Collective Creation and Sense-Making of Mobile Media

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ABSTRACT
Traditionally, mobile media sharing and messaging has been studied from the perspective of an individual author making media available to other users. With the aim of supporting spectator groups at large-scale events, we developed a messaging application for camera phones with the idea of collectively created albums called Media Stories. The field trial at a rally competition pointed out the collective and participative practices involved in the creation and sense-making of media, challenging the view of individual authorship. Members contributed actively to producing chains of messages in Media Stories, with more than half of the members as authors on average in each story. Observations indicate the centrality of collocated viewing and creation in the use of media. Design implications include providing a "common space" and possibilities of creating collective objects, adding features that enrich collocated collective use, and supporting the active construction of awareness and social presence through the created media.

Author Keywords
Mobile group media, collective use, computer-mediated communication, mobile phone applications.

ACM Classification Keywords
H5.3 [Information interfaces and presentation (e.g., HCI)]: Group and Organization Interfaces—*Collaborative computing*; H4.3 [Information systems applications]: Communications applications.

INTRODUCTION
Mobile media sharing is a growing field of research in HCI and related disciplines. Current mobile terminals combine connectivity and media capturing capability with support for software development. These features have facilitated the introduction of mobile devices into everyday picture-taking and sharing. The key research questions for HCI in this area are related to evaluating different media sharing approaches, finding suitable interaction design principles, observing emergent uses in real life, and identifying specific application areas. Previous research in mobile picture sharing has focused, among other things, on the use of multimedia messaging (MMS), showing its interactive, sequential and indexical character. However, as MMS does not support mobile media sharing within groups very well, new applications have emerged to move beyond this limitation. In these systems, albums or blogs are usually created by individuals and then shared for group discussion. While new systems appear, reports on their situated use are still largely missing. Instead, results have been mostly drawn from content and log analyses supported with interviews, instead of field observations of actual use.

Our contribution focuses on mobile media sharing among group members who are both collocated and remote, and we have adopted a constructive approach that combines explorative application development with naturalistic trials in real settings. This allows us to evaluate design approaches and report on emergent practices. We have carried out ethnographic studies, application development and field trials at a large-scale event with the aim of providing groups of spectators (at the World Rally Championship competition) with an application that combines mobile media "chatting" with the creation of shared media albums [6,7]. The field trial, which included observations of use, made it possible to analyze not only the content and interaction logs but also the situated use of the media. To anticipate our results, we found a variety of collective uses of mobile media that extend our understanding of how groups create and share mobile media. While current systems approach sharing mostly from the viewpoint of individual users, our study shows how creating, sharing, and viewing can be seen to emerge collectively. This means a shift, for example, from how a photo album is created by an individual and then shared and discussed with others towards its collective creation by remote and collocated participants. Moreover, the trial shows the relevance of collocated participation in the creation and viewing of mobile media objects.

USING CAMERA PHONES TOGETHER
There are some research findings on how mobile media messages are created and viewed together. For instance, in a study on the motivation of experienced camera phone users to take pictures, interviews revealed that pictures taken in social gatherings were shared with the co-present people from the phone screen rather than by sending the

pictures to the other phones. This kind of sharing covered one third of all the sharing cases [9]. Another study reports that being an owner of a MMS phone does not mean that the person is its only user. Messages were created together in a group and also received by a group (or a couple). This involved passing the camera from hand to hand after having taken the picture [2]. It has also been shown that children may start creating sequences of messages together, e.g., to play out a story that is then sent to others [14].

The studies cited above based their analyses on what MMS content was exchanged and what people said in interviews. However, some studies cover the interactions taking place in messaging situations. For instance, traditional text messaging has been studied from the point of view of gift-giving practices. In collocated viewing situations, users (teenagers in this case) were observed showing personal messages to each other. These gifts (i.e., messages given to the other to see) were argued to strengthen the mutual trust and loyalty of the users for each other [17].

Interactions in the use of camera phones and MMS have also been studied [7]. Results indicate the importance of the active role of technology in constructing people's experiences. Ways in which technology enables active, joint participation in situations were seen in forms of expression such as staging pictures, competing over who takes the best shots, storytelling, joking and communicating presence.

To sum up, MMS technology enables a variety of collective uses in local interaction. But there are also commercial systems that have been designed with a stronger focus on group use. Mobile instant messaging systems with image uploading capability[1] form one category. Their features include contact lists and support for multiple discussions. The other category is photo blogging systems,[2] which provide a way to publish mobile pictures on the web and allow visitors to comment on the published pictures.

Research papers on new mobile media prototypes provide additional views on mobile sharing, such as how systems are used and how MMS technology could be improved. For instance, MobShare is a system similar to photo blogging systems but with the ability to form new viewer groups and picture albums on the fly in mobile settings. In a field trial, 5 users created 74 albums with varying viewer groups. Authors contend that picture sharing is thus contingent on the social settings where pictures are created [16].

