

# Sound Pryer Field Trials: Learning About Adding Value to Driving

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## ABSTRACT

Sound Pryer augments traffic encounters with streaming audio. It is a collaborative car stereo allowing sharing brief and transient musical experiences among drivers. It is a peer-to-peer application for PDAs capable of wireless ad-hoc networking. We have identified seven issues concerning, studying entertaining mobile applications, the control of and the spontaneity of traffic encounters, driver's safety, user's privacy, technical support and copyright, when evaluating it with unacquainted drivers in traffic. We argue that field trials allow us to obtain rich holistic data on usage yet overcoming them. We demonstrate a manageable and realistic procedure also appropriate for other mobile collaborative applications and services.

## Keywords

Field trials, wireless ad hoc networking, traffic encounters, streaming audio

## 1. INTRODUCTION

Traffic encounters are highly transient but also often co-operative interaction among drivers. They are central in their experience of driving. Appleyard and Lynch argue that to him or her:

“Most impressive of all is the motion of the accompanying traffic, to which he is forced to be attentive, and which even passengers will watch with subconscious concern [1].”

That is, besides maneuvering, driving in traffic also concerns careful co-ordination with other co-located drivers. But this effort could sometimes also be enjoyable by itself. Once in a while, the co-ordination effort of a stream of traffic encounters may be “punctuated,” allowing the driver a quick impression of the participants, their cars etc.

Motor bikers, for instance, is a category of road users that particularly fancy driving for the sake of driving. In a study we uncovered how they take interest in meeting other bikers especially on the roads. We have confirmed this through field trials with an application that gives awareness of upcoming encounters with other bikers [3]. Accordingly, our hypothesis is that traffic encounters is a strong candidate for augmentation through mobile and wireless services. And such services could also appeal to broader scope of road users than bikers.

We have developed the Sound Pryer application in an attempt to try this. It is a “collaborative” car stereo. You can hear the music played on your own, but also tune into other car stereos and hear what they play as long as you stay within close proximity. It is a peer-to-peer application for PDAs capable of wireless ad hoc networking. It accomplishes brief joint listening experiences in

traffic encounters by streaming MP3 files. The Sound Pryer application contains an automated mode to tune in the remote music selection available in traffic encounters.

Here we present and discuss refined approach to the field trial method to obtain data on mobile collaborative applications such as Sound Pryer. We believe field trial lets us obtain holistic data on usage yet overcoming and taming some of the issues that arise with such undertakings.

The Sound Pryer application raises at least seven important issues when evaluating it in the field. First, the Sound Pryer is meant to add value or, at least, deepen the experience of driving. It is not about rationalize movement or make life more efficient. It is a methodological challenge to find out whether the prototype actually fulfils this objective. Second, there is a relation between the number of simultaneous users and the area in which we allow Sound Pryer to be used governs the number of encounters. A low number of users in a too wide area will dilute the number of encounters. This will make reactions to Sound Pryer experiences difficult to observe. Third, a too constrained area may hamper the spontaneity of using Sound Pryer with unacquainted users. Fourth, as the application is to be used while driving we also have to care for the driver's safety. We tackle this in the design of the application itself but we also have to minimize any risks in the actual trials. Fifth, the nature of Sound Pryer and testing it with unacquainted users raises some privacy concerns. Sixth, it is difficult to provide the application over any longer periods of time. It requires some delicate installation and configuration. This complexity increases with the number of users. Seventh and finally, Sound Pryer highlights some aspects of copyright protection.

## 2. THEORETICAL FRAMEWORK

According to Hughes et al [6] ethnography is the appropriate method to study collaborative applications. The ethnographer participates in a user's mundane interaction with the application. The data he or she collects portrays a rich picture of these activities. Ethnography gives means to perform a holistic evaluation of applications in their naturalistic setting. This method is a proper tool to gather participant's viewpoints as it examines not only what concerns they express, but also what actions they actually take. However, ethnographic evaluations of mobile collaborative applications generated by a design process, informed by initial fieldwork observations, seldom occur [8]. This is probably due to the practical difficulties of achieving a diverse and rich body of subjects that use the applications in manner that is accessible and observable for the ethnographer. Instead it is often the case that he or she rather studies a related setting and an application already installed in it, to learn more of the concepts

they are suggesting. The work of Juhlin and Weilenmann [7] is typical example of this conduct in their research on mobile opportunistic meetings. Fieldwork is not applicable for evaluating mobile applications like Sound Pryer, as a number of issues prohibit a full implementation.

