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Designing Integration of Sharing, Messaging, and Awareness for Mobile Users

Giulio Jacucci[1*]

[1]Helsinki Institute for Information Technology HIIT;
Department of Computer Science, University of Helsinki
(Finland)

ABSTRACT

Recently we witness a variety of social software that can be used in mobile settings. We here discuss how the integration of functionality such as messaging, media sharing and awareness cues involves several challenges that go beyond simple aggregation. We present the iterative design and evaluation of mobile social software that integrates aspects of the above areas. The first version called mGroup proposes stories as common messaging spaces and collections that both serve messaging and media sharing. In the second prototype CoMedia awareness cues are integrated in the platform within stories and in contact lists. We reflect on the qualities of openness, multiplicity and continuity of functionality and discuss the multiple roles of integrated features in the appropriations of users.

Keywords: *mobile groups, group messaging, field study, events, spectators.*

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1. Mediated Social Shaping of Mobility

Mobile users are exposed to, and even search for, a variety of stimuli and situations related to their social needs and motivations. For example, sidestepping behaviour, the tendency of mobile people to opportunistically drop in to stores and visit nearby friends and acquaintances. The use of mobile phones shows that people are often engage in mediated interaction often sparked by local stimuli. We believe that core motivations for mobility and the control of its "doing" are socially shaped along three aspects:

1. *Pursuit of relatedness*. Communication and action in a group is often carried out in the pursuit of relatedness, togetherness, and connectedness. Relatedness is a

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*Corresponding Author:
Giulio Jacucci, P.O. Box 68 (Gustaf Hällströmin katu 2b), FI-00014 University of Helsinki, Finland
giulio.jacucci@hiit.fi

technical term in the psychology of motivation to describe the (organismic) need to establish close emotional bonds and attachments with other people.

2. *Construction of experience*. Often, experiences are lived through, constructed, and interpreted as a group rather than as an individual. These can be mediated and constructed by technology for example the mobile phone camera can be a tool for expression (Jacucci, Oulasvirta, , Salovaara, 2007).

3. *Uncertainty of events*. All mobility is characterised by the uncertainty of events and courses of action. On the negative side, this leads to pressures to coordinate the actions of the group in the face of unexpected events. Ad hoc coordination like this is typically carried out mostly by the means of mobile phone calls. On the other hand, the positive side of this uncertainty – accidentally bumping into friends, discovering new shops, finding out new possibilities for activities and experiences in general – can be a fulfilling source of experiences.

1.1 Mobile Social Software

User studies of available desktop social software are useful in detailing its perception and use. Joinson (2008) identified seven unique uses and gratifications: social connection, shared identities, content, social investigation, social network surfing and status updating. Mobile social software has been rather addressed with prototypes and too seldom accompanied with field trials. Prototypes have been reported in three areas: mobile awareness cues, media sharing and group messaging. Generally these systems include lab evaluations or limited field trials. A variety of systems addressed awareness cues on mobile. Most notably in Oulasvirta, Raento and Tiitta (2005) ContextContacts is presented where awareness cues are integrated in the contact list of the mobile phone.

Various trials (Oulasvirta, Petit, Raento, & Tiitta, 2007) found three functions of mobile awareness cues: coordination, expression, and companionship. An example of mobile media sharing for instance is MobShare (Sarvas, Oulasvirta, & Jacucci, 2007), similar to photo blogging systems but with a possibility to form new viewer groups and picture albums on the fly in mobile settings. Group messaging have been addressed for example by Heyer, Brereton and Viller (2008) presenting a prototype system that aggregates cross-channel communication, allowing users to participate in group conversations using text messaging, instant messaging, email and the web communication across SMS and email. It was found that participants used the system

mostly for ad-hoc coordination. Other findings interested the absence of chat and a particular half invite style of inviting in communication.

1.2 Design Challenges for Integration

In our design work we set out to support partly remote and partly collocated groups using mobile phones with the aim to support the above aspects through media sharing, messaging and awareness cues applications (Jacucci, Oulasvirta, Ilmonen, Evans, & Salovaara, 2007). Our contribution is to investigate and analyse the integration of these application features and reflect on how mobile social software for youth could evolve in the future.

On one hand we witness the multiplication and dedication of social software that create an increased complexity for users. On the other aggregation software and migration to mobile terminals could provide new social software practices. Rankings of social software in the web change rapidly and show some tendencies. First social software continues to be diverse in its offering of functionality including media sharing, instant messaging, and networking. Recently aggregators have emerged that bring diverse functionality in one portal. Social media aggregators combine popular social media feeds in separate tabs or in one feed and allow to post status updates to multiple sites.