Flipper [4] is a system where group-centricity and minimal interaction with a device (PocketPC) have lead the design. Flipper shares pictures automatically with fixed predefined "buddies" (but allows the sender to remove a shared picture later) and organizes them according to who was the sender. Additional features include textual annotation capabilities, hit counters on each image, and a desktop interface. A field trial indicated improved awareness and an interest in viewing other users' pictures.

In sum, previous studies on camera phones have recognized the importance of considering groups in mobile media creation and viewing. However, not all of the aspects of this topic have been addressed yet in application development.

MGROUP AND MEDIA STORIES

Technically, mGroup is a client-server Java MIDlet that runs in Series 60 smart phones[3] like the Nokia 6630, which has been used as a test environment. Its support for group use lies in the concept of *Media Stories* (hereafter Stories) that make up the system's content structure. The Stories integrate four important features beyond the paradigms represented by MMS or instant messaging: (1) the free combination of pictures and text in a single message, (2) group contribution—all invited Story members can contribute as authors to the discourse, (3) the immediate sharing and availability of messages to the group, and (4) a persistent discourse context—messages and replies in Stories are gathered in a shared space and persist after logouts. They are also accessible from the web as shared albums.

New Stories can be initiated by any member in the system by giving a title and a description. By ticking items on a list, the initiator can then invite the members who will be entitled to participate in message reading and creation. Using Stories, messages with different audiences and thematic contents can be organized into dedicated spaces. The design also includes support for awareness of other users' online/offline status and an automatic web album creation for the group to relive their experiences afterwards and to store the material in an accessible form.

Figure 1A shows how the Stories are presented to a user. If there are Stories to which the user has not been included, they are not shown on the screen. In addition to the Story names in the rightmost column, the user can also see who has sent the most recent message to each Story and how much time has passed since that message was sent.

When the user opens a Story, the screen in Figure 1B is displayed, presenting messages ordered by their sending time. The most recent message is shown at the top, and some contextualizing information about each message is given: a thumbnail image, a sender name, the time passed since the message was sent, and the first words of the text field, if one is included. An alternative ordering is a threaded view, in which messages and subsequent replies are shown one after another. Figure 1C shows a view of a single message that is opened when the user selects a mes-

[1] E.g., Agile Messenger (www.agilemobile.com)

[2] E.g., Blogger (www.blogger.com), Buzznet (www.buzznet.com), Kodak Mobile (www.kodakmobile.com), Nokia Lifeblog (www.nokia.com/lifeblog/), and Photos to Friends (www.photostofriends.com).

[3] www.series60.com/about

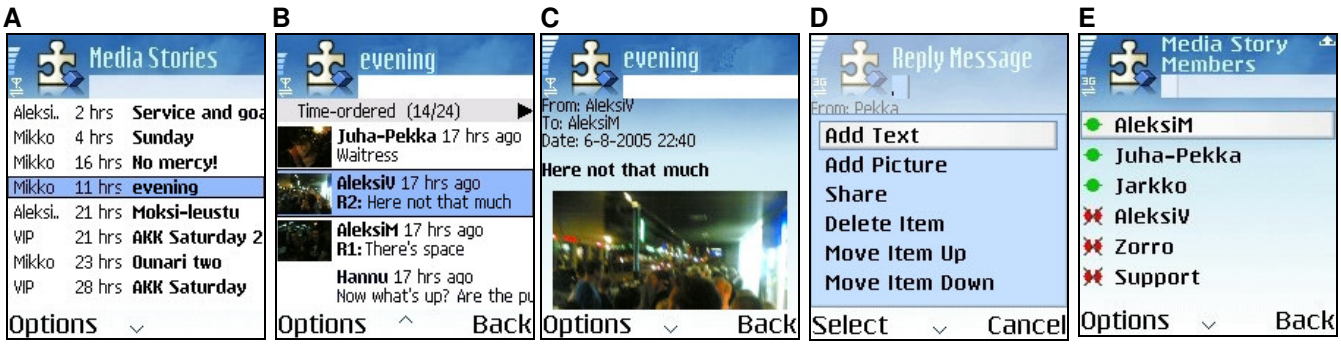

Figure 1. Screenshots from mGroup, translated from Finnish. A) Media stories view; B) A view of messages and replies in a Story; C) A view of a single message; D) A popup dialog on the message creation screen; E) A view that shows the included members.

sage in the list view. The entire message can be read by scrolling up and down with the arrow keys.

Sending messages to the active Story is possible both in the message list view and the single message view. The user can either create a new message or reply to the selected one. The difference is in the way the message is displayed on the message lists. Figure 1D shows the screen while message creation is in progress. The user can include pictures and text in the message in any order and amount and arrange their relative places. When the message is ready, the user can send it to the other invited members by selecting "Share". The message is uploaded immediately and will soon appear in the same Story on other members' phones, as well as in the respective Story album on the web.

The Story member list shown in Figure1E depicts the design of the awareness support. The view can always be opened from the Options menu. It shows whether mGroup is running in other users' phones (green) or not (red).