On the other hand, in a *field trial* a prototype is arranged in its intended setting, or a setting that resembles it to a high degree. It is similar to fieldwork in that it gives an opportunity to obtain holistic data on usage. However, the formal requirements of ethnographic fieldwork are not met since a number of restrictions are introduced and the usage situation is intentionally “flawed” by the researchers. For instance, there are restrictions on the scope of the implementation e.g. the time of the prototype is available to users, or limitations on the area in which they can use it.

### 3. RELATED WORK

As such the work presented here relates to a number of field trials of applications of mobile technology designed for leisure activities.

Sotto Voce is a tour-guide for museum visits to support social interaction among pairs of visitors [5]. It is a content-centered shared media space that allows two visitors to overhear the other’s playing of audio descriptions. The Sotto Voce is an application for PDAs with headphones and capable of wireless networking. Users interact with it and may select audio clips to listen to. A user may at any time switch over and overhear what his or her companion is listening to. The synchronization of such events is performed over the wireless network.

Use of the guidebook was studied with 47 participants over four days in three museum rooms in the following way. First, each participant filled in a questionnaire covering basic questions, such as age and technological experience. They were then given a tutorial on how to use the Sotto Voce. During the tour their conversations were recorded and in two of the three rooms there were video cameras to record their interactions. All events on the PDA were logged. Finally after completed the tour, which took about 15 to 20 minutes the couples were invited to a semi-structured interview.

Hocman is an awareness tool augmenting and supporting planning of motorcycle rides based on encounters with other unacquainted bikers [2]. It is a HTTP peer-to-peer application for PDAs capable of wireless ad hoc networking. It works as an automated HTTP client, active in the background of the user’s attention. When discovering a new peer in the ad hoc network, it plays a sound icon and downloads an index page on the newly discovered peer. This index page could fulfill several purposes, such as personal information or for-sale ads.

Use of the Hocman application was studied with six different bikers at two occasions [3]. Three bikers at the time were summoned to separate rendezvous locations along a circular route. Each driver was then given instructions and got a PDA running Hocman rigged. The bikers then drove two laps at the speed limit, taking off in different directions two maximize the number of encounters. Each lap took about 7 to 8 minutes to drive and afterwards each biker was invited to a semi-structured interview.

Sotto Voce and Hocman are examples of field trials and they share many similarities. First, in both cases usage is constrained

temporally and spatially. Second, both applications are aimed at heightening the experience of leisure activities, which makes the impact of use difficult to observe. Therefore, in Sotto Voce the researchers monitor usage by various means, audio recordings, logs etc. They also perform interviews in close succession to usage in order to collect opinions and reflections, which is hard to capture by other means. This is similar to Hocman where the researchers also do interviews after usage. However, in Hocman the researchers could not observe the impact of using Hocman for practical reasons. Bikers travel relatively fast over wide outdoors area and their interaction is rather brief. There is little or no room on a motorbike for a researcher ride along to observe or video record. Moreover, engine noise and headwind drown audio recordings. In the case of audible recordings they would still capture very little “useful” information on biker interaction.

### 4. SOUND PRYER

Sound Pryer (Figure 1) augments a traffic encounter in two ways. First, all Sound Pryer peers play and broadcast a song stored on the device. A user will thus hear his own songs he or she selected like an ordinary car stereo but unnoticed to him or her, the song is also broadcasted. In a traffic encounter involving Sound Pryer peers, an arbitration procedure determines which peer will continue playing and broadcasting a local song and which peer will switch over and begin receiving for remote playback. In the case of two peers, ultimately one peer will broadcast and one will receive. This means that encounters are not reciprocal, which is a consequence of Sound Pryer being designed to provide joint music listening experiences. On the other hand, several nodes may receive from a single broadcast source. Second, the peer that receives a stream also displays a stylised shape and the colour of the vehicle where the remote peer is located.

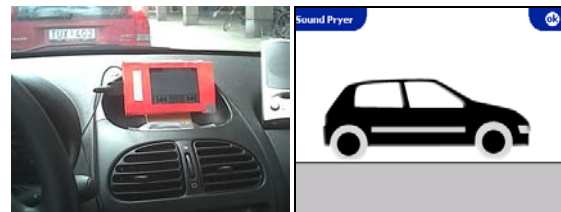


Figure 1. PDA running Sound Pryer mounted on the dashboard (left). Graphics displayed in augmented traffic encounter (right).

