

# Hummingbirds Go Skiing: Using Wearable Computers to Support Social Interaction

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## Abstract

*The Hummingbird is a wearable computer that aims to support communication in co-located groups of people, by giving users a continuous awareness of the physical presence (or absence) of others. To examine the effect on group communication, we performed a study where six ski instructors used the Hummingbirds during a five-day trip. The study showed that the Hummingbirds were used more as a support for informal social interaction than for the actual work activities of the test group. In subsequent focus group sessions, we saw a clear difference between instructors who had used the devices and those who had not, in that the first group gave many enthusiastic suggestions for improvements and new usage areas, whereas the second group had great difficulties in seeing any use for the devices at all.*

## 1. Introduction

Mobile computing and communication technology is becoming more and more common. In Scandinavia, mobile phones have entered into the fabric of daily life to such an extent that they are practically ubiquitous. With the continued evolution of the functionality of mobile phones, and the addition of wireless communication capabilities to hand-held computers, the line between communication and computing devices is starting to blur.

However, the interaction paradigm of the mobile phone has been directly inherited from the stationary phone. Receiving a call requires the user to do an explicit “context switch”, thus often disrupting other activities. An alternative interaction paradigm is offered by *wearable computers*. These are always “on”, continuously augmenting the user’s abilities, thus requiring no context switch to use. However, most wearable computers are designed to be multi-purpose devices. By designing a wearable computer specifically for augmenting inter-personal communication, we may explore new paradigms for computer-augmented interaction.

## 2. The Hummingbird

Previously, we have developed the concept of inter-personal awareness devices, *IPADs* [1]. IPADs aim to support awareness between users, but not the actual communication that might result from that awareness. The *Hummingbird* is

an IPAD that enhances the *awareness of presence* between the people in a group by extending their range of “detection” even through physical obstacles and over some distance, according to the following principles:

- If two or more Hummingbirds belonging to users in the same group are close (currently roughly 100 meters apart or less) they will produce a sound – they “hum”.
- Additionally, a display shows the identity of the other Hummingbird users in the vicinity (since there may be more than two users in the group).

The original Hummingbirds were built from scratch using standard electronic components. For this study we developed a new generation of prototypes with a larger display and more flexibility, using a Nintendo GameBoy hand-held video game as a base. We designed a small radio transceiver, which communicated with the GameBoy through the serial port. Custom software was developed using tools freely available on the Internet [2], and transferred to commercially available blank cartridges [3]. The devices were small enough to be comfortably carried in a pocket or worn in a special case.

## 3. The study

To test the prototypes in a realistic environment, and to get feedback from a user group not normally exposed to wearable technology, we performed a study in the ski slopes of Oppdal, Norway. The team testing the Hummingbird was formed by six ski instructors being part of a group of sixteen instructors responsible for a trip with two hundred Swedish students. Using the qualitative framework of ethnography, the test was observed by a researcher who lived with the ski instructors during the five-day trip, thus watching how the Hummingbirds became a part of their daily life. To examine the group members’ thoughts and ideas around the concept of IPADs, we performed two focus group sessions after the actual test; one focus group consisting of five users and one with four non-users.

The findings from the study are explained in terms of activities, using concepts from activity theory [4]. The framework of activity theory makes it possible to study the artifact in a context and considers the artifact as a tool to achieve a goal. The activities during the time in Oppdal can for our purposes be divided into activities related to work

(skiing instruction, organizing the bus trip, etc.) or to social activities (having lunch, going to parties, etc.). These activities are then expected to occur at different times during the day and at different places. The two types of activities also differ in the need for knowing whether the others are present or not, hence we may expect difference in how the Hummingbirds will be used.

#### 4. Findings from the study

One interesting finding was that it seemed that the ski instructors had more use of the Hummingbirds in activities that they did not consider the devices to be meant for. From the very beginning the users regarded the Hummingbird as a tool meant for work activity, more precisely teaching skiing skills. They saw the test as a way to determine how useful the Hummingbird was in helping them organizing this activity. However, it is clear that the Hummingbird was more often used in situations where the object of the activity was of a social character. It was used during the day to achieve goals such as to find other instructors in order to have lunch with them or to see who had left the cabins in the morning. During the actual skiing, the Hummingbirds were not often used, since they were considered to have a too short range; also, the sound was not sufficiently loud and it was considered cumbersome to take the device out of the pocket to look at the display. Users would look at the devices when they were in the lifts or while taking a break in the skiing session. Some of the instructors also used them when organizing the student group on the bus trip to and from the destination.

The ski instructors constantly had to negotiate with each other around the use of the artifact. These negotiations were a way for the users to reach a consensus of when, where, and for what purposes the Hummingbirds should be used. Since the instructors had not been told how and when to use the Hummingbirds, they had to establish their own roles toward the artifacts. To quote [4], the users had “an active role, using given artifacts but deciding actively how, where and when, to use them”. During the test, several of these negotiations of use were noted, for instance when some people wanted to bring their Hummingbirds to the night club, and then were told by other users not to bring the devices to places that they were not meant for.

Another finding is related to the notion of privacy. During the focus group session the users expressed a fear of misuse of the Hummingbird, if designed in a way that would not give all users access to the same information. The members were afraid that such an artifact could be used for surveillance purposes and could harm the personal integrity. However, they also recognized a few contexts where such a function would be useful, such as a kindergarten. In the focus group session, the users also said the Hummingbird was different from mobile telephones and beepers, in that it “does not demand anything from you, this is more relaxed”.

Several improvements of the Hummingbird were suggested in order to make it more suitable for skiing; extended

range, a possibility to determine direction of the others and a smaller design, for instance in form of an arm wrist watch or a badge on the sleeve.

The Hummingbird became the trip’s conversation piece, a fact that the informants themselves acknowledge. They enjoyed using the Hummingbirds, and were often seen to be testing them in different ways. They expressed many creative uses for the Hummingbird. A notion that came up in the focus group session was that the Hummingbird could be seen as a means to achieve status; users appeared more important when carrying technological equipment. The ski instructors *not* using the Hummingbird differed from the users in that they could not as easily imagine potential ways to use the Hummingbird and could not understand its meaning. Considering the discussions in the two focus groups, it became clear that it is easier for a group of people to talk about a concept and imagine its possible uses, if they have been able to use the technology in practice, even if only in prototype form.

#### 5. Conclusions and future work

Our study showed that Hummingbirds can be used to augment informal social interaction between novice users, and in the focus group sessions, users gave many suggestions on how to improve the devices to make them more useful for professional activities. The subjects who had not been using the devices, however, did not have any clear notion on what the possible use could be. We believe that by exposing potential users to new technology in realistic environments, important ideas and improvements will come up which would otherwise not have occurred, neither to the developers nor to people who have not actually tried using the technology. Future work will include studies in other types of environments, including mobile blue-collar workers, and construction of new prototypes based on these studies.

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