FIELD TRIAL

The trial was one phase in a cycle of observing use, designing, building and again observing [1]. A prototype was introduced into an ongoing activity in a real setting, which in our case was a group of spectators at a rally. It was not the set of metrics of the system that was evaluated but the possible roles of a novel technology in participants' activities. Thus, the objective was to understand how mGroup could support the use of mobile media to enrich the group's experience. In particular, we observed and analyzed

- how Stories would be used in the group and what kind of content and message threads would emerge (see the section "Stories as Collective Achievements"), and
- how messageges would be created and viewed; in particular, how this would be part of the interaction of collocated members (see the section "mGroup in Collocated Resourceful Use").

The Setting and the User Group

The Neste Rally in Finland is a part of the World Rally Championships and gathers many spectators (hundreds of thousands in some estimates) for 3 and a half days along the roads of central Finland, distributing them across an area of almost 100 km. The rally has 22 Special Stages (hereafter stages) – routes in the normal road network that are temporarily closed to traffic. Statistics show that most spectators arrive at the rally with a group of friends. As the rally progresses from one stage to another, the spectator groups do likewise. They park their cars along the side roads close to a stage, walk the last part and settle down. After having seen at least the top drivers, spectators start to move to the next stage, driving often along minor roads in order to avoid traffic jams caused by other spectators. Planning well and using experience gained from previous years are important in accomplishing this smoothly [7].

We recruited the spectator group through the rally organizer's database of last year's visitors, finding a representative group that had decided to visit the rally again this year. The group consisted of enough people to make it likely that it would sometimes split into sub-groups. Some of the members lived in the town that acted as the center point of the rally. The others came from other cities or from abroad. The local members could therefore provide accommodation to others. The total number of people (13) and the distributed accommodation resulted in creating two sub-groups that spent the days visiting different stages. Despite several attempts to meet during the daytime, the sub-groups managed to meet only in the evenings at parties or pubs.

The larger of the sub-groups had 8 people, all males, and they had created a challenging schedule for the rally: waking up before 6 AM on two of the three mornings and seeing 2-3 stages per day. In order to keep together despite the traffic jams that easily separate people in different cars, they had hired a minivan. The sub-group had been at the rally many times before, almost always in the same group composition. Six phones were given to this sub-group, distributed in a way that provided the maximum coverage of phones for the homes where people stayed during the rally.

The smaller sub-group had 5 people: a couple, their two Australian guests who were vacationing in Finland, and a Finnish friend. Unlike the other sub-group, in this group English was the primary language of communication. This sub-group had a relaxed approach towards the rally: waking up when they felt like it and then planning where they still had time to go. They received two phones.

Of the Finnish users, one half were students and the other half had recently begun working life. Their average age was 25. They were frequent text message and email users, but their frequency of MMS, instant messenger, chats and web forums use varied from daily use to never used.

As can be noticed, there were not enough phones for everyone. The initial group size was 8, but it gradually increased and exceeded the number of phones. We ensured that the people that connected the sub-groups received a phone.

The users volunteered for the trial without being paid or rewarded in any other way than being allowed to use mGroup and all the phones' functionalities (voice calls, SMS, MMS, internet) freely and to personalize the phones.

Methods

We collected the following data on the use of the Stories and their creation and viewing:

Content Analysis. This includes the Stories created and messages sent through mGroup.

Interaction logs of each phone. For instance, each viewing of a message was tracked down, as well as detailed data on how messages were composed.

Participant observation and video recording of the group's rally activities during the daytime. For this, both sub-groups were shadowed by one researcher. To observe natural behavior, we avoided instructing users on any of mGroup's possible uses, suitable moments of use, places in which it could be used, or suggesting anything about how users might spend their time at the rally. To make shadowing and videotaping more efficient, we had a third researcher following the group's discussions on mGroup through the Internet, and informing the observers by SMS whenever messages were sent. For the observers, this remarkably facilitated their decision making on where to point the video camera. The data amounted to 19.5 hours of video during the four days of the rally.

Background questionnaires on 1) the frequencies of using related communication technologies, and 2) the social relationships between the users: how they knew each other and how often and in what circumstances they usually met.

Concluding interviews held individually with each user within three weeks after the rally. With each user, we conducted cued recall interviews by discussing the messages in four of the pre-selected Stories (printed on paper): first, a Story that this user had initiated, and second, one with the highest number of messages sent by the user. The other two were the same across all the interviews: a Story with daytime content and the widest participation in sending messages, and a Story with nighttime content with the same criterion. Finally, the users also filled in a social presence questionnaire and explained their ratings. The typical length of an interview was 1.5 hours.

In the following chapters, we present excerpts from and analyses of the collected data.