The Sound Pryer application is implemented in C/C++ interfacing the Pocket PC 2002 operating system API. The prototype runs on three sets of devices: the Compaq Ipaq 3760, the Compaq Ipaq 3850 and the HP Ipaq 5450. In the first two cases, Lucent Orinoco Silver WLAN cards running the IEEE 802.11 IBSS mode are used to accomplish single-hop ad hoc networking. In the latter we use the built-in WLAN card in IBSS mode. We achieve decoding of MP3 data by our own port of a publicly available MPEG audio decoding library to the Pocket PC 2002. Similarly, we chose to port a public RTP stack to implement the streaming operations performed by the server and client module. The GUI of relies on a Game API for the Pocket PC 2002 handheld devices

## 5. FIELD TRIALS

When deciding on the procedure for the field trial on Sound Pryer we had to manage the following issues:

- **Entertainment.** How do we acquire a way to learn about whether the users enjoy their experience of Sound Pryer in a constrained field trial?
- **Encounters.** The road networks constitute a far too wide area for a low number of users to roam freely in order for encounters to take place at an interesting rate. Given an amount of users willing to undergo the trial we will restrict the area accordingly and also choreograph their movements so that we can guarantee encounters to happen.
- **Spontaneity.** The Sound Pryer application is developed to automate spontaneous interaction among unacquainted users. More so, there is an important element of surprise in a Sound Pryer experience. Using too few users in the trial will take away this i.e. they will quickly recognize and learn which the other users are.
- **Safety.** Driver's safety is addressed in the prototype. However, in the actual procedure we have to take care for potential hazards. With respect to this we should perhaps use roads blocked for public access and clear of other cars. However, this would severely hamper the situation in which we ideally want to try Sound Pryer, i.e. in mundane traffic.
- **Privacy.** As we engaged unacquainted users in the field trial, sharing their music preferences may feel intimidating. Undoubtedly it is the very intention of Sound Pryer to share your music and we therefore informed the users of this prior to engaging them in the trial. We then investigated the impact of using Sound Pryer on the personal integrity through interviews.
- **Support.** Unfortunately the prototype requires some delicate configuration and set-up in order to be functional. For instance, the wireless network interface has to be activated before launching the Sound Pryer application and it must also be allotted unique IP address. A user also needs to activate a particular usage mode. We deem this require solid support effort which would be difficult to provide over any longer periods of time.
- **Copyright.** Sound Pryer raises questions whether copyright law is infringed. However, settling the case would actually involve legal investigations or even court rulings, which is beyond the scope of our research.

### 5.1 Participants

We got in contact of 15 people willing to experience Sound Pryer in a field trial. Out of these 5 were women and all but two were driving i.e. two drivers were accompanied by a passenger. The test subjects were 25 to 45 years of age and had a very diverse music preference and varied experience of driving.

### 5.2 Procedure

We came up with the following procedure that resembles the approaches of the related work, but with important variations to accommodate the particulars of using Sound Pryer in its intended setting. A few days prior to the test we asked each participant about his or her music preferences. We used this information to

acquire and prepare the devices in advance with a matching music selection. Then we summoned four to five participants at different locations in order to keep them unacquainted and keep their sense of expectation and curiosity of whom else they would encounter. We showed them their music selection we prepared for them, so that they could distinguish it from what others play later. We instructed them to limit their driving to a circular route in a recreational area of Stockholm. This route is public and there were other cars not part of test also present. We also inserted some stops and turns to create a diverse set of encounters. Traffic lights and narrow curvy roads along the route also contributed to this. As joint listening is not reciprocal we will also made us of a few "dummy" participants in order to guarantee that all user experience overhearing what others play. These dummies used Sound Pryer in particular mode that always broadcasted their music selection and took no part in the arbitration procedure. Each participant was then accompanied in the car by a researcher and video recorded throughout the test. We drove around for about 30 minutes. After finishing driving around we performed a semi-structured interviews of each participant individually. These interviews were also taped or video recorded. The procedure was repeated at three occasions in three days.

### 5.3 Preliminary findings

We have just begun analysing the material of the field trial. However, our approach allowed us to collect data on all the above listed topics. The prototype we used was did not provide as good experiences in all encounters as we desired. Often the encounters where to short, such as in meeting someone going in the opposite lane, for the prototype to react and play anything meaningful. In other encounters the poor quality of the wireless carrier had a detrimental effect on audio quality. For instance, annoying "clicks" and "breaks" made music sound "choppy". On the other hand, the prototype was able to provide at least one lengthy acceptable quality transfer for almost all test-subjects. Thus, we are quite confident that we will have enough data to decide whether Sound Pryer does give added value to traffic interaction and whether this is interesting to a general road user. A preliminary survey of the material tells that if the test subjects had at least one good transfer they were also positive to the concept. However, not many test subjects were indecisively impressed by the technical performance of the prototype.

## 6. CONCLUSION

With the above outlined procedure we have to collected data having quality enough to test our hypothesis of augmenting traffic encounters in general and Sound Pryer being useful for such purposes in particular. This procedure allowed us to go beyond mere technical performance test and receive feedback on the usage experience. We hope to be able to use this information in further designs iterations of the system.

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