Exploring the Concept of Group Interaction
through Action in a Mobile Context

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Abstract. This paper explores the concept of interaction through action. The exploration is done empirically in the setting of bird hunting. Using qualitative research methods, we studied how a hunting group secure awareness in order to coordinate their actions and to collaborate. We analyzed the data using a modified CSCW-model and found that the methods for securing awareness and coordination are rather complex and that environmental constraints play important roles. Dealing with coordination and collaboration in a setting such as the one we study is not easy. Based on the empirical findings, we derive design implications to consider in the design of artifacts for supporting group activity grounded on the concept of interaction through action.

1   A Forgotten Field

Today the usage of information technology have increased and the IT support for group activities is highly developed. In organisations, groupware makes it possible to coordinate work and the communication infrastructure is very advanced. But it seems as if some human group activities are isolated from this evolution, the group activity of hunting for example. The activity takes place in a setting with a low frequency of artefacts and with lots of outer constraints such as variation in vegetation and weather. Group activities in the wild seem to have been left behind in the technological evolution. How do groups manage to coordinate their activities and secure collaboration between participants?

Reviewing the literature on the topic we found some research that had explored HCI issues in wild settings[1]. Authors are mostly concerned with technical demands on artefacts to support individual activities in such environments [4, 5, 6]. We also found literature about coordination, communication and collaboration in groups, but not in settings with a low frequency of artefacts and not through the aspects of interaction through action. Accordingly, no research so far has explored the aspects of interaction through action. How is the group activity of collaboration, coordination and communication structured in a context with a low level of artefacts and in an environment where ordinary methods to secure these issues are constrained?

In order to investigate the question empirically, we conducted an empirical study of a hunting group in northern Sweden. Using qualitative research methods, we studied how the group coordinate, communicate and collaborate in order to make the hunting session as fruitful and safe as possible. We analysed the data using the "CSCW framework" [7].

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[1] In this paper a wild setting is a setting that contains a low level of artifacts. Another example of a wild setting could be a subsurface environment.

The rest of the paper is structured as follows: Section 2 contains a background describing how group activities are supported. Section 3 presents the theoretical framework. In section 4 we introduce the empirical study, i.e. bird hunting in Lövånger/Västerbotten, Sweden. Section 4 presents the main results from the study. We do so by applying the "CSCW framework" [7] on the empirical data. Finally in section 5 we conclude the paper and present implications to consider in the design of artifacts for supporting group activity grounded on the concept of interaction through action.

2   Background: Interaction through Action, Organization of Team Activities and Awareness

In this section we describe in more detail the concept of interaction through action, the organization of group activities and the importance of awareness.

2.1   Interaction through Action

One reason for people to collaborate is that they can achieve things together that is not possible to achieve for the individual [8]. A collaborative group can improve some aspects of their activities by doing it as a group and not as individuals. Co-watching a movie makes it more fun, co-diving makes diving safer and co-hunting is both more effective and safer.

The "CSCW framework" [7] shows aspects of group activities and describes the relation between participants, and participants and an object. The facilitation and study of this communication is very important to the field of CSCW, but it is not all there is to CSCW. The term implies that the participants often have some object that they are working upon. The nature of the object is what decides if one or more of the participants can control, modify or affect it. The participants will, under normal circumstances, be able to receive feedback of their own actions and receive feedthrough from the actions of others.

To be able to receive feedthrough from the actions of others is essential in many cooperative situations. Dix and Beale [7] claim that this feedthrough is many times more important than the direct communication. Their model is shown in figure 1:
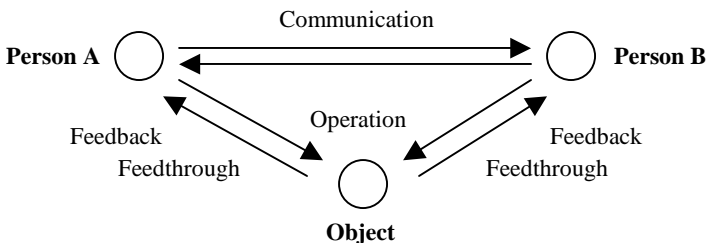

Fig. 1. The "CSCW framework" shows how collaboration is managed through action/reaction and a more or less shared view of situation.