STORIES AS COLLECTIVE ACHIEVEMENTS

Participation in mGroup was surprisingly active. In the 4-day trial, the users created 22 Stories and sent 230 messages. The Stories had on average 10 messages, the two longest ones containing 25 messages. That is, the Stories collected successfully several messages. Every user initiated at least one Story, with three story initiations on average, indicating a wide participation in initiating Stories. Furthermore, several people contributed to each Story on average, evidencing a wide participation: 7.4 members were included in one Story on average, of which more than 4 were also contributing. This shows that the use of Stories was not limited to one-to-one communication but involved a significant part of the group. Also, the authorship of Stories was shared beyond the initiator. In 44% of the Stories, the main contributor (the one contributing with the most messages) was not the initiator. In the same amount of Stories, the initiator was also the main contributor. In the remaining 12%, the initiator and another member had an equal number of messages. In sum, the wide engagement of the group members points to the conclusion that S*tories were not the products of individuals but the achievements of a group*. This observation is elaborated on below.

Stories as Invitations and Mirrors of Unfolding Action

When starting a Story, users are asked to give it a title. The titles chosen for the Stories mirrored the unfolding of events and activities of the whole group. Most of the Story titles (54%) described stages or events at the rally that the members were attending, like "Killeri 1" or "Vellipohja 2." A few Story titles (18%) were of chronological kind ("Friday evening" and "Evening") and equally many described the current situation of the group, enclosing details or evaluative assessments of some kind ("Maija and Katja on board," "Evening fun," "To the pub," "In the Pub").

Finally, only 10% of the Stories had topical titles, such as "Rally betting" or "Hit the gas!" This shows how the titles mostly pertained to the sub-group and its next activity, as anticipated at the moment of Story initiation. We observed on many occasions how a Story indicating a rally stage was created before arriving at it, without adding messages right away. It appears that the initiation of a Story indicates preparations, traveling etc. towards the next event. Simultaneously, it also keeps the other sub-group informed about these activities. As described above, mGroup allows users to reply to specific messages. On average, Stories contained 4.7 replies. In addition, many normal messages were actually replies to or comments on previous messages. Thus, individual messages did not stand alone, but in relation to previous and subsequent contributions (see also [10]). As a result, Stories not so much documented events anticipated at the moment of Story initiation, but consisted of unfolding sequences of messages that could, but did not need, to follow the name given to the Story. As Story titles potentially invite contributors, users pre-empted the problem with generic and open-ended naming, except on a few occasions

Msg 4
AleksiV Sat 17:03:58
Hey gents how is your day going? Any luck with the ladies last night? You guys heading out for a big night again? DaMo.

Msg 5
AleksiV Sat 17:18:45

The jump

Msg 6 (Reply to **4**)
Eljas Sat 17:26:50
Hi guys! Sat night plan -> First to Killeri, there is a rallycross competition from 19.30 to 22.00. After that "little" bit drinking and then to pub. How about you?

Msg 7 (Reply to **4**)
Mikko Sat 17:31:08
With these looks the "luck with ladies" is unachievable. But we will try until the sun burns us alive and the wind will tear our skin off.

Msg 9 (Reply to **5**)
Maija Sat 17:50:49
Hey eljas! No idea what we are doing yet, we will go wherever the wind (or crazy finnish people) take us. Hopefully we'll meet up with u guys at the pub, for more than a "little" bit of drinking!

Msg 10 (Reply to **7**)
Maija Sat 17:58:34
Shit, sounds like we may have to bury you here ... ;) maybe we should all get naked and hang out in a little wooden room with a bunch of boys instead.

Figure 2. Coordination in a message strip from a Story titled "Moksi-leustu" (the name of a stage) with the description "40.96km".

Msg 11 883
Hannu Sat 23:12:47
Now what's up? Are the pubs also today full packed?

Msg 12 (Reply to **11**)
AleksiM Sat 23:28:43
There's space

At least in Amarillo you have space

Msg 13 (Reply **12**)
AleksiV Sat 23:40:14
Here not that much

Msg 17
AleksiM Sun 00:24:57
Jubu in the pub

Msg 19
Mikko Sun 01:51:08
Nightly activities

Msg 21
AleksiV Sun 01:59:19
We could not get in the bar

Figure 3. Achieving awareness in the Story "evening" (description "Night," initiator Mikko), between members at different pubs.

when a particular point was to be made about some topic or item at the moment of Story initiation.

Coordinating and Constructing Events with Stories

In the next paragraphs we will describe how Stories helped the participants in constructing their collective experience of the rally event.

Coordinating activities. In some Stories the dispersed subgroups posted and replied to messages in a coordination effort. The strip in Figure 2 shows, first, how the group as a whole was able to coordinate their doings. The series of messages is produced by several users and, most importantly, this strip is visible to and is referable by all the users. Second, the series builds a stepwise summary of prior doings more or less aligned with the future activities being coordinated. Third, the series encloses joking and chitchat, thus serving a social purpose within the group. Fourth, constructing the messages requires or provides grounds for collective activities on the sending side. Apparently, four users (AleksiV, Eljas, Mikko, Maija) take part in this interaction. A more careful analysis of the text and videos, complemented with interview data, reveals how this interaction extended to more members. For example, Msg 4 is actually written by Damo, who does not have an mGroup terminal. He views the message and negotiates with collocated members before responding with the text. We observed that routine activities, such as coordinating with others, also served many other purposes, such as documenting and joking.