To anticipate possible evolution and use of future mobile social software we analyse the iterative development of prototypes that integrate common communication concepts such as messaging, sharing, and awareness cues. Integration here constitutes a deeper operation than aggregation reinterpreting and not simply composing previous communication functionality.

In integrating the design challenges are well described by qualities such as openness, multiplicity and continuity (Binder et al, 2004; De Michelis, 2004). Openness refers to the capability of an artefact (an affordance) to have different, potentially unlimited, ways of being used and perceived. Multiplicity refers to the capability of an artefact of being made of different components having different functionality. Continuity refers to the capability of supporting the navigation and use across components. How should messaging, media sharing and cues be integrated? How should the qualities of openness, multiplicity and continuity be implemented?

The first version called mGroup proposes stories as common messaging spaces and collections that both serve messaging and media sharing. In the second prototype CoMedia awareness cues are integrated in the platform within the stories and in the

contact list. The field trials of these systems are organized in both cases during large-scale events lasting over a weekend. In each trial we compare two age groups in two different events one in Germany and one in Finland. In the Germany trial users in their thirties have been recruited among visitors of a music event, while in Finland users are in their twenties recruited at a rally event.

2. Integrating Messaging and Media Sharing into "Stories"

Existing mobile media sharing or messaging applications, rather than supporting groups, support individuals in one-to-one or one-to-many communication. For example, in MMS, multiple messages can be sent separately with no information about other recipients. And emerging one-to-many applications are based upon uploading multimedia collections to the internet for others to comment on and browse through at a later time.

mGroup, a client-server Java MIDlet that runs in Nokia Series 60 smart phones is based on the concept of Media Stories. They can be initiated by entering a title and inviting specific members with the result of creating a space for group messaging that is persistent and is archived as a group media album. The Stories integrate important features beyond the paradigms represented by MMS or instant messaging through the feature of a common space: 1) reciprocality — invited Story members can all contribute as authors immediately sharing messages; these are available to all invited members, who have an awareness of who the others are, and 2) objectified achievements — messages and replies in Stories are gathered in a common space and persist after logouts and are archived as participatively achieved objects or group albums, which are also available from the web.

Figure 1A shows how Stories are presented to users, story names of which the user is a member in the rightmost column, who has sent the most recent message and how much time has passed since.

When the user opens a Story, the screen in Figure 1B is displayed, presenting messages ordered according to their sending time. The most recent message is shown at the top, and some contextualising information about each message is given: a thumbnail image, a sender name, the time that has elapsed 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.

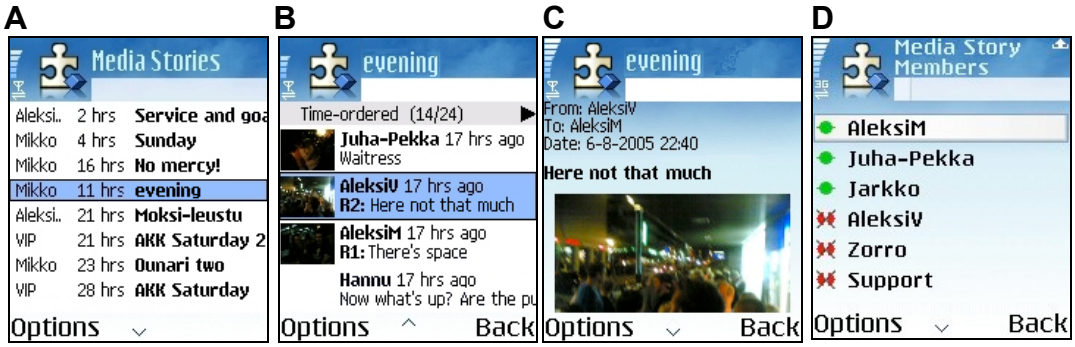

Figure 1. Screenshots from mGroup, translated from Finnish. A) Media stories view; B) a view of messages and replies in a Story; C) a view of a single message; D) a view that shows the members included.

2.1 Stories as common spaces and collections

We organised two trials at two different large-scale events, a rock festival in Germany and a world championship rally competition. In both cases we contacted groups of spectators that had already organised themselves to be spectators at these events.

The relevant differences in the two trials consisted of the profile of the spectators and the characteristics of the event (Table 1). The WRC Rally in Finland gathers many spectators (hundreds of thousands, according to some estimates) for more than three days along the roads of central Finland, distributing them across an area of almost 100 km. We distributed 8 terminals among a group of 13 spectators linked by friendship and common plans to visit the rally. Their distributed accommodation resulted in the creation of two sub-groups that spent the days visiting different rally stages. Despite several attempts to meet during the daytime, the sub-groups managed to meet only in the evenings at parties or pubs. The other trial was organised at the co/pop festival in Cologne, Germany. In this trial we distributed 6 terminals to a group of friends living in Cologne who planned to attend several of the activities of the festival. This group of participants provided interesting variations on the previous trial, as they were of another nationality, bound to the event by different cultural interests, were several years older, and provided a balance of female and male members (see Table 1).

	Rock Festival, Germany 2.5 days	WRC Rally, Finland, 3 days
Setting	Live Music dj, vj on stages/bars	Race in the woods, city exhibition
Participants	3 males, 3 females, ages 28-32	7 males, 1 female, ages 20-25
Created media	27 Stories	22 Stories
Stories' length	9 msgs average, longest 30	10 msgs average, longest 25
Story Initiation	At least 2 per user, average 4.5	At least 1, average 3
Story Members	4.7 of which 3 contributing	7.4 of which 4 contributing

Table 1. Summary of use of media stories in the two trials.

The research approach consisted in both cases of a naturalistic trial that lasted approximately as long as the event. After a short tutorial participants were occasionally shadowed and videotaped. Interaction logs in their phones recorded the use of mGroup. Participants were interviewed in semi-structured interviews and a walkthrough of stories and of the mGroup interface provided important insights into the way they used and interpreted the system. On the basis of this information, we carried out a detailed content analysis of the stories, analysing the purpose and use of the stories as a common space.

As Table 1 shows, the participation in mGroup was surprisingly active, especially at the rock festival. The Stories successfully collected several messages. Several people contributed to each Story on average, evidencing wide participation. This shows that the use of Stories was not limited to one-to-one communication but involved a significant part of the group. Additionally, the authorship of Stories was shared beyond the initiator. In sum, the wide engagement of the group members points to the conclusion that Stories were not the products of individuals but the achievements of, and a common space for, the group.

The most striking difference between the two trials was the use of the invitation feature in creating a Story. While at the rally users aimed always to invite all other members, at the rock festival 5 of the stories were specifically created for subgroups. Two stories were just for female members and two stories for male members. Finally, one story was created just for a couple who were part of the group. This indicates the possibility of using stories to create common spaces for targeted subgroups of members.

In the field trials, mGroup was used predominantly for presence and coordination between remote partners (see Salovaara, Jacucci, Oulasvirta, Kanerva, Kurvinen, & Tiitta, 2006). Topics ranged from a discussion on what had happened the previous night in a bar and what would be done the next evening to notifications from people stuck in a traffic jam stating whether they could make their way to where the others were and join them at the same rally track.

2.2 Implications for Media Integration

Most of the applications in media sharing and messaging channel individual media creation efforts into blogs or photo albums that are then shared and discussed. We stress in our design the participatory nature of the common space provided by mGroup, which proposes shared authorship with the result of producing collective objects. We presented a mobile implementation of a common interaction space that supports the collective creation and sense-making of media by providing a common context and a way for collective objects to emerge through shared authorship. Several implications where drown from the trial:

Cues about other members. In the field trials, one of mGroup's main uses was coordination of activities between remote partners. Topics ranged from a discussion on what happened last night in a bar, and what will be done this evening, to notifications from people stuck in a traffic jam telling whether they can make their way to where the others are and join them at the same rally track. We noticed that in important issues, people made follow-up calls to know whether a message had been read at the other end. This implies a need for increased awareness of other users' activities. Essentially, it is easy to collect information about users' activity in the system and mediate it quickly to everyone. But in addition to this, such information can be augmented with other sensor data that a phone may sense: for example, where people are (acquired with GSM cell ID positioning), where they are coming from, and whom they are with. This points to the opportunity for combining real-time information about both the system usage and other user activities.

Contextual cues on media. Providing information about past activities in the system, such as contextual information from each message creation situation, can also be useful. In the field trial, we noticed that people found it very rewarding to browse

through old messages with other people by talking, joking, pointing at pictures, and passing the phone from hand to hand.

To create opportunities for such situations, data about past message-creation situations should also be displayed. In the longer term, contextual annotations also enable both the original creator as well as other members of the group to search for and organize media, as well as helping to remember the situation the media was created in.

Integrating audio-video and event information into stories. While most of the messages in stories were chained implicitly or explicitly to previous messages and the stories, on average, contained a significant number of messages, the metaphor of media stories was not fully implemented in the design. From the interviews with users two aspects emerged that could have improved Stories. Firstly in the Rally and Music trial recording of sound and video could have provided richer Stories such as the car sounds and jumps and live performances. Secondly, interviews indicated the opportunity to integrate in the media created by users official information of the event in particular while browsing (reliving) stories the next day.