2.2 Organization of Team Activities

There are two levels of activities and performance in a collaborating group. You have your own performance in relation to yourself and you have your performance in relation to the group. As Hutchins [8] claims, team performance make things possible to achieve for the group that would be impossible to achieve individually, at least in the same effective way. This is mainly why groups are formed, to achieve better results or in order to be more effective. There are other reasons for teams to be formed as well, for example social reasons.

The performances of teams can be classified as sequentially unconstrained or constrained. Hutchins [8] defines a procedure as sequentially unconstrained if "the execution of any enabled operation will never disable any other enabled but as yet unexecuted operation". If the task has no sequential constraints it can be accomplished by a "swarm of ants" strategy [8]. This means that there is no need for communication between the participants only feedthrough because of their effect on the shared environment. Hutchins defines a procedure as sequentially constrained "if the execution of any enabled operation will disable any other enabled but as yet unexecuted operation" [8]. This means that actions are dependent of the actions of others.

But the participants of a team also take action individually. This means that while performing, each and every participant of the group is involved in a "mixed-focus situation" [2]. Group members shift their attention continuously between group and individual activity. Therefore it is important that the environment allows quick gathering of information in order to maintain a feeling of awareness of what the other participants are doing and where they are.

Kirsh [9] discusses the coordination of a football team where the roles of the players are not specified completely, because of the dynamics of the situation in the field. They have to understand the point of their role in relation to the play as a whole. If things go well it leads to desirable results. A leader is required to add some constraints.

In order to form a platform for action, the use of "human interfaces" [8] is essential in a setting as the one we studied. The use of a human interface is when one person makes another person a human interface to a task. This means that a person acquire information about something through another person.

2.3 Awareness

The coordination of group activities highlights the need for awareness in group activities as it is impossible to know when to execute an operation for one participant if the operations of others are unknown. Sequentially unconstrained procedures on the other hand are more easy to distribute or can be solved by systems that are very loosely interconnected. Sequentially constrained procedures require coordination among the actions to be taken. However, there are ways to achieve this coordination. One way is to secure that each group member knows how to act when certain conditions in the environment are produced [8].

Awareness has been defined as "[…] an understanding of the activities of others, which provides a context for your own activity" [1].

In order to support awareness, one should see to it that information leaves the scene of work and that one's colleagues receive the information. The possibility to be aware of the actions of one's colleagues is better, the more information one receive. There is however is a flip side on that coin, the more information we receive from others, the greater the risk that the information will disturb our normal work [3]. One thing that

is important to know is that it is never possible for anyone, at any point to have complete overview in a distributed and mobile setting [11].

In the coordination of group activities information about awareness is always needed [10]. Accordingly you have to be aware of the actions of others to be able to respond to them and in order to collaborate as a group and achieve coordination. Dourish and Belotti [10] claim that awareness provides a context for the action of any individual in the group through helping actors to understand the actions of others. Further, the context is used to guarantee that the contributions of every individual are relevant to the activity of the group, and to evaluate the actions of participants with respect to the goals of the group and the progress.

In an environment where you have full awareness of all participants of the group activity, it is easy to coordinate the action of each and every individual, and even if the procedures are sequentially constrained, it is not a problem. However in a situation where the possibility for securing awareness sometimes is bad, a need for buffers [8] arises. Hutchins claims: "buffering prevents the uncontrolled propagation of effects from one part of the system to another" [8].

3   Theoretical Framework

In order to explore interaction through action in a mobile setting, we found it necessary to develop a conceptual framework to guide the study, and in particular to analyse the empirical data. The fact that it, in the setting where we conducted our study, does not exist shared object, forced us to modify the model "CSCW framework" [7]. The one thing that to some extent is shared between participants is the view of situation. The modified model that we have used is shown in figure 2.
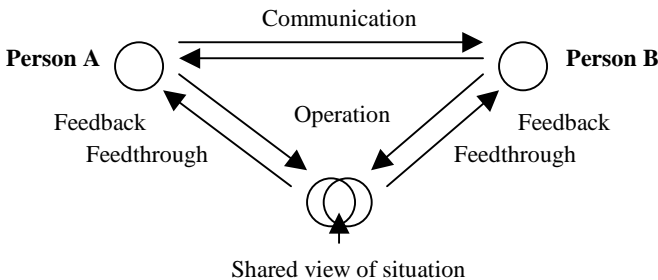

Fig. 2. The theoretical framework of the study

The framework above makes it possible to explore the procedure of interaction through action in a wild setting. The model suggests that communication is the exchange of some kind of information between people and that collaboration is when two or more people operate a shared view of situation. When one person changes his/her view of situation it changes the shared view. When doing that the person receive feedback and the other participant receives feedthrough. According to Ljungberg [12], we can in the context of the model conceive collaboration and communication as subsets of interaction. It is important to have some level of coincident view in order to secure some level of collaboration. If the coincident is complete, Person B also experiences everything about the situation that is experienced by Person A, and vice versa. And if the views of situation are totally different, then we have a breakdown.