Achieving awareness through chains of messages. The strip in Figure 3 was created while the group was split into three different locations. The strip shows how a question prompts answers from the other two sub-groups. The answers align themselves both to the question and the earlier answers visible to everyone. The strip communicates aspects of the situations and thus builds awareness between isolated people. Furthermore, the parties not only communicate their situation, but also align the formats of their messages with those of others. As a result, the strip unifies the dispersed groups in very concrete ways, as it displays common features of the events they are involved in.

Constructing events. In the trial, some messages turned into events of their own, beyond mere documentation or communication of external events or circumstances. As can be seen in Figure 4, a picture of Damo's dirty pants taken by AleksiV in Msg 3, documenting how clothes get dirty at the rally, is then commented on by Damo himself using Maija's phone, thus adding a related joke. This event constructed through messages is also acknowledged by the comment of a remote member, Hannu. In the strip, instead of plainly recounting the events, the participants in fact reconstruct a series of events that are likely to be more entertaining than mere documentation. Again, not one but several participants, co-located and remote, are involved in the meaning-making process (see [3,11]).

Msg 3 (Reply to **1**)
AleksiV Fri 19:24:34
Poo

Msg 4 (Reply to **3**)
Maija Fri 19:28:37
Oiy it was too far to the toilet so i had to go in my pants.

Msg 5 (Reply to **4**)
Hannu
Fri 20:10:04
This is a weird conversation here! :)

Figure 4. Message exchange in the Story "Killeri 2" (description "Cucumber," initiated by AleksiV).

Co-Presence

What emerges from the analysis of the strips above is how mGroup can be used to enhance a feeling of togetherness, especially for remote and distributed members. When trying to evaluate this aspect, the data led us to translate it into analyzing "presence," which is a known phenomenon and the object of a variety of studies. Because mGroup was frequently used and the Stories were produced in a joint effort, the underlying hypothesis was that mGroup would be a medium to experience high levels of social presence.

When perceiving technology-mediated information, users may have a feeling of presence, a perceptual illusion of non-mediation [13]. The key dimensions of presence are spatial, social and co-presence. Spatial (physical) presence is the feeling of "being there" in a mediated environment. It also includes a psychological component (feeling immersed, engrossed, engaged). Social presence implies "being together with another" or a sense of being together. Co-presence is a subdivision of social presence and is defined as "being socially present with another person" [15]. It has the implication that people are physically separated from each other but still feel a sense of togetherness in an electronic communication network.

In the interviews, we were interested especially in social presence and its subcomponent co-presence. Social presence was operationalized in five questions based on existing social presence scales [12]. The users were asked to indicate in a scale from 1 ("I do not agree at all") to 7 ("I fully agree") how much they agreed with statements and to substantiate this with examples. The results (see below) do not warrant strong inferences, but the analysis of the examples points to an unexpected interpretation of presence.

Q1 (avg 3.5, sd 1.5) *When using mGroup I felt the most feeling of togetherness with people I could physically see close to me and who were using mGroup.* Here users pointed out that with collocated people the sense of presence arose mostly from direct human-human interaction rather than from messaging.

Q2 (avg 5.9, sd 1.2) *When using mGroup I felt the most feeling of togetherness with people I could **not** physically see close to me and who were using mGroup.* This was a complementary question to Q1 and produced more substantive ratings. The higher average may indicate that users of mGroup indeed experienced intensive social presence with other users not physically present in the immediate use context. There were some indicators that the high degree of social presence may co-exist with certain social practices: Three users reported on the use of mGroup for informal interactions "outside" the task of documenting and following the rally events. One user wished to be but could not be physically together with certain other users, and used mGroup to compensate for being together with them. Another user tracked the physical whereabouts of others with mGroup by looking at where the pictures were taken and posted. On two occasions users said that they checked mGroup content first thing in the morning or just before going to sleep.

Q3 (avg 5.0, sd 1.4) *When using the mGroup I felt as if I were interacting with the other users and those I could not see as if we shared a real, physical setting.* The feeling of shared spatial and physical context as a result of using mGroup was reflected in the answers of the users. Pictures as a medium containing representations of physical places or the other users and oneself especially seemed to increase the feeling of a shared physical space. One user reported that he followed the mGroup events most of the time and not the events of his physical surroundings. Again here one user tracked down the physical whereabouts of users by looking at the pictures they had taken.

Q4 (avg 5.3, sd 1.1) *When using the mGroup I felt as if other users were intimately present in my mind.* Here one user reported that receiving facial pictures from other users contributed to a feeling of intimacy. One user reported feeling intimately connected to others when receiving a personal message or when tailoring personalized messages to other group members. One user again reported that he checked mGroup content immediately after waking up to catch up on the shared events. Also, one may think of the personal production and consumption of messages as related to thinking about others.

Q5 (avg 5.1, sd 1.9) *When using mGroup I felt as if I was having a shared, common experience with other users.* Here users reported a feeling of shared experience when looking at the world through others' eyes by seeing the pictures they had taken. One user said that by looking at the pictures he could imagine how events for the picture-taker and fellow participants had unfolded. Another said that funny situations such as pictures of one user passing out after a restaurant night were significant in the sharing of experiences.

Picture Content

To estimate the role of mGroup in supporting social presence with complementary data, we compared the content produced during the event with the content produced in a field study the year before where we used camera phones with no additional group application with 8 spectators in two groups (for a detailed content analysis of that study see [7]). In previous sub-sections, we used message strips to show how Stories support group activities instead of individual efforts and endeavors. Therefore, if the system is used for collective purposes, it should be reflected in the number of pictures that are of group activities vs. of the general event. The proportion of pictures of the general event, on the other hand, should reflect individual endeavors such as documenting the event. The analysis shows that with mGroup there are many more pictures (in terms of the proportion of total pictures) of the group and its members, while the proportion of event-related pictures (i.e., cars) is much lower in comparison to last year. To this end, we calculated the proportions of pictures with group members and cars separately. Of the total of 253 pictures taken, 12%

were of cars, in comparison to 36% (of 527) taken with the MMS system last year. On the contrary, a whopping 40% of the pictures were of the group and its members in comparison to 22% of the MMS study.

Co-Constructing Presence

To conclude, in agreement with the presence ratings, users reported several moments when mGroup was important to them in experiencing the presence of others. These included tracking other users by looking at content they had produced to infer physical whereabouts, using mGroup in informal settings outside the immediate task of following the rally, or repeatedly checking for new content after sleeping or late at night when one had been off-line for a while. Rather than seeing mGroup as a medium for social presence, these findings bring us to consider social presence as collectively constructed in a joint effort. Participants had to actively contribute to the Stories to build up the feeling of togetherness. In doing so they were also building the medium.

MGROUP IN COLLOCATED RESOURCEFUL USE

Collective use occurs also in collocated interaction. For that, we applied interaction analysis [8] to the video footage of mGroup use. We found three general types of use where the interaction varied in the intensity of participation. All three types occurred both in message creation and viewing.

Individual use. In most cases, a message was viewed quietly and possibly also replied to without drawing attention from co-present others. Although picture-taking was easily noticeable, in this type of use others rarely showed interest in seeing the message. This may be due to an awareness that images would eventually appear in mGroup anyway. However, attention was paid in more complex types of use, as described next.

Asymmetric participation. Here other people participated in viewing or creation, but apparently as secondary participants. One viewing pattern was a *display–acknowledgment sequence*, in which the phone holder either made a verbal remark (usually addressing two people at most) on a message or held out the phone to show the screen. The ones addressed could acknowledge the display in different ways:

- *Responding* with "mh-mm" like utterances (if any) without interrupting their ongoing activities,
- Gathering for *collocated viewing* (see Figure 6A), in which they gathered around the phone to see it, or
- *Grabbing* (see Figure 6B), in which the addressed person grabbed the phone without asking permission (or said "show me" at most), then looked at the message for a few seconds, and finally handed the phone back, usually not opening any discussion about the content, but resuming the previous activity.

When creating a message, asymmetric participation occurred as a *suggestion sequence* where others posed suggestions for content to be written by the holder. As message creation was possible from one phone only, the holder however, having power over the task, could decide on different strategies of taking the suggestions into account: either finishing the message or letting the others participate.

Participative use. In these cases, mGroup became the center or mediator of people's activity for a moment and sparked further interaction and discussion. This differs from the previous types of use in which the surrounding activity was mostly not affected by the use of mGroup, and the state of affairs was resumed after viewing or creating a message. There were certain kinds of creation and viewing that were likely to spark this kind of activity, for example:

- *Taking portraits of the group*, usually in a bar at night. This required coordination in assembling people for the picture, taking the photo, possibly re-shooting it, evaluating the result together, and sending it to mGroup.
- *Recording recurrent topics* such as traditions, conventions and proverbs – things that had become part of the yearly rally experience. The group had many years back seen a phrase "world's bestest rally people" in a professional-looking brochure, and they found the grammatical mistake funny even now. A user wrote the text on their van's muddy rear window, and recording the text into mGroup was immediately invented and accomplished together. Another recorded recurrent topic was the incredible sleeping skill of one of the users. When he was taking a nap, others covered him with all the objects that they had at hand, filled his clothes with vegetation, and even opened his eyes without him waking up.
- *Creating remarkable events.* Members used the camera phone not only to post a message but also to produce an eventful situation for the involved collocated participants (see episode 1 below).
- *Making sense of messages together*. Often these were messages that were first hard to interpret, such as failed pictures where the accompanying text did not reveal the original intent or such messages that showed something exceptional (see episode 2 below).

From the perspective of mediated social interactions and the collective uses of mobile media, the asymmetric and participative use patterns contain the most interesting cases. Next, we analyze two episodes more closely to understand the interplay of technology and social interaction.

Episode 1: Collective Message Creation

In this transcript and Figure 5, a person in the smaller subgroup finds a pornographic magazine on the rally track. During the five minutes that follow, the collocated members are all engaged in creating a message about the magazine and sharing it through mGroup with the remote subgroup, having fun doing so. A single phone is used to carry this out, but different people contribute different parts to the message: one takes the pictures, another one writes the text and sends the message, and finally they wait until the message appears on all the phones.

Figure 5. Video images from episode 1. A) Damo taking the picture; B) Checking that the message arrives in mGroup.

((Damo is standing close to the magazine, others are a few meters away))
Aleksi: ((makes mGroup ready for shooting photographs, leans to hand the phone to Damo)) Take a picture
Damo: Yeah ((takes the phone))
Aleksi: Yes, take the picture (inaudible) ((returns back))
Damo: ((walks to the magazine, bows down))
* Aleksi: ((whistles)) WHAT ARE YOU DOING DAMO?
Tom: Hh-hh ((laughs))
Damo: ((returns with a set of pictures, hands the phone back to Aleksi))
Aleksi: ((looks at the screen)) Hh-hhhh ((shows the screen to Maija and Tom)) Just takehhh the picture-hh
((Everyone laughing))
Tom: Send it on
Aleksi: Yeah I'm going, I have to add the text ((writes a text
** "Notes" but interrupts the task to sip beer and look at by-passing rally cars, sends the message as soon as the text has been written, turns to Maija)) Does it show there? Can you see it?
((Maija and Aleksi start side by side looking at their phones. A few minutes later, Aleksi also calls his friend in the other sub-group and asks if they have also seen the "Notes".))

There are two important issues in the transcript. First, *media creation is a collective event*, which can be seen e.g. in how Aleksi and Damo jointly create a message, then view it from the screen and wait until it appears on all the phones. Second, collectivity extends beyond the fact that a message is jointly created since *message creation also becomes an event for collocated members engaged in this activity*. While communication with the other sub-group is also important in the transcript (Aleksi first checks Maija's phone to see if the message is there, and then even calls a remote friend to ensure that the message has been seen), we want to point out the opportunities that mGroup gave the co-present group for local, engaging interaction. The message was not sent by an individual to a remote audience but rather was a product of the whole local group. Using mGroup enabled them to establish a joint focus for active participation in constructing an entertaining event. To achieve this, properties in the surrounding environment were drawn into the activity: trying to embarrass Damo by catching surrounding people's attention (the point marked with *) and annotating the picture with "Notes" (**) to hint that the co-driver had used the magazine in guiding the rally driver, but then had thrown it out of a car window.

Episode 2: Engagement in Making Sense of Messages

In this transcript, the users of the larger sub-group are together viewing messages that had been taken already two nights before. One user (Juha-Pekka) happens to browse an old Story and finds messages that he (and many others, as it appears) had not noticed at all before. During the three minutes that follow, Juha-Pekka's phone is passed around, viewed together and grabbed, while people talk and make jokes about the messages. The following excerpt is from the end of the episode.

((Juha-Pekka gets the phone from a round in which people have been looking at a previous message, but then he notices another message))
Juha-Pekka: Hh-hh what is this ((shows his phone to Mikko, displaying message shown in Figure 6A))
Mikko: Hh who has taken these ((laughter))
? (not identifiable person): Jukka
* Mikko: ((talking to the researcher)) Well you know, as Jukka does not have that phone, so when you hand it to him you never know what happens…
Juha-Pekka: And then you have the memory full…
Jukka: What pics? I have not shot anything
Mikko: Anything-hh-hhh…
Juha-Pekka: What's this, "the boys keep it going, but we have…" What's that in the picture, what's innit ((Mikko grabs the phone))
Juha-Pekka: A sack or something…oh gooosh hh-hh
Mikko: They are so dark these pictures ((Jari grabs the phone))
Juha-Pekka: The boys keep going, we have… and then you have some sack picture
Jari: ((not very loudly)) A cushion and (inaudible) ((gives the phone back to Juha-Pekka))
Juha-Pekka: Oh, you're right

Of the six different users in total in the episode, the transcript shows four participating in viewing. In addition to the examples of asymmetric participation patterns embedded within a sequence of collective use (see pictures B-D in Figure 6), the following issues are worth noting:

The phone as a group object. Mikko's statement (marked with *) about Jukka having taken many pictures using other people's phones shows that the group application attracts group members even if they have not been given an mGroup terminal. The part of the first episode where Damo borrows Aleksi's phone echoes this practice. Another aspect in group use is that the same phone is circulated among the group members and viewed together. Interaction log analysis pointed this out as well, showing less viewings per message on average than Stories had members. Since in the interviews users could find only a few messages that they had not seen before, this means that they were often looking at each other's phones.

Collective viewing as engaging sense-making. The episode shows how viewing—as much as creation in the first episode—is an active and engaging social activity that contributes to complete group experiences. The episode in the video is full of laughter and ridicule about the poor picture quality and about the annotations that are hard to make

Figure 6. A) The message spoken about in episode 2 and instances of asymmetric participation embedded in the episode: B) Collocated viewing; C) Grabbing; D) Display by showing from screen.

sense of. It goes beyond *reminiscing talk* about pictures [5] solely within the original capture group by including learning what others were up to elsewhere and providing opportunities for rewarding storytelling for the message authors.

In order to estimate the effect of not all the group members having phones, we calculated the episodes of collective collocated use (both creation and viewing) where one phone was in use by many people. In 6 of the resulting 29 episodes, all the present people could have used their own phones as well. In 8 of the episodes, more than half (but not all) of the people were phone holders. This indicates that collective use also takes place when not in lack of phones.

Put together, the episodes point out the importance of mGroup as a resource for joint engagement in collocated interaction, not only in documenting or communicating situations for remote members.

CONCLUSIONS

Existing mobile media sharing or messaging applications have been designed to support communication from one person to a group, either through sending multiple messages separately with no information about other recipients (as in MMS) or by providing an uploading feature for multimedia collections that others are allowed to comment on and browse at a later time. With mGroup and this field trial, we successfully uncovered alternatives to these approaches, showing the relevance of the collective creation and sense-making of mobile media. mGroup supported distributed members with a novel group messaging system that allows members to jointly contribute to media collections. The multimedia messages, or shared annotated pictures, contribute to creating collective media albums that we call Media Stories.

We have used the term "collective" with the aim of contrasting our design principles and findings with the prevailing approaches designed for individuals. What we want to stress is, firstly, how mGroup allows members to participatively create media, and secondly, how the sense-making of media, including its creation, can be a collective and collocated achievement. Collective use appears to be rewarding because it not only provides new forms of interpersonal and inter-group communication, but also provides ways to re-enact and reuse a group's conventions and shared memories in novel, inspiring ways. Such social appropriations go beyond mere practical purpose innovations by extending the ways for engagement in the surrounding activity.

However, collectivity might not always be as relevant. The question of how these findings can be generalized is connected less with the number of trials or users but rather with the specificity of the setting. We maintain that our findings concern especially situations similar to the one described here, where a partly distributed group is temporarily bound together when participating in an event. In other settings collectivity may manifest in weaker ways.

Design Implications

Previous approaches have considered mobile picture sharing as an act that an individual displays to a group that then is able to discuss (e.g. [16]). Applications explicitly designed to support instant media sharing among groups (e.g., [4]) have not tackled collocated use either, since they group media according to the member who produced it. What these approaches lack is support for immediate and real-time interaction with mobile media and the possibility to transform mobile media into collectively created objects. The trial evidenced how members were able to share authorship, as each Media Story was co-authored by more than half of the members. Stories became collective objects as they included a large proportion of chained messages. These conclusions point to the following implications.

Creating a "common space." Traditionally, the inbox of a mobile phone has been seen as a "space" accessible only to the user of that mobile phone. In contrast, Media Stories create a common space for a group. The invited members can interact in this space and maintain mutual awareness and a common context. The space needs to be shared in conjunction with authorship, enabling more members to contribute with media and not only with comments.

Enabling the emergence of collective objects. Media Stories not only provide a space for a common context, but also a way for collective objects to emerge and become distinguishable to the contributors, having a title, a beginning, and a life cycle. Media Stories provide a definable and negotiable context with their titles and with messages that directly or indirectly refer to previous ones. Message chains are building blocks for the collective objects.

Features for enriching collocated use. The mobile phone has been mostly seen as a device that connects remote us-

ers. Following the same lines, in the design of mobile media sharing applications, sharing has been considered asynchronous or spatially distributed activity. The observations, on the other hand, show how central synchronous and collocated use can be. This provides opportunities for the emerging short-range communication and augmented reality technologies to enrich local interaction.

Providing awareness cues to foster participation. Some limitations of mGroup were observed when users had to ask whether others had seen a certain message (see episode 1). This indicates that supporting social presence by providing cues of message viewings and of collocated members could be useful to users. Previous work on mobile picture sharing (e.g., [4]), when referring to *presence,* has not made use of the body of research that has sought to define the phenomenon and develop methods to study it. Users' active participation in the construction of social presence has also been less in the focus of presence research, which originated in investigating media such as television or virtual environments. Our work points to how cues can be designed not only to support awareness or social presence but also to encourage in using the system and inviting contributions.

Finally, some approaches (e.g., [16]) see sharing as a separate phase in a mobile picture lifecycle, during which pictures are made available to other people to view and discuss. Our study shows how sharing can be seen in a richer way, as a moment when collocated members create and make sense of messages, turning the phone into a group object. In these moments, mobile media acquire meaning through members' interaction (see episode 2) and through the ways media are actively related to features of the immediate environment (see episode 1). Mobile media objects do not always have an inherent meaning. Rather, they contribute to the group experience in the way collocated members construct and reconstruct their meaning in the interaction.

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