer disturbances for busy people during inappropriate moments. It could also lead to less frustration for a person trying to make a call, for instance to a phone that is silent because it is at a meeting or the cinema. In this case, the person would probably never try to make the call at all at that time, but instead wait or use another communication channel such as email. Herstad et al. [9] propose a related idea, introducing a feedback loop for contextual information into a mobile communications network. The context information could be used either by the system or by the calling party to select the most appropriate communication channel according to the current situation.

2.3. Automatic sensing and privacy

Some communication systems, e.g. ComCenter [10] and ICQ, present the user with some information about another person before communication is initiated. However, many such systems rely on the user to *explicitly* select an appropriate mode each time. ICQ has a very simple way of automatically sensing the context of its user: no mouse or keyboard activity for a few minutes, and it activates the “away” mode. Other types of context information derived from various sensors would be able to describe the user’s state in a much more accurate way, *without* explicit user intervention, and this might be a key factor for a successful system. However, we believe that in order to gain acceptance among ordinary people, there must be a “manual override” function, e.g. stating that you are busy while not really being busy. There are also some serious privacy concerns here, such as who controls information about you that is being distributed, abstracted, where it is stored, etc. What if the phone also transmits information about other people nearby? There is clearly a trade-off between privacy intrusion and user benefit, but if the benefit is perceived as large enough, some privacy losses will probably be accepted. This is already the case with GSM and its associated positioning systems and caller logs, though this has so far mainly been used as evidence against criminals and for surveillance.

3. Conclusion

Few awareness systems have been successful in gaining acceptance from a large number of users. One reason for this might be that the awareness they introduce is an artificial awareness state, one that would not be present without the system, and is also continuous and therefore might be distracting. However, in the case of mobile phones, people already communicate their context to each other verbally. Introducing context-awareness technology to support this would thus support an existing practice rather than introducing a new one, and it would not be continuously attracting attention. With third-generation mobile networks such as UMTS approaching, the technological premises for such systems will soon be available.

With the availability of digital networks that allow for distribution of contextual information, it is not necessarily the person whose context is gathered that benefits the most from it. Rather it could be someone else who is currently communicating with this person, or considering contacting this person for some reason and therefore must select an appropriate communication channel. We have used mobile phone calls as an example of this, where the calling party generally would be much better off if they had access to some of the aspects of the context of the person they are trying to communicate with before even choosing the communication channel and initiating, for instance, a phone call. However, most of the discussion applies to some extent to other channels for interpersonal communication as well.

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