4   Entering the Forgotten Field

We now wish to direct the attention to the results of the empirical study of this paper. The research issue we have explored is how group communication, coordination and collaboration is supported in mobile settings with a low level of artefacts.

4.1   Method

We used ethnographic techniques to collect data, i.e. qualitative interviewing and participating observation. Hammersly and Atkinson [13] describe ethnography as follows:

"In its most characteristic form it involves the ethnographer participating, overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions – in fact, collecting whatever data are available to throw light on the issues that are the focus of the research. [13]"

Ethnography should last for an extended period of time, our study did not, but we used ethnographic techniques during our data collection phase. We made participant observations of a bird-hunting expedition. While studying the bird-hunting group we participated during two days, approximately 15 hours and afterwards we conducted tree qualitative interviews [14]. Only four hunters participated in the hunting session (one of them was the author of this paper) and that is why the number of interviews is relatively low. All interviews lasted between 30-45 minutes. The empirical data was analysed using the theoretical framework shown in figure 2 above.

4.2   Research Sites

The bird-hunting group is a group of three hunters (and me) who bird hunts together for a weekend every year. The host is a frequent hunter in the area, the rest of the participants have some knowledge of the terrain but for the author it was very limited. The hunting area is located in the north of Sweden, in a village named Lövånger, located approximately 90 km north of Umeå. The hunting session started an early Saturday morning in September.

A hunting session is normally divided into a couple of rounds. Every round starts with instructions from the guide. Normally he says something about the vegetation and he always say where the group shall reunite. Sometimes other information is of interest, for example rough passages or maybe an anecdote. Then the participants form a line with 30-50 meters in between and on a given signal they start moving. They try to move with a constant velocity in order to maintain the formation.

The shooting line is supposed to cover as much area as possible as the group move through the forest. The aim is to force birds to take off in front of the line so that a hunter can take a shot. The line is supposed to scare the birds and to force them to take off. The formation makes it easier to cover larger areas and if a bird takes off in front off the line it is more likely that some one or several of the hunters get the chance to shoot.

The guide normally walks on one of the ends of the shooting line in order to direct the movement. The one person next to him/her has to move according to the guide in order to keep the chain intact. The third person moves according to the second and so on. It is important to keep the line through keeping the same speed and direction as the person you orientate by. Being aware is crucial for the hunting session.

Besides the four hunters, there was also a dog participating in the hunting session. The dog is supposed to search for birds in front of the line and to force them to take off and land in a tree. The dog then distracts the birds with a constant barking. The birds then focus on the dog and one or more hunters can sneak within shooting distance and take a shot. Another area where the dog is useful is when a bird is wounded and a hunter need help to catch it.

The level of technological equipment to support collaboration used by the hunters is almost none, some hunters use a compass and some wear their cellulars (in case of emergency).

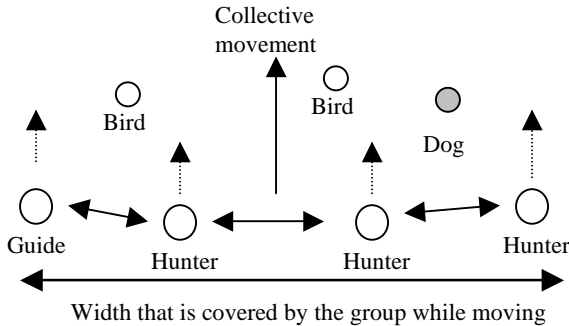The activity of bird hunting, as this group pursue it can be viewed as follows:

Collective
movement

Bird   Bird

Dog

Guide   Hunter   Hunter   Hunter

Width that is covered by the group while moving

Fig.3. The activity of bird hunting, as this group pursue it

5 Results

We now apply the "CSCW framework" [7] on the model above, by going through the empirical data.