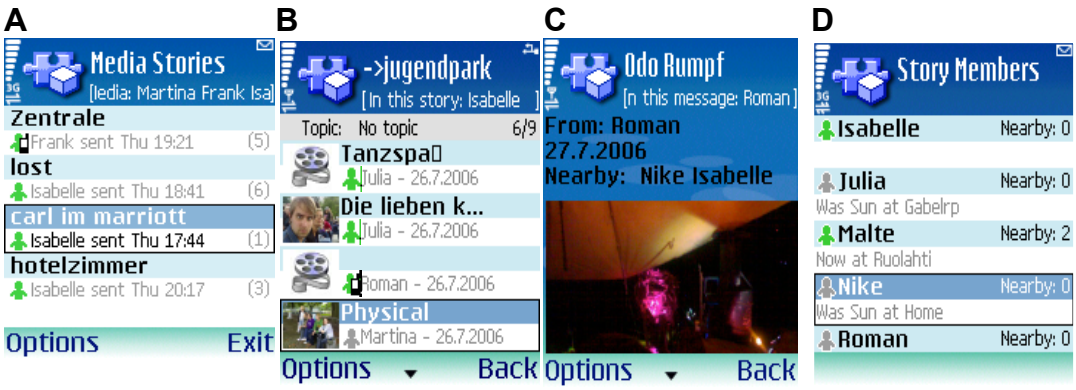

Figure 2. CoMedia integrating awareness cues in Media Stories A) Media stories view; B) a view of messages and replies in a Story; C) a view of a single message; D) a view that shows the members included.

3. Integrating Awareness Cues

CoMedia (Jacucci, Oulasvirta, Ilmonen, Evans, & Salovaara, 2007**)** extends mGroup with a native Symbian application that provides list of nearby Bluetooth devices, location of the phone, and information about phone usage. This allows integrating

awareness cues throughout the interface. The Media Story List in Figure 2 displays stories that the user can access. For each story, CoMedia shows the title, the time of the last post, who made the post–including the poster's status–the number of people viewing the story and the number of messages.

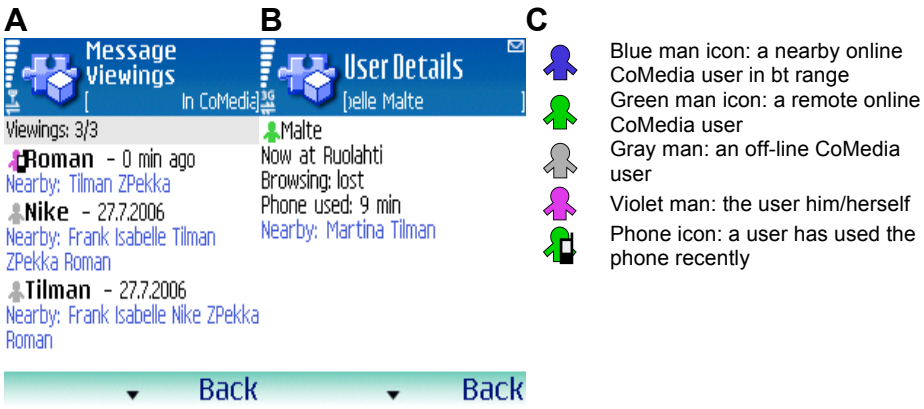

Figure 3. Details showing additional awareness cues A) Who viewed the message and who was next to them; B) A member location, nearby members and activity; C) awareness icons of members.

The second row contains information about the last message posted to a story and the author. If there are new messages, the number in parenthesis turns red. This also serves as cues of on-line activity, showing who are actively using the system. In the Individual Story View lists there are member icons representing the number of people viewing that message, analogous with similar icons in the previous view. The scrolling ticker at the top of the view shows the names of the people viewing this story. The Message View shows the contents of a single message. The media is automatically augmented with information about who were present when the message was taken or viewed using Bluetooth scanning (see Figure 2 D and Figure 3 A). Media can be acquired using CoMedia's built-in media capture functionality (photos, videos and audio) or taken from the phone's gallery.

The Member List (Figure 2 D) can be a global list or just of the members of a particular story. The List shows where other users are and whom they are with. Another view to a member list is through a Story. In this view, each member's general status is shown with the coloured icon next to the person's name. Beneath the name is information about the person's current location (if known) and how long (s)he has been in the place. In addition, the system shows how many other members are in the person's vicinity. Clicking on a member drills into the Detailed Member View (Figure

4), showing what the person is browsing currently, when she used her phone previously and who are in Bluetooth range.

Occurrence	**Rally Trial** (2.5 days, N=8)	**Festival Trial** (3 days, N=8)
CoMedia running per day per user	7.8 h	7.3 h
Stories created altogether	35	47
Average lifespan	68.2 min	115.3 min
Text elements in a Story	4.2 (SD 4.3)	2.7 (SD 3.3)
Images in a Story	1.0 (SD 1.5)	4.6 (SD 6.2)
Video clips in a Story	4.4 (SD 5.8)	1.1 (SD 1.7)
Audio clips in a Story	0	0.3 (SD 0.6)
Messages per Story	4.7	5.5
Messages created per day per user	4.7	8.6
Messages viewed per day per user	13.6 (SD 7.9)	38.0 (SD 13.7)
Average number of users present when creating a message (Bluetooth)	3.3	2.4
Member List access per day per user	5.3	5.5

Table 2. Summary of use of media stories in the two trials.

We arranged two field trials of CoMedia, one in Finland during a world championship rally event, and the other at an electronic music festival in Cologne. Logs, media content, video-taped observations, and interviews were analyzed.

The analysis evidence in the CoMedia trial as also in the mGroup trial qualitative differences in the usage by age group (Table 1 and Table 2). Younger users privileged longer text and videos while user groups in the thirties made more clearly use of the grouping feature where stories are addressed to a particular subgroup.

Cues like location also served as an expressive tool as the festival group entered descriptions for a location 72 different times with an average of nine descriptions per user. Like one user commented “within a group new descriptions for places emerge; this makes our group feeling stronger”.

The integration of cues supported the collective creation of stories (see Table 2). We analyzed the role of integration by identifying how it supported users appropriations distinguishing the role of Stories and of cues (Table 3):

“On-site reporting,” reporting activities and events to a remote friend. Here, location and online status cues were important; they enable the remote spectator to engage in interaction and the reporters to know who is online and follows their reports.

"Keeping up to date with others," following what others are doing at the moment. Here, the location cue was of importance, especially when making sense of media sent by others.

"Remote spectating," remote spectators portray themselves to be part of the group, offsite members construct socially an awareness of the remote event by commenting and discussing with collocated members

"Reliving" reflecting and joking about past happenings using the Media Stories as a resource. Media Stories provide documentation of situations enriched with dialogues and contextual information that spark discussions and jokes and contribute to prolong the event experience.

"Coordinating," planning and monitoring the mobility of other group members. Here, location and proximity cues were important.

Activity	Stories integrating sharing and messaging	Integrated Awareness Cues
Onsite reporting	Creating media of on-going situations	Social context
Keeping up to date	Reading about latest activities	Knowing where others are
Remote spectating	Spectating through others' messages	Knowing the spectating spot
Reliving	Reviewing past Stories	Social context
Coordinating	Negotiating plans, reporting progress	Following others' progress

Table 3. Utilization of CoMedia's features in spectator activities. Aggregated over the two field trials.

4. Conclusions

Integration of functionality is an important design topic and one of the less exploited opportunities in mobile social software. In practice, integration in the two examples of mGroup and CoMedia resulted in two different operations.

In mGroup we created a new "Format" driven by a different metaphor, Media Story that integrates functionality from messaging and media sharing. The difference to alternative formats such as messaging (MMS), media sharing and publishing, (blogs, channels, feeds, or walls is that they afford different uses (see uses reported in Heyer, Brereton, & Viller 2008; Joinson 2008).

Selection and composition of cues close (visually or interactionally) to content in an application. Content can be something as simple as the name of a contact or a more complex entity like media. From the perspective of social cognition, the role of integration is in the guidance of users' processing. Integration guides the user's

attention to process particular pieces of content alongside with the cues, but it also primes the formation of goals as they provide the opportunity for action.

Challenges we encountered in integration were connected to the trade-off between multiplicity and openness. These can be thought as different strategies as multiplicity creates distinctions and boundaries between one function and another, whereas openness breaks down all borderlines to encompass all functions in one whole. Media Stories create a new format that is open and affords messaging and sharing. Conversely the contact list that was augmented with cues followed the strategy of multiplicity and was limitedly integrated with Media Stories. One of the arguments that may guide such integrations is that the new formats need to combine openness and multiplicity through continuity. Continuity can be achieved by putting resources on the borders of objects in our case for example by allowing to use the contact list of members to access or create Media Stories, so that the borders act as both, separators and connectors.

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