5.1 Feedback

The operations that a person does on his/her view of a situation give immediate feedback. There is however, a problem with feedback. If you drift off it and loose contact with the others it is very difficult to get feedback about the new situation you are in. This means that if you are not sharing view of situation with the others, it is almost impossible to take further actions. The support that you have for making your next move is the plan that the group made together in the beginning, and maybe a wild guess, and that is not enough.

5.2 Feedthrough

The level of feedthrough that other participants receive on the actions of a participant varies a lot. Because of the chain formation it is very rare that all participants receive the same feedthrough. Often the hunter next to the person that produces the feedthrough is the only one that receives it and can act accordingly. This means that the next person in line then have to receive feedthrough from the second person in

order to act accordingly. If no feedthrough is provided the shared view of situation is impossible to achieve.

There is often a slack between an execution of an operation and for a participant to perceive the feedthrough of that operation, in that way feedthrough is communicated from one end of the firing line to the other. This means that it could take a while for it to reach all participants. For example if a person on the edge of the line avoids a certain area, maybe a ditch or trench, this may cause him to move towards the others. This starts a chain reaction where everybody moves further away. Only the second man in line does it because of the feedthrough from the action from the first person, the others they do it because the person next to them does it. Because of the slack it is therefore possible that the first person that avoided the obstacle may have returned to his position before the last person has responded to the first movement. This means that the firing line is almost always moving, not only forward, but also from side to side.

5.3   Communication

The ability to communicate with other participants varies a lot, depending on many factors. The density of the forest sometimes makes it difficult to signal to each other, and the level of communication through signalling is low. To speak or shout between participants is often out of the question since it scares the birds. This highlights the importance of buffers. Buffers are not something that is managed centrally but is managed inside the heads of every participant. For example if you do not know where the others are, then you have to remember the last time you saw someone and estimate the speed and direction that the person moved in on that occasion in order to act upon his/her movement. You also have to think about any obstacles that could have influenced the choice of path that the other person might have made, this is of course very difficult. This use of buffers is a part of communication through action and it means that lots of attention has to be directed towards other participants. But it also means that while a person is performing an egoistic operation, he is also communicating to the others. So by firing a shot, for example, you communicate something to everyone. But what you communicate is difficult to say, according to our study there are several reasons for firing: To shoot a bird, to signal where you are if you are lost or to notify the others that you've seen a bird.

During our interviews, we were told that the need for verbal communication is low during the sessions, but because of the social nature of hunting is the same need between the sessions high. One person gave an example were it is very frustrating not to be able to talk, and that is when the group walks in an open field and one participant spot something and want to direct the movement towards it. He complained that the possibilities to have some higher level of verbal interaction are low. However, the main opinion is that this is not a problem.

5.4   Operation

The operation is the actions that a hunter takes. Some operations provide a good feedthrough to the others, like a shot, and some operations do not, for example if a hunter drifts off or stops.

Because of the fact that you act upon the actions of the participants next to you and the feedthrough of their operations, it is possible that the actions of the participants on both sides of you provide feedthrough that collide. This means that the feedthrough is redundant and difficult to act upon. The opposite situation is also possible, when you do not receive feedthrough from anyone and you do not know how to act. This

situation is often solved by going back to the plan, and through keeping the same direction as in the beginning, maybe with the help of a compass. This is what we call a breakdown, when you are not aware about the situations of the others and when you have low support for making decisions. In case of a breakdown, and if the hunter is not wearing a compass and the clouds make it impossible to orientate by the sun, things can get pretty ugly.

Normally the operations that a participant take is within the common sense of the group, for example you have to avoid a trench but you keep the contact with the shooting line, there are though, times when a participant break the pattern and then the awareness is threatened. There are in fact several events that could trigger a break of the shooting line: to get out of dense vegetation, to shoot at a bird, to sneak on a bird that one observes, if the dog starts barking and you sneak towards the bark or if someone shoots and you move into a better position.

5.5   View of Situation

The view of the situation that a person has is changing continuously. The use of buffers makes it possible to relate the movement and actions of oneself to the actions and movements of others. In that way you achieve a level of awareness. To be able to secure awareness the hunter uses eyes, ears, buffers, and memory of the direction, knowledge of the terrain and also knowledge of each other and the hunting plan. When something happens, for example when the dog starts barking, then the hunter has to decide how to act upon the event. If he feels that the dog is closest to him, then he moves toward it. With satisfying awareness and with a certain level of shared view of situation this makes the shooting line stop for a while and the hunter can operate without any risk. But if there is a low level of awareness and if the level of shared view is low, then there could be a risk. It is possible that more than one of the participants believe that he or she is the one that is closest to the dog. This means that hunters get within shooting range of each other and that they do not know where the others are.

The use of buffers is something that helps participants to maintain their view of the situation. If a hunter loose contact of the others he/she tries to remember the velocity and direction of the others in order to position himself in relation to them and create a view of his situation and also the shared situation.

5.6   Shared View of Situation

As we mentioned earlier it is a good thing if the shared view is indeed shared between the participants. In that way the coordination and collaboration is easy to achieve and the hunting session is safe and effective. The shared view is achieved through knowing each other, knowing the terrain, input through senses. To achieve a completely shared view within the group everyone would have to be standing at the same point and share the same values and knowledge. But then the hunting session would not be that effective.

It seems as if there are ways to achieve an acceptable level of shared view of situation under certain circumstances. These circumstances are good sensory input, terrain that is not too dense, good knowledge of each other's behaviour, the terrain and the plan. However this is seldom the case.

The fact that the goal and the starting point is briefed in the beginning and that the guide give some introduction to the hunting area makes it possible to keep a shared view. For example if the guide says that we should walk towards the sun for about 45 minutes, then we all know that it is a good thing to have the sun in the face, and as

long as we do we are in some way coordinated with the others, and have somewhat a shared view with the others. If everyone used a compass it would be easier.

The shared view of situation is of course improved if the participants are familiar with the terrain in the area were the hunting session takes place. But even if the position of oneself is known, the possibility to know the positions of the others and the relative position is not secured.

7   Discussion

This paper has explored the concept of interaction through action in order to support collaboration for groups in mobile wild settings.

This paper has shown that the collaboration of a hunting group is structured in a very special way that leaves a lot to the judgement of every participant and there is a great variation in the way that participants operate, this variation is a problem. We have to remember that we are dealing with lethal weapons. Incidents do happen. Often, the only thing that happens is that the session is cancelled and the group has to look for a hunter that is lost, but every year people get shot in the forest. And during our interviews some examples of terrifying incidents were brought up. This group has hunted together before and they know each other in some way, but today it is quite common that a hunting group contains people that do not know each other, they may not even speak the same language.

So, if we were to think about implications for the design of some artefact based on the outcome of this study. First, while moving in the forest, there is a mixed-focus [2] situation indeed. The switch back and forth from the individual and the shared activity and vice versa is crucial. Because of this the time used to alternate from one to the other needs to be as short as possible.

A second implication is the fact that depending of the density of the vegetation, the distance between hunters varies from 15 to maybe 50 meters. The denser the vegetation is, the shorter distance. This is a method to secure awareness of each other and also to make the session as effective as possible. If you walk close the total width of the firing line gets small and this makes the area that is swept small and also the chance of finding birds, but the securing of awareness is easier to achieve in that way. The alternative is to keep a longer distance between the hunters in order to make the width of the firing line larger and in that way encounter more birds. This is a trade-off that is important to be aware off in future designs.

A third implication is that awareness is crucial in the activity of hunting. The way that this is secured today is through a rather complicated process with human interfaces and interaction through action. An artefact on which relative positioning could be presented would improve the hunt in many ways. Incidents where people get lost would occur less frequently, so would accidental shots.

A fourth implication is the fact that lots of the interaction during a hunt is interaction through action brings the conclusion that to be aware of the movements and positions of others is much more important than to be able to talk to each other. This means that the use of walkie-talkies never can solve all issues, but this does not mean that a walkie-talkie is not useful in this kind of setting, it is, but as a compass, it can only do so much.

The fifth implication that we would like to make is the fact that hunting has to be hunting. The unpredictability of hunting is very important and should never be threatened by any invention. But there are two reasons for using this kind of IT for bird hunters. First, during our interviews all respondents talked about some incident that could have led to a serious accident. The number of accidents that happens during hunting is not acceptable. The second reason is that the efficiency of the hunting

session could be improved by IT. Today it is quite common to disorientate and get lost or left behind. This means that the hunter becomes inactive and the efficiency is damaged.

The final implication that we would like to make is that this study stresses another area for expert systems (ES) than the conventional one. Most work on ES has focused on applying ES technology on data processing areas [15]. The implications that this paper have for expert systems is that the setting is mobile and the support that is needed is on a local level in order to support local security and coordination of group activities